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ROYAL BOTANIC GARDENS, KEW.

23

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 8.] [1906.

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XLVI.—THE OIL-GRASSES OF INDIA AND CEYLON.

(*Cymbopogon*, *Vetiveria* and *Andropogon* spp.)

(With Plate.)

OTTO STAPF.

About eight years ago the firm Schimmel & Co. (Fritzsche Bros.), of Leipzig, manufacturers of volatile oils, commissioned Messrs. E. Gildemeister, of Leipzig, and Fr. Hoffmann, of Berlin, with the preparation of a treatise on the entire subject of volatile oils. The result was a volume of over 900 pages (with maps and numerous illustrations) which, under the title "*Die ätherischen Öle*," was published by Julius Springer, of Berlin, in 1899. In the following year it appeared in a slightly condensed edition (*The Volatile Oils*, 732 pages), translated by Edw. Kremers, of Madison, Wisconsin, and published by the Pharmaceutical Review Publishing Co., of Milwaukee. The work is a remarkable and unfortunately all too rare instance of co-operation between practical and scientific men. In plan and execution it gives striking proof of the farsightedness and liberality of the manufacturers, who wished to see their business placed on a scientific basis, and at the same time of the thoroughness of the experts who were invited to carry out the ideas of their commissioners. The part dealing with the "Oils of the Gramineae" occupies pp. 280–300 of the "Special Part." Those oils—there are seven of them—are first treated generally in an introductory paragraph and then individually with respect to origin, preparation, composition, properties, production, and commerce. They are:—

1. Palmarosa Oil from *Andropogon Schoenanthus*, L.
2. Ginger-grass Oil, described as inferior Palmarosa, or a mixture of the latter with turpentine or mineral oil.
3. Lemon-grass Oil from *Andropogon citratus*, DC.
4. Vetiver Oil from *Andropogon muricatus*, Retz.
5. Citronella Oil from *Andropogon Nardus*, L.
6. Oil of *Andropogon odoratus*, Lisb.
7. Camel-grass Oil from *Andropogon laniger*, Desf.

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The botany of the oil-grasses is only slightly touched upon in the work. The definitions and the nomenclature of the species are, on the whole, those of Hackel's monograph of *Andropogoneae* and of Hooker's elaboration of the grasses of India. The origin of the several oils from the species mentioned is stated somewhat apodictically, and there is nothing to suggest the difficulties which from time to time have arisen owing to the unsatisfactory state of our knowledge of the "botany" of those grass-oils. This condition has become more accentuated with the increased interest in the grass-oil industry during the last few years and with the attempts at reorganising and extending it in its old homes and at introducing it into other tropical countries. The 'Semi-Annual Reports' published by Schimmel & Co. contain not a few direct and indirect references to the uncertainty of the taxonomy of the grasses involved: I quote only two passages.

In the April–May Report for 1903, p. 23, the authors say :—"It has repeatedly attracted our attention, that when it is a question of their origin, the Andropogon grasses are frequently confounded with each other . . . there are some exactly defined species indicated as the mother plants of oils which, according to our information, could not possibly be produced from them"; and again in the October–November Report for 1905, p. 52: "On a previous occasion we have already pointed out that the Andropogon grasses, where their origin is mentioned, are frequently mistaken one for the other. This inconvenience is all the more felt as the uncertainty of the botanical nomenclature also exists in scientific work."

At Kew the experience has been the same. The incongruous application of the names '*Andropogon Schoenanthus*' and 'Lemon-grass' and the obscurity of De Candolle's *Andropogon citratus* have been among the principal sources of trouble. To them has had to be added, more recently, uncertainty as to the origin of the Ginger-grass oil. Even the comparatively well-known Citronella grass has been suspected to be a "composite" species, or at any rate to include two varieties, the distinctive morphological characters of which were still to seek.

Under the circumstances a thorough overhauling, from the taxonomic standpoint, of the grasses involved was essential in the interests of the grass-oil industry. Having been entrusted with this task, I revised in the first place the material in the Kew Herbarium. Rich as it was in some respects, it was sadly lacking in others. A fine collection of oil-grasses made in Southern India at the instigation of Mr. C. A. Barber, Government Botanist at Madras, went a long way to fill the gaps, so far as the Madras Presidency and Travancore were concerned, whilst Dr. Lotsy, of the Rijk's Herbarium at Leiden, and Dr. Treub, of Buitenzorg, supplied useful material from Java. Convinced that no scientific problem should be approached without due consideration of its historical development, I have endeavoured to get a good grasp of the history of the subject. This has entailed a great deal of library work and search for original specimens, as documentary evidence, in the older herbaria. Professor Urban of Berlin, Professor Mattirolo of Turin, and Dr. Briquet of Geneva, have assisted in this direction by the loan of specimens; but the

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greatest help has come from the collections in the British Museum and in Hanbury's Herbarium at the Pharmaceutical Society of Great Britain. The Council of the latter Society have placed me under a special obligation by sending the whole of the *Andropogoneae* of that valuable collection to Kew in order that I might study it at leisure. For this liberal and courteous assistance I wish to express my sincere gratitude to all concerned.

In this paper I have endeavoured to embody the results of my researches into the history and taxonomic position of the oil-grasses of India and to introduce the necessary changes in their nomenclature. I hope to have laid the foundation for a more satisfactory conception of those grasses as taxonomic units. At the same time I am well aware of the incompleteness of my work and the inevitable defects of research carried on to a great extent with material which has been collected casually or at least without consideration for the requirements of the problem as it presents itself to-day. Moreover, certain questions, some of them of great theoretical and practical importance, can, at the herbarium table, only be approached by a method of inference. The conclusions arrived at in this way will carry more or less weight according to the number and precision of the data which the specimens present. I have in view more particularly the question of "variability" on which so much depends for the correct co-ordination and subordination of forms. The notes we have on this point from collectors and others who have had opportunities of observing the oil-grasses in their natural stations or in cultivation are few and extremely meagre. Systematically conducted experiments there are none. When this is the case the taxonomist has generally to fall back on his 'tact'; but valuable as this somewhat ill-definable quality in certain circumstances may be, conclusions based on it cannot be accepted as final so long as they have not been confirmed by extended and direct observation in the field and by experiment. Work of this kind must therefore necessarily be more or less incomplete and preliminary. Nevertheless, it is a *conditio sine quâ non* for systematically conducted field-work and experiment. It provides field-workers with a starting basis and with the means of checking the identity of the plants under observation. In return it will no doubt one day receive its corrective from that quarter. In discriminating and defining the species which are here under consideration I have so far relied on external characters. They might, and certainly will, in the future be supplemented by anatomical characters. I have not carried my investigations in this direction far enough for publication, but sufficiently far to see that they promise especially the possibility of greater precision in the description of some of the external characters. For naming purposes the anatomical characters will hardly be required in cases where complete material is at hand; but they may be of value where, for instance, as is sometimes the case, barren plants have to be determined.

How far they may influence the classification of the oil-grasses it is premature to say; but I would quote Hackel's* observation on the taxonomic value of anatomical characters in *Andropogoneae*

* Andropogoneae in DC. Monogr. Phaner., vol. vi., p. 17.

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generally. Having examined the leaf-structure of more than one fourth of all the *Andropogoneae* described in his monograph to see how far the anatomical characters coincide with the morphological and can be used for the definition of the natural groups, he says : "*The result is absolutely negative.* Neither is it possible to distinguish anatomically the *Andropogoneae* from the allied tribes or even the remote tribe of *Chlorideae*, nor is there any one character or combination of characters which is confined to one genus. Even the sub-genera possess a uniform leaf-structure only in some cases when they comprise less than ten species. The species, however, are, with the exception of such as are very polymorphous, mostly well characterised by their anatomy." It must, however, be remarked that the leaf is probably more plastic than any other organ in grasses and might therefore *a priori* be expected to exhibit the phenomena of epharmosis in a prominent degree. The study of the anatomy of the glumes and fruits would possibly yield a different result. However this may be, an investigation into the anatomy of the oil-grasses, and particularly into the development and distribution of the oil cells, is highly desirable. With the exception of a very valuable description of the oil cells of "*Andropogon Schoenanthus*" by Professor F. von Höhnel,* nothing is known in this direction. Yet it is quite obvious that to know the seat of the oil-yielding tissues, their properties, the time and conditions of their formation and the changes they subsequently undergo, must be of considerable importance for the rational development of the grass-oil industry, just as it is, from the standpoint of pure science, necessary for the complete understanding of the organisation of those grasses.

In so far as organisation means correlation of structure and function, new problems await us on that ground, but they are problems for the physiologist. Some are of a general nature, as the question of the genesis of the grass-oils and the place of these in the economy of the plants which produce them; others are more directly connected with the practical side of the subject, such as the problems of the changes in the yield of oil according to the season, its reduction in old plants, the variation in the chemical constitution of the oils in morphologically indistinguishable races, and the apparently capricious limitation of some forms, particularly suitable for industrial exploitation, to certain geographical areas. Remote as the relations of physiology to the taxonomy of the oil-grasses may appear to be, there is one problem which touches the latter directly. This is the question of purely physiological races : how far they actually exist, what they are, and what place they ought to be given in the 'system.' Other physiological problems are intimately connected with 'variability,' and so have a distinct bearing on taxonomy. Beyond this it is at present probably impossible to indicate in detail the help which in this, as in similar

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* F. von Höhnel, in Sitz. Ber. Akad. Wissensch. Wien, Mathem-Naturhist. Cl., vol. lxxxix., part. i. (1884), pp. 14, 15.—I have put the name *Andropogon Schoenanthus* between inverted commas because the author obviously intended to deal with the anatomy of the grass yielding the Palmarosa oil, viz., the *Andropogon Schoenanthus* of most Indian botanists, whilst he actually described the structure of the original Linnaean *Andropogon Schoenanthus* or the *A. laniger* of Desfontaines. Such are the pitfalls of a confused nomenclature.

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cases, the taxonomist may expect from the physiologist. But there will always be that general and fundamental relation which results from the rational conception of the ultimate task of the taxonomist, namely, to classify, not the dry and dead specimens of a herbarium, but through them the infinite diversity of forms in which plant life manifests itself.

In making these observations I may seem to have gone somewhat out of my way; but I shall perhaps be pardoned if I say that it appeared to me useful to show, in a case which is typical of the possibilities of applied botany, what the term 'botany' really means; to fix within its compass the position, the claims and the limits of taxonomy, and to emphasize the interdependence that exists between taxonomy, anatomy and physiology.

I have to add only one other observation in this place; it concerns the limitation of the genus *Andropogon*. Hackel's* definition is well known. It is wide enough to take in, not only the *Andropogon* of Bentham and Hooker's 'Genera Plantarum,' but also their *Heteropogon*, *Chrysopogon* and *Sorghum*. Hackel enumerates 193 species. This was in 1889; since then over 100 species have been added. But the genus is not only large, it is very heterogeneous. The author himself leaves no doubt as to that. He divides it into 13 subgenera, most of them very homogeneous groups. Their affinities are, however, admittedly† such, that some of them exhibit much closer relations to genera left outside the genus *Andropogon* than to the other congeneric subgenera. The result is a lack of symmetry in his system which is not only felt by the theoretical taxonomist, but also by the practical worker who has to sort and name *Andropogoneae*. Reaction was unavoidable, and it has already set in. Rendle‡ in England, Britton and Brown§ in America, Husnot‖ in France, have, more or less, returned to Bentham's exposition of the genera of *Andropogoneae*, and Sir Joseph Hooker¶ has expressed himself in favour of a similar course, whilst Nash** has even gone a step farther and re-established *Schizachyrium* and *Vetiveria*. Although convinced of the desirability of some change in this direction I have so far hesitated to accept it on account of the great number of alterations in nomenclature thereby entailed and of the difficulty in deciding what should be left in *Andropogon*. The latter objection does not, however, affect the grasses with which I have to deal in this paper. The subgenera *Cymbopogon* and *Vetiveria*, to which 11 out of the 12 oil-grasses belong, are sufficiently distinct to be recognised as genera, whilst the position of the remaining species in the reduced genus *Andropogon* is, whatever its exact limits may be, equally well assured. This being so, and considering the general tendency towards the recognition of less bulky and more homogeneous genera, it is clear that the change is bound to come. I have therefore decided to introduce it myself on this occasion,

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* Hackel, Andropogoneae in DC., Monogr. Phaner., vol. vi., p. 359.
† Hackel, l.c., pp. 360–361, and tab. 2.
‡ Rendle, in Cat. Afr. Pl. Welwitsch, vol. ii., p. 142.
§ Britton and Brown, Ill. Flora, Northern States and Canada, vol. i., p. 100.
‖ Husnot, Graminées de France, etc., pp. 15–17.
¶ Hooker, in Trimen, Fl. Ceylon, vol. iv., p. 227.
** Nash, in Small, Flora, South-East. United States, p. 60.

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the more so as other changes had to be made in any case. I am alluding to the circumscription of the species *Andropogon Nardus* and *A. Schoenanthus* of Hackel's monograph. They have become overloaded with subspecies and varieties just as the genus *Andropogon* has become overloaded with subgenera. Theoretically there is little or no objection to the subordination of those forms under a group of higher rank ; but it appears to me inexpedient to introduce those theoretical conclusions into what I may call our everyday nomenclature, which should be short, plain and direct. The species as I have defined them are with few exceptions, geographically, morphologically, and as far as we can see at present, also physiologically tolerably well defined, and those which are in cultivation have proved remarkably constant.

The complexity of the historical and argumentative part of the matter has obliged me to extend the volume of the paper so much that it is desirable to divide it into two parts. In the first part I attempt to give a circumstantial account of the botanical and economical history of the oil-grasses. The second is more of the nature of a résumé with the addition of such data as either result directly from the conclusions arrived at (*e.g.*, most of the synonyms) or have been thought worth including as a further help in the identification of the oil-grasses (*e.g.*, the enumeration of herbarium specimens and vernaculars). I have not thought it necessary to describe the species at length, as descriptions already exist, although in several cases the describers have treated some of the grasses merely as varieties. It has seemed to me, however, useful to add an expanded key to the species. This contains all that is essential for naming purposes; references to more extensive descriptions may be found under the heading 'Descriptions.'

I.—BOTANICAL AND ECONOMICAL HISTORY OF THE OIL-GRASSES.

All the oil-yielding grasses of India belong to the tribe *Andropogoneae*, which is, on the whole, rich in more or less aromatic species. No attempt has been made to treat them comprehensively from that standpoint, and practically nothing is known of the nature and distribution of the oil-containing tissues and their functions. The oils themselves have been examined in a few instances and their chemical constitution and physical properties ascertained ; but even in those cases a renewed examination is desirable as the botanical identification of the material examined is not always above suspicion.

The aromatic character of some of those grasses is so pronounced as to have attracted the attention of man at a very early period of his history. They found a place in the performance of religious rites, among domestic medicines, in the dispensaries of the medical practitioners, and in the department of spices and perfumes. The "Schoenanthus" of the Ancients, the "Viranam" of the Vedhas and the "Sereh" of the Malays are illustrative instances, and there is very little doubt that the much discussed κάλαμος ἄρωματικός of the Greek writers was a plant of the same category although we have not so far succeeded in fixing the

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species. With the discovery of more powerful or more pleasant aromata these oil-grasses gradually lost their importance or even fell out of use. But in our own day the highly perfected art of perfumery has seized on them again, has revived the taste for their odours and created that demand for their oils which has found its response in the development of a regular oil-grass industry in Ceylon, India, and to a less degree in the Malay Peninsula and in Java. Out of the 12 grasses treated here, only four are worked commercially; but there is no doubt that others are to be found, particularly among their African congeners, which might be equally serviceable and probably place new essential oils at the disposal of the manufacturers of perfumes and perfumed articles.

The genera to which those 12 species belong are *Cymbopogon* with 10, and *Vetiveria* and *Andropogon* with one species each. The following paragraphs contain an account of their history, botanical as well as economical.

1. Cymbopogon Schoenanthus, *Spreng.*

(*Andropogon Schoenanthus*, Linn., not of most authors.)
Camel-Hay—Izkhir (Arab.)—Khavi (Hind.).

"HERBA SCHOENANTHI," THE FOUNDATION OF THE SPECIES.—*Andropogon Schoenanthus* was established by Linnaeus in the first edition of his Species Plantarum, p. 1046, in 1753. As is so frequently the case, his diagnosis is utterly insufficient for identification. It consists of the specific phrase of the *Lagurus*, No. 465, of his Flora Zeylanica (1747). On the other hand, his references leave no doubt whatever that he meant the "*Herba Schoenanthi*" of the earlier herbalists and the pharmacopoeias of his time. He, moreover, states this expressly in his Materia Medica (1749), p. 31, where he also indicates Arabia as the native country of the species. In his Species Plantarum, it is true, he added "India" to the distribution area of *Andropogon Schoenanthus*. He cannot have known of the extension of this species into North-Western India; the reason for the addition must therefore be sought somewhere else. As this addition has led almost from the very beginning to great confusion, it appears necessary to examine the circumstances that may have guided Linnaeus. Was it the inclusion of the Ceylon *Lagurus* into the synonymy of the species, or did he possess specimens from India which he thought were identical with the Arabian "*Herba Schoenanthi*," the foundation of his species?

I take the case of the Flora Zeylanica first. There the passage concerned, and referred to above, is made up of diagnostic phrases of the "*Herba Schoenanthi*," of a citation from Burmann's 'Thesaurus Zeylanicus,' p. 107, and of another from Hermann's 'Museum Zeylanicum,' p. 66. Burmann himself, l.c., quotes Plukenet, Alm. p. 175, t. 190, f. 1, and Hermann. Neither Plukenet's text and figure, nor the original which is still preserved in his herbarium at the British Museum leave us in doubt as to his having the officinal "*Herba Schoenanthi*" in view. Concerning Hermann, however, this is what he says: "*Kalanduru*: Gramen Dactylon Zeylanicum radice tuberosa, aromatica, dulci, odorata." *Kalandura* is a name still in use in Ceylon, and applied to

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Cyperus rotundus, with which Hermann's description agrees. It is evident that the "*Herba Schoenanthi*" found its way into the Flora Zeylanica through Burmann's careless interpretation of Hermann's *Kalanduru*, and that Linnaeus was wrong if, indeed, his term "India" was meant for Ceylon.

The next question is, did Linnaeus possess specimens of *A. Schoenanthus* (in the sense of the "*Herba Schoenanthi*") or any other Indian specimens which he considered representative of his *A. Schoenanthus*? Munro* has stated that there are in Linnaeus's herbarium two specimens of "*A. laniger*" (that is "*Herba Schoenanthi*"), one in the cover containing *Avena*, the other placed with *Festuca* and written up as "*Nardus spuria Gangitis, Lob.*" In both cases he was mistaken. The specimen in the *Avena* cover is without any name or other note. When and whence Linnaeus got it, and even whether he himself placed it there, will probably never be known. In my opinion it is a sample of *A. marginatus*, Steud., from South Africa. The other sheet contains a couple of leaf-tufts, or rather their bases. They belong probably to *Ctenium americanum*, Spreng., an aromatic grass which was figured and described by Parkinson† first (p. 115), as "Nardus gangitis spuria Narbonensis," and then (p. 1688) as "Nardo gangiti spuriae Narbonensi similis planta Virginiana." But Munro‡ also pointed out that there was a specimen of "*A. Schoenanthus*, L." in the Linnaean herbarium, and he says of it: "*A. Schoenanthus*, L. From India and Arabia. This is the plant generally called '*A. Martini*,' Roxb., '*A. pachnodes*,' Trin., and many other names. It is quite distinct from Wallich's *A. Schoenanthus*. Linnaeus's specimen is remarkably well figured by Ventenat, Cels. t. 89." The only word on the sheet is "*Schoenanthus*," written by Linnaeus. The specimen itself consists of the upper part of a culm with a few leaves and a panicle. One thing is at once clear. It is not "*Herba Schoenanthi*." Nor is it *A. Martini* (or *A. pachnodes*), unless this name is made to include the whole of Hackel's *A. Schoenanthus*. It is indeed very similar to Ventenat's figure, cited above; but this was made, as I shall have to show later on, from a specimen raised from seeds collected in Mauritius, and represents *A. pruinosus*, Nees ex Steud. The Mauritius specimens, placed side by side with Linnaeus's "*Schoenanthus*," do not exactly match it. The latter is a slender plant with narrow leaves, slightly rounded at the base, rather narrow reddish spathes and small spikelets, such as are characteristic of the Chinese specimens enumerated by Rendle under '*Cymbopogon Schoenanthus*, Spreng., var. *caesius* Hack.' This, I believe, gives the clue to the origin of the Linnaean specimen. We know that Osbeck, who was in Canton in 1751, on his return to Sweden in 1752 gave Linnaeus a complete set of his collection ("Pastor Osbeck gave me one of every species he found in China and Java").§ We further find in Osbeck's "Voyage to China and the East Indies," vol. i., p. 346, this passage: "Among the hay which was given to our cow in the

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* Munro in Journ. Linn. Soc., vol. vi. (1862) pp 46, 48.
† Parkinson, Theatrum Botanicum (1640).
‡ Munro in Journ. Linn. Soc., vol. vi. (1862), p. 52.
§ B. D. Jackson in Proceed. Linn. Soc., Sess. 1887–88, p. 21.

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factory (in the suburbs of Canton) I found the following scarce grasses . . . *Andropogon Schoenanthus*," and later on in his Flora Sinensis (vol. ii. p. 364) "*Andropogon* 1. *Schoenanthus*." This by itself is conclusive evidence for the assumption that the specimen named "*Schoenanthus*" in Linnaeus's herbarium is Osbeck's, and therefore of Chinese, not Indian, origin. Moreover, Mr. B. D. Jackson pointed out to me that a specimen named "*A. Schoenanthus*" appears already in a manuscript catalogue of Linnaeus's herbarium drawn up about 1754. This date includes Osbeck's collection whilst it excludes all contributions of Indian plants, which Linnaeus may have received, with the exception of the small set which Olaf Toren sent him from the west coast of the peninsula in 1751. Linnaeus may, of course, have had Osbeck's specimen in his mind, when adding "India," using that term in a very vague way as often was the case in those times. But, however that may be, the determination of Osbeck's specimen as *A. Schoenanthus* and its presence under that name in the Linnaean herbarium only proves that Linnaeus also made mistakes. The supposition that the sheet written up by Linnaeus as "*Schoenanthus*" was really intended to serve as the "type" of his *A. Schoenanthus* is in the circumstances untenable, and it is therefore only reasonable that the name *Schoenanthus* be restored to the species which for 2,000 years had been known by it.

History of "Herba Schoenanthi."—When in 1881 Emil Brugsch Bey discovered the tomb of Deir-el-Bahari in the necropolis of Thebes, the secret vault which contained the coffins of so many illustrious kings also yielded a remarkable profusion of botanical treasures: funeral wreaths which the kings of the 20th or 21st Dynasty (between 1,200 and 1,000 B.C.) had deposited on the sarcophagi of their predecessors, offerings of fruits, lichens, bundles of a grass (*Desmostachya bipinnata*) and quantities of the straw of another grass which Professor Schweinfurth* recognised as "*Gymnanthelia lanigera*" (a rarely used synonym of *C. Schoenanthus*). Some of the inflorescences were still in excellent condition. Even "the odour of the grass was preserved to a certain extent in the mixture of the offering." So early begins the history of the grass. Then the grass was found under similiar conditions in the tombs of the cemetery of Hawara† in the Fayum, again associated with *Desmostachya bipinnata*. According to Professor Flinders Petrie some of the tombs were probably‡ of the 20th, 26th and 30th Dynasties, but most were Ptolemaic. According to Loret§ the grass is also frequently mentioned in hieroglyphic perfumery receipts as 'Aethiopian cane,' 'rush of the Sudan,' and 'Cyperus of the West.' Whether all of these names actually refer to *C. Schoenanthus* or not, the finds of Deir-el-Bahari and Hawara afford in any case indisputable proof of the high place which was assigned to the grass 3,000 years ago. To-day *C. Schoenanthus* does not grow in the neighbourhood of old Thebes or in the Fayum; it has in fact, with one exception,

* Schweinfurth in Nature, vol. xxviii. (1883), p. 113.
† Newberry in Flinders Petrie, Hawara, Biahmu and Arsinoe (1889), p. 53.
‡ Flinders Petrie, l.c., p. 8.
§ Loret, Flore Pharaonique, (1887), p. 11.

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never been observed in the Nile valley north of the Baiuda Desert (16°–18° N.), the exception being some specimens collected by Bové* in the desert near Cairo in 1829. Schweinfurth identified the *Andropogon* of Deir-el-Bahari more particularly with the article which nowadays is brought down from the Sudan and sold in the bazaars of Cairo as a medicinal drug under the Arabic name 'Mâhareb.' We shall, however, hear presently that the African *Schoenanthus* was considered by the ancients to be of very inferior quality, and it is therefore more likely that at least a part of the supply for Thebes and Hawara came from the Arabian trade emporia on the Red Sea; so far indeed as the Ptolemaic period is concerned we know this for certain.

It has been suggested that the 'Kaneh bosem' or 'Kaneh hattobh,' the "good" or "fragrant" reed of the Bible was also *C. Schoenanthus*. It may, of course, be assumed that the old Hebrews knew the grass; but how far it answered to those terms, is difficult to say, considering the vagueness of the passages in which they occur. The first Greek translators of the Bible, however, rendered them as "Κάλαμος ἀρωματικός," which was very generally put down as a product of India.

The early connections which existed between Egypt and ancient Greece, possibly also those with Phoenicia, may have made the Greek doctors familiar with *C. Schoenanthus* at a remote date. Hippocrates (460–357 B.C.) knew it as 'σχοῖνος'† κατ' ἐξοχήν, or in connection with the epithets ἡδύοσμος, εὔοσμος and εὐώδης.‡ He does not attempt to describe it. It was evidently an article familiar to those of his contemporaries for whom his treatises were written. It is only gradually that we learn more about it until at last we have undisputed evidence of the meaning of those terms which were handed on, mainly in prescriptions, from generation to generation. Theophrastus§ (390–305 B.C.), mentions σχοῖνος among the aromata, and he makes the first attempt to fix its origin. He indicates two localities as its home. One is "on the other side of the Libanon" in the marshes of a lake which can easily be identified as Lake Huleh (Lake Merom of the Bible) in Galilee. So far, he is no doubt wrong, for *C. Schoenanthus* is not a marsh plant and has never been observed there. Its nearest station is some 270 miles north-east of Lake Huleh, on the Euphrates. The other habitat mentioned by Theophrastus is Arabia, of which he says "the steppes are, as is common knowledge, fragrant with the exhalation of the grass" ("in Arabia aspirationem agri odoratissimam esse inter omnes constat"). Dioscorides‖ (circa 77 A.D.) takes us a step further. He too knows the Arabian variety and accords the first place to it, particularly to that which comes from Nabataea. Then there is a Babylonian kind, also called τευχίτης, and an inferior variety

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* According to his own labels; but he does not mention the grass in his Relation abrégée d'un voyage bot. in Ann. Sc. Nat. sér. 2., vol. i. (1834), pp. 72–76.

† Hippocrates, ed. Anutii Faësii, Francf. (1595), sect. v., p. 138, line 16.

‡ According to Stephanus, vii., p. 1682, A and B. *See also* Kirchner, Bot. Schrift. Theophrastus (1874), p. 493.

§ Theophrastus, Hist. Plant. Illustr. J. B. Stapel, lib. ix., p. 1004.

‖ Dioscorides Anaz., De Materia Medica, ed. Sprengel, p. 31.

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from Africa (Libya). As *C. Schoenanthus* has not so far been observed in Arabia north of 18° N., we must assume either that the author took the term Nabataea in a wider sense than we do in confining it to Arabia Petraea, or that the article arrived through Nabataean channels, whence Nabataea acquired the reputation of being the home of the drug. Considering the position which that region long occupied in the commercial relations of Arabia with the Levantine countries, the latter explanation is the more probable. The source of the 'Babylonian' article is undoubtedly that small and rather isolated area which extends from Rakka* on the Euphrates east and south-east to the Turco-Persian frontier. Plinius† (23–79 A.D.) merely repeats Theophrastus' and Dioscorides' statements concerning the origin of σχοῖνος, or as he calls it, *Juncus odoratus*. Galenus‡ (131–200 A.D.) also refers to Arabia as the home of the σχοῖνος, adding that he does not know why it is vulgarly called "σχοίνου ἄνθος," there being as a rule no flowers with the grass as imported from Arabia: for the camels are very fond of it and eat off the tops. This is the first time that σχοίνου ἄνθος is mentioned. Its Latin equivalent, however, '*Schoeni odorati flos*,' occurs already in a prescription of the Roman surgeon Scribonius (about 40 A.D.). On the other hand the contracted form '*Schoenanthus*' (Squinanthus) does not appear until the fourth century when Palladius§ uses it in a recipe for spicing wine. That the inflorescences, however, were used and valued long before Galenus is evident from Dioscorides, who says (l.c): "Usus est floris culmorum radicisque" and recommends for medicinal purposes the selection of many-flowered (πολυανθῆ) specimens. Possibly it was just the rarity of the flowers which enhanced their value in the Greek and Roman markets. As a medicinal drug it was chiefly appreciated as an active carminative, diuretic and emmenagogue. I have referred to the use of σχοῖνος for spicing or perfuming wine. It is already recorded by Cato‖ (223–149 B.C.). For that purpose it was either pounded in mortars (Cato) or boiled with the wine (Columella).¶ Similarly it was used for aromatising oil, and the '*oleum juncinum*' of Plinius** was probably nothing but olive-oil perfumed with '*Schoenanthus*.' In a similar way it entered into the preparation of laurel-, rose-, and quince-oil (Dioscorides),†† and was no doubt, even in those remote days an ingredient of cosmetics and perfumes, so that Propertius‡‡ could very well say: "Afflabunt tibi non Arabum de gramine odores, sed quos ipse suis fecit Amor manibus."

It is quite in keeping with the general character of Greek and Roman literature that we do not meet with any serious

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* Rauwolf, Beschreib. Raiss. Morgenländ. (1583). p. 160.

† Plinius, Nat. Hist.; ed. Dalecamp. (1615), lib. xii., cap. xxii., p. 256.

‡ Galenus, Lib. de antid. i., cap xiv., according to Stapel in his edition of Theophrastus, l.c.

§ Palladius, Agricultura, xi. (October), 13.

‖ Cato, De Re Rust., cap. civ. (p. 45 of ed. Lugd., apud Gryphium, 1541).

¶ Columella, Rei Rust., lib. xii., cap. xx.

** Plinius, l.c., lib. xv., cap. vii.

†† Dioscorides, l.c., pp. 55, 57, 58.

‡‡ Propertius, ii., 29, 17–18.

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attempt at describing an article like σχοῖνος. In fact, the only reference to it which contains a descriptive element is in Dioscorides* where he gives instructions for the selection of the material :—it is to be fresh, reddish (ἐμπύῤῥον), many-flowered, purplish and whitish when split apart (*i.e.*, when the leaf-bases, which are purplish and white, are pulled apart), to emit an odour like roses when rubbed in the hand, and to have a hot, pungent taste. The use of the drug continued in the West after the downfall of the Roman Empire, although apparently only for medicinal purposes, through the Middle Ages and even into the 18th century, when it gradually became obsolete. We find it in the prescriptions of Aëtius (450 A.D.), and in the writings of the School of Salerno. Here the name '*palea camelorum*' may have originated. At least it is attributed to Matthaeus Platearius (about the middle of the 12th century) in the various editions of the Ortus Sanitatis,† although it may, of course, be much older, as Galenus had already connected the '*Schoenanthus*' with the camel. In the Ortus Sanitatis we also find the first figure intended to represent the '*Schoenanthus*' or '*Squinanthus*,' as it is called there. It is so conventionalised as to be unrecognisable. From Brunfels‡ (1536 A.D.), onward it is a standing article in all the herbals of the 16th and 17th centuries, and is the subject of sometimes elaborate discussions in the commentaries on Dioscorides, Plinius, and Theophrastus. It was very frequently figured in those works, the figures being drawn from the mostly barren leaf-tufts as they reached Europe. Sometimes inflorescences more or less conventionalised were added. One of the earliest of those figures, by Lobel§ (1576 A.D.), is among the best. A very good description of the drug was given by Joh. Bauhin (1658 A.D.).‖ Finally in 1692 we have Plukenet's¶ description and figure, which I have mentioned on p. 303. Both are indifferent; but they are supported by Plukenet's original specimen which still exists in his herbarium at the British Museum, and is the typical '*Schoenanthus*' of the old herbalists. On this, and on this alone, Linnaeus based the '*Lagurus*' of his Materia Medica, which is—if I may say so—the backbone of the *Andropogon Schoenanthus* of the 'Species Plantarum.' To finish my account of the '*Herba Schoenanthi*,' I now turn once more to the East. We have seen that the Nabataean *Schoenanthus* was, in the times of Dioscorides and Plinius, more valued than any other, and I have already pointed out that it was called Nabataean more likely because it came viâ Nabataea than on account of its growing there. In connection with this, it is interesting to note that according to Meyer,** Qûtsami's "Book of Nabataean Agriculture" actually enumerates 'Idshir' (Izkhir, the Arabic name of *Schoenanthus*, quâ drug), but with the epithets 'Babylonian' and 'that of Hedjas,' and not as Nabataean. Meyer quotes from Ibn Alawwam's 'De Agricultura,' who in turn quotes largely

* Dioscorides, l.c., p. 31.
† Ortus Sanitatis, Matth. Sylvatici (1511), cap. cccclii.
‡ Brunfels, Nov. Herb., vol. ii. (1536), p. 100.
§ Lobelius, Stirp. Hist. (1576), p. 42.
‖ J. Bauhinus, Theatr. Bot. (1658), p. 165.
¶ Plukenet, Phytogr., tab. 190, fig. 1.
** Meyer, Gesch. d. Botanik, vol. iii., p. 61.

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from the Arabic translation of Qûtsami's great work which, again according to Meyer, was probably written in the 2nd or 3rd century of our era. How far this is correct, I must leave others to decide, but the statement about the origin of the '*Schoenanthus*' is quite consistent with Dioscorides' and Plinius' accounts, whilst the mention of the Hedjas, where the grass has actually been collected, satisfactorily fixes the home of the Nabataean 'σχοῖνος'. Ishag Ben Amrân* of Bagdad (died 903 or 905 A.D.) also mentions the Hedjas as the country producing the best *Izkhir*. It comes next to that of Antiochia, whilst the African is the worst. The *Izkhir* of Antiochia is evidently the 'Babylonian' variety, Antiochia being merely the market whence it was distributed. Avicenna† (980–1037 A.D.) too distinguishes two kinds, the Arabian and an inferior 'foreign' (Ajami) kind. As may be expected there is more freedom in the way in which the Arab writers treated the subject, as some of them must have known the grass in the field or at any rate had first-hand evidence. Thus Abu Hanifadt‡ (died 895 A.D.) gives a description of it which could only have been made from autopsy. I quote it: "*Izkhir* is a plant with a root deep down in the ground and slender, very fragrant culms, like rush or papyrus, but finer and with smaller joints. It has tufted infructescences (fruits) like the panicles of the reed, but more delicate and smaller. It is pounded and mixed with perfumes. It rarely grows solitary. Where it has settled, it may be seen to spread and cover the ground; it inhabits plains and desert land. When it dries up, it turns white." Like the old Greek doctors the Arabs prescribed it for the preparation of unguents, theriacs—among them the famous Electuarium Mithridatis—and oils. Ibn Baithar§ quotes from the 'Books of Experience' the method of preparing the latter thus: "Take of the flowers of the grass, put them in double the quantity of oil of unripe olives . . . press the whole well and throw the flowers away; take another lot of flowers and put them in the oil. Repeat this three times in the hot season." From the Arab writers the drug passed naturally into the Persian pharmacopoeias, as for instance the 'Ulfaz Udwiyeh' of Mohammed Abdullah Shirazi‖ (1450 A.D.), and the 'Pharmacopoea Persica' of Frater Angelus¶ (1681 A.D.). Whence the Persians got their supply of '*Izkhir*' is not quite certain. So far the grass has been found only in a few localities in Persia and nowhere in quantity. It was probably mostly Arabian. Still Kaempfer** speaks of a "Persian and an Arabian Schoenanthus." Considering the part which Arabian and Persian doctors played at the courts of the Mahometan princes of India it would be surprising if the ingredient of so many theriacs, electuaries and other preparations had not also found its way into the Indian dispensaries. We possess a fairly full account of an instance of import of '*Izkhir*' under rather remarkable circumstances in Garcia de Orta and

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* *See* Ibn Baithar; transl. Sontheimer, vol. i., p. 19.
† Avicenna, Lib. Canon. ed. A. Alp. Bellun. (1555), p. 160.
‡ *See* Ibn Baithar, transl. Sontheimer, l.c.
§ Ibn Baithar, transl. Sontheimer, l.c.
‖ Ulfaz Udwiyeh, transl. Gladwyn,
¶ Pharmacopoea Persica (F. Angelus), pp. 108, 109, 301, 302, 307, 312.
** Kaempfer, Amoen. Exot. (1712), p. 772.

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Acosta. This is what Orta,* in Clusius' edition of the Aromata, says: "*Juncus odoratus* grows in great abundance in the Arabian provinces of Mascat and Kalhat. The natives call it '*Sachbar*,' some also '*Haxis cachule*' (Hashish ghasul), that is lotion grass . . . and the flowers '*Foca*' . . . With the Indians no special name has arisen; but they dub it Mascat grass, some also Mecca grass, and also Camel Hay. There are in those countries plenty of asses, mules, horses, etc., which know no other fodder. . . . It is imported into India for medical purposes; but the greatest quantities come with the horse-dealers (of Mascat and Kalhat) who take it tied up into bundles with them in their ships to use it as litter for their horses . . . I remember that at Diu they sold many bundles of *Juncus* for a mere trifle; . . . but the natives do not appreciate it, as they are a rough and savage people, and they do not use it. We, however, and the Arab and Persian doctors employ it. The (Arab?) natives wash themselves and their beasts with it." In the 'Coloquios dos simples e drogas' the same author† also observes that the Arab and Persian doctors in India call it by its Arabic name *Izkhir* (*Adhar*, as he renders it) and the learned physicians of the Nizam of Haiderabad, 'Esquinanto,' and they are well aware that this is a Greek name. The grass has been collected in the interior of Mascat by Aucher and Bornmüller, and although I cannot find any reference to its growing there so very profusely, there can be no doubt that Orta's and Acosta's accounts are substantially correct. The horse trade from Arabia to India ceased, or was in any case greatly reduced, when the Portuguese dominion in the Indian Seas came to an end, and with it most likely the import of '*Izkhir*' into India disappeared. For this there was also another reason; the Indian drug dealers must soon have found out that they not only had the same grass growing in the Panjab, but also that it came in its properties so near to other indigenous aromatic grasses with which the native doctors had long been familiar that the foreign article could well be dispensed with. The influence of the Persian physicians and the reputation of their pharmacopoeias were sufficiently weighty also to transfer the foreign name '*Izkhir*' to the native drug. Not only was and still is the *C. Schoenanthus* of the Panjab‡ sold in the bazars as '*Izkhir*,' but the name has also passed on, with or without the qualifying epithet '*ajami*' (foreign) or '*Hindi*,' to *Vetiveria zizanioides* (*A. muricatus*) and other indigenous aromatic grasses, so that it has become with certain writers almost a generic name. Thus the '*Izkhir*' of the '*Abir Izkhir*' of the Ain-i-Akbari§ (end of the 16th century) is *V. zizanioides*; the 'Taleef Sherif'‖ has '*gundheel*' (*C. Martini*) as synonymous with '*Izkhir*,' and the author of the 'Makhzan-el-Adwiya' (1771 A.D.)¶ enumerates no fewer than six Hindi synonyms for '*Izkhir*,' most of them vernaculars of *C. Martini*. It will be seen that the vernacular synonymy of *C. Schoenanthus* was, in India at any rate, just as confused as the scientific nomenclature of the species at present is.

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* Garcia de Orta, Arom. Hist. lib. i., cap. xxxiv. (in Clusius, Exot., p. 203).
† Garcia de Orta, Coloq. Simpl. e drog. (ed. 1872), pp. 197y, 199y.
‡ Baden Powell, Punjab Prod. (1868), p. 383; *Andropogon iwarancusa* in part.
§ Hooper in Calcutta Review, Oct., 1904.
‖ Taleef Sherif, transl. Playfair, p. 129.
¶ Dymock, Veget. Mat. Med. Western India, ed. 2 (1885), p. 851.

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CONFUSED CONCEPTION OF LINNAEUS'S ANDROPOGON SCHOENANTHUS.—The second edition of the Species Plantarum* (1763) agrees with the first in the definition of *Andropogon Schoenanthus*. Previous, however, to its publication Linnaeus had already added to it Rumphius' '*Schoenanthum Amboinicum*'† as a synonym, and this was kept up in the following editions. For a fuller account of this reduction I would refer the reader to *Cymbopogon citratus*. The identification was accepted by Lamarck,‡ Willdenow,§ Roxburgh‖ and others, and was gradually extended so as to include a number of other species, as will be seen from the paragraphs dealing with their history. An important factor in this development was the publication of a description and plate of '*A. Schoenanthus*, L.,' from cultivated specimens, by Ventenat,¶ which requires therefore to be explained. Lamarck, in 1783, stated that "*Andropogon Schoenanthus*"—he included under it (*a*) Rumphius' plant (= *A. citratus*, DC.), (*β*) Rheede's *Kodi-pullu* (= *A. flexuosus*, Nees ex Steud.) and (*γ*) the same author's *Ramacciam* (= *A. muricatus*, Retz.)—was cultivated in the Jardin du Roi (Jardin des Plantes) and that he saw living specimens of it. Mr. H. Hua, who kindly looked up the Lamarckian specimens of '*A. Schoenanthus*,' informs me that there are no specimens from the Jardin du Roi in Lamarck's collection. What they actually were we therefore do not know. Seventeen years later we hear again of '*A. Schoenanthus*' being in cultivation in Paris, but this time in the garden of J. M. Cels, the distinguished horticulturist. Ventenat gave an elaborate description of it, accompanied by a very good plate. He does not say where it came from, but merely states that it had been growing there for several years. On the other hand, he indicates, just as Linnaeus did, India and Arabia as the home of the species. Fortunately Ventenat's original specimen is preserved in Delessert's collection at Geneva, and with it are two other sheets of exactly the same plant, collected by Riche. One of them is labelled : "*Andropogon Schoenanthus*, Linn., Hort. Cels. pl. ex Indiâ, *Riche*. Herb. de Ventenat" ; the other contains merely the words "Indes—*Riche*." Riche was the naturalist on board the 'Espérance,' one of the vessels sent in search of the 'La Pérouse.' After having been forcibly detained on the return voyage with other members of the expedition in Java, he went to Mauritius (Isle de France) in May, 1794, returned to Java in August or September, and in the following year sailed again with Labillardière and others of his colleagues for Mauritius, which they reached in May, 1795. Labillardière stayed there till late in the autumn and arrived in France in the spring of 1796. Whether Riche returned with him or in the following year with Lahaye, another of the naturalists of the expedition, I do not know. In any case this much is certain ; Riche never was in India, and Ventenat's '*A. Schoenanthus*' was raised from seeds collected by Riche in Mauritius about 1795. The indication "Indes" originated evidently from the vague sense,

* Linnaeus, Spec. Plant. ed. ii. (1763), p. 1481.
† Rumphius, Herbar. Amboin. vol. v. (1750), p. 181, tab. 72.
‡ Lamarck, Encycl. vol. i. (1783), p. 375.
§ Willdenow, Spec. Pl. vol. iv., part ii. (1806), p. 915.
‖ Roxburgh, Fl. Ind., ed. Carey & Wall., vol. i. (1820), p. 278.
¶ Ventenat, Hort. Cels. (1800), tab. 89.

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already adverted to, in which that term was frequently used in earlier times. Ventenat's '*A. Schoenanthus*' has, of course, nothing to do with the classic "*Schoenanthus.*" It is what was subsequently issued by Sieber from the same island as *A. aromaticum* and described as *A. pruinosus*, Nees, by Steudel,* a form very closely allied to *Cymbopogon polyneuros* (*Andropogon versicolor*) of the Nilgiris and Ceylon.

The vagueness of Linnaeus's diagnosis and the absence or extreme rarity of herbarium specimens at that time on the one hand, and on the other the precision of Ventenat's description and figure, explain sufficiently why henceforth his '*A. Schoenanthus*' was very generally taken as the type of that species, although it remained assigned to Linnaeus as the author. The identity of Linnaeus's original '*A. Schoenanthus*' was, however, further obscured by the circumstance that in the very year (1800) in which Ventenat published his plate of a Mauritius grass under the name of '*A. Schoenanthus*,' Desfontaines† described the old '*Schoenanthus*,' which he had collected in Tunis in 1783 or 1784, as a new species, viz.: *A. lanigerum* (sic). Desfontaines, who in 1800 would know the *A. Schoenanthus* of his friend Cels if he did not already then grow the grass himself in the Jardin des Plantes—he did so in 1804‡—must of course, have considered himself quite justified in doing as he did. The confusion has not entirely escaped the attention of botanists, as for instance of Nees and Steudel, but it soon became so great that their efforts have resulted in merely further complicating the nomenclature.

Oil of Cymbopogon Schoenanthus.—I have already pointed out the use, which was made of '*Schoenanthus*' in ancient Greece and Rome and also in the Orient, for aromatizing oils. The same use is recorded by the author of the 'Tuhfat-el-muminin' (1669 A.D.), but he also mentions, according to the 'Pharmacographia Indica' (vol. iii. p. 558), "a distilled water prepared from *Izkhir*." It is, however, not quite clear which '*Izkhir*' is meant. On the other hand Kaempfer§, who travelled in Persia from 1683–1688, speaks distinctly of the distillation of oil from Persian and Arabian '*Schoenanthus*,' but whether he refers to it only as a casual experiment or as an industry is not said. If the latter, it cannot have been on more than a very moderate scale, such as we find in existence in the Panjab. Edgeworth,‖ who is the first to mention the grass (under *A. Ariani*) from North-Western India, made the following note on a label accompanying a specimen collected by him near Firuzpur in 1840, and now in the Wallichian collection of the Linnean Society: "An essential oil expressed from the roots, manufactured only at Kasúr in the Punjab." This is probably the same kind of oil which Vigne records from Hassan Abdal (between Attok and Rawulpindi) with these words: "A stimulating oil is extracted and used in medicine." Mr. Drummond assures me that a family of priests at

* Steudel, Syn. Pl. Glum. vol. i. (1855), p. 388.
† Desfontaines, Fl. Atl., vol. ii. (1800), p. 379.
‡ Desfontaines, Tabl. École Bot. (1804), p. 14.
§ Kaempfer, Amoen. Exot. (1712), p. 772.
‖ Edgeworth in Journ. Linn. Soc., vol. vi. (1862), p. 208.

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Kasúr produced this oil quite recently. Dymock* obtained from the grass purchased in the bazar an essential oil with an odour like that of Elemi oil (Schimmel & Co.), probably due to its Phellandrine content. The yield is rather large, 1 oz. of oil to 6½ lbs. of the dry grass.

This is then all that is left of the once much-prized drug: a few dusty bundles of hay in oriental bazars, a few ounces of oil, and the ancient name under cover of which other grasses have found their way into the pharmacopoeias and the chemical industry of our day. There seems to be, however, no reason why the old article should not to some extent recover its lost prestige, at least in the province of perfumery, which is ever in search of change and variety.

2. Cymbopogon Jwarancusa, *Schult.*

(*Andropogon Jwarancusa*, Jones.)

Jwarancusa (Hind.)

DISCOVERY OF THE GRASS AND DERIVATION OF THE NAME.—This grass became first known (1790) through a publication on the 'Nardus Indica or Spikenard' by G. Blane,† whose brother discovered it in 1786. His account of the discovery may be worth reproducing: "Travelling with the Nabob Vizier, on one of his hunting excursions towards the northern mountains, I was surprised one day, after crossing the river Rapty, about 20 miles from the foot of the hills, to perceive the air perfumed with an aromatic smell; and on asking the cause, I was told it proceeded from the roots of the grass that were bruised or trodden out of the ground by the feet of the elephants and horses of the Nabob's retinue. The country was wild and uncultivated, and this was the common grass which covered its surface, growing in large tufts close to each other, very rank, and in general from 3 to 4 feet in length. As it was the winter season there was none of it in flower. Indeed, the greatest part of it had been burned down on the road we went, in order that it might be no impediment to the Nabob's encampments. I collected a quantity of the roots to be dried for use, and carefully dug up some of it, which I sent to be planted in my garden at Lucknow. It here throve exceedingly, and in the rainy season it shot up spikes about 6 feet high. . . . It is called by the natives Terankus, which means literally in the Hindu language, fever restrainer, from the virtues they attribute to it in that disease. . . . It is esteemed a powerful medicine in all kinds of fevers, whether continued or intermittent. The whole plant has a strong aromatic odour; but both the smell and the virtues reside principally in the husky roots, which in chewing have a bitter, warm, pungent taste, accompanied with some degree of that kind of glow in the mouth which cardamoms occasion." Banks, who received a specimen from Blane, recognised it as a hitherto undescribed species of *Andropogon*; but neither he nor Blane gave it a name. On the

* Dymock, Warden and Hooper, Pharmacogr. Indica., vol. iii. (1893), p. 564.
† Blane, in Phil. Trans., vol. lxxx. (1790), p. 284; abridged edition, vol. xvi., p. 658.

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plate accompanying Blane's paper it is called 'Nardus Indica,' Blane being of opinion that it was the Nardus Indica of the ancients. In 1795 Jones* disposed of that theory, and also established the specific name by which it is now generally known, except in so far as it is always spelt erroneously "*Iwarancusa.*" The first letter of the name as used by Jones is distinctly J, not I. The substitution of I for J has altogether obscured the derivation of the name, which is from Jwará (fever) and ankusá (the hook used by the elephant driver to restrain his elephant), hence "fever-restrainer" as Blane and, more recently, Madden† have correctly rendered it. The grass was subsequently found by Dr. Boyd near Hurdwar, and as his specimens were distributed with Wallich's plants, it has become fairly well known. Its further history is of little interest, and may be gathered from the synonymy given on p. 354. In the Panjab it is known under the same name as *C. Schoenanthus*, viz., *Khavi*,‡ and is probably also used for the same purposes. Its affinity with *C. Schoenanthus* is, indeed, very great, and the two are, as Hackel has already pointed out, not always distinguishable with certainty. The area of *C. Jwarancusa* extends from the outer hillzone of the United Provinces into Kumaon and Garhwal, and westwards as far as Kashmir and the north-eastern Panjab. At high altitudes, as in Kumaon and Spiti, or in the dryer parts of the Panjab, it becomes dwarfed and narrow-leafed and forms a "transition state" to *C. Schoenanthus.* The latter is a characteristic desert plant, able to exist with a minimum supply of water. On the other hand, *C. Jwarancusa* is dependent on an, at least temporarily, abundant supply of water, and prefers the neighbourhood of rivers, or actually grows in the beds of torrents. It is not impossible that the distinguishing characters of *C. Jwarancusa* as compared with *C. Schoenanthus*, that is the robust state, the long, flat and relatively broad leaves, and the more composite panicles, are mainly due to edaphic influences.

3. Cymbopogon Nardus, *Rendle.*

(*Andropogon Nardus*, L.)

Citronella Grass.

Foundation of the Species and Early History.—If the history of Linnaeus's *Andropogon Schoenanthus* is bewildering, that of his *A. Nardus*, the other aromatic *Andropogon* known to him, is perfectly clear. In this case Linnaeus has been quite consistent, and his references, with the exception of those to Mattioli and Bauhin, are unobjectionable. Moreover, there is still at the British Museum, in excellent preservation, Hermann's specimen of '*Pengriman*' on which the species finally rests.

Paul Hermann, chief medical officer in the Dutch East India Company's service, resided at Colombo between 1672 and 1677, and all his collections were made in the neighbourhood of that town. This fixes sufficiently the origin of the specimen which, in

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* Jones in Asiat. Research. vol. iv. (1795), p. 109.

† Madden in Trans. Edinb. Bot. Soc., vol. v. (1857), p. 138. Madden has given here also another version, viz., *Jwaranásaka* (fever destroyer).

‡ Baden Powell, Punjab Prod. (1868), p. 383.

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his posthumous 'Museum Zeylanicum' (p. 26), published by Sherard in 1726, is referred to as: "*Pengriman Arundo Zeylanica farcta odore et sapore calami aromatici.*" *Pengriman* evidently stands for "*Pengiri mānā*" (*i.e.*, sour mānā), the name by which the grass is still known in Ceylon. Nicolaus Grimm,* a contemporary of Hermann, also a medical man, and also for a considerable time resident at Colombo, calls it "*Arundo indica odorata*," and says of it: "Its lower part is like that of cane and the upper like a grass. The root is rather hard, splits like wood, and is very fragrant; it resembles somewhat *Calamus*, and is divided into joints of equal length and nodes. It grows rather copiously near the town of Colombo. . . By distillation a fine oil is prepared from it, which in small doses contains all the virtues of the plant, comforting the stomach and aiding the digestion when it is disturbed by cold, slimy or fœtid humours. It is the best remedy in cases of obstructed menses, and accelerates them. A watery infusion has the same power. The plant is very good for cold and hot baths in beri-beri and in the diseases mentioned above." Hermann's specimen agrees absolutely with the ordinary Citronella grass as it is at present cultivated in South Ceylon, and there is no doubt in my mind that the grass was already in cultivation in his time, so that Grimm's note as to the grass growing copiously near Colombo would refer to plantations of the grass.

Linnaeus, like other writers before him, was inclined to find the "*Nardus Indica*" of the ancients in some reed-like grass, and thinking that Hermann's *Pengriman* might be it, called it *Andropogon Nardus*. In connection with this, it may be of interest to point out that Camus and Penzig found†, in the so-called Este Herbarium at Modena, which was formed between 1565 and 1598, a portion of a shoot of *C. Nardus* under the name of "Spigo Nardo." Others saw in it the old *Calamus aromaticus*, and it may actually have been offered, under that or a similar name, in European drug-shops. Thus, for instance, there is attached to Hermann's specimen in the British Museum the note—in whose hand I do not know—"*Calamus odoratus officinarum.*"

Confusion with Lemon Grass.—The Citronella grass early shared the fate of the other aromatic *Andropogoneae* by becoming almost hopelessly confused. It was Ainslie‡ who first (1813) suggested that it was identical with the 'Ginger grass' of Courtallam (*C. flexuosus*) and the cultivated 'Lemon grass' (*C. citratus*), and it seems to have been known for a long time by the latter name; but as 'Lemon grass' was very generally put down as '*Andropogon Schoenanthus*,' Citronella was also frequently referred to by that name, chiefly by pharmacists and chemists. Then, the French name for 'Lemon grass' being 'citronelle,' the latter term also found its way into English literature, originally as a synonym of 'Lemon grass' in the wider sense, and later on more especially of the 'Ceylon lemon grass,'

* Grimm, Labor. Ceyl., p. 120, ex Burmann, Thes. Zeyl. (1736), p. 35.
† Camus and Penzig in Atte Soc. Natur.. Modena, Mem. ser. iii., vol. iv. (1885), p. 33 (of reprint).
‡ Ainslie, Mat. Med. (1813), pp. 115 and 128.

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that is, *C. Nardus*. Pereira* (1850) seems to have been the first to use the term 'citronelle oil' as equivalent to 'lemon grass oil.'

CITRONELLA OIL AND PLANTATIONS.—J. Bell,† in his notes on the London International Exhibition of 1851, mentions "oil of citronelle, or oil of lemon grass." He says it is imported from India, "and is the produce of a grass, known to botanists as *Andropogon citratum* and by some persons considered to be identical with *Andropogon Schoenanthus*." In the Ceylon catalogue of the Paris Exhibition of 1855, p. 17, we find two distinct oils: (1) Lemon-grass oil, from '*A. Schoenanthus*,' and (2) "Citronella oil; citron oil; perfumery," and against the latter there is in the Kew copy an entry in Alex. Smith's handwriting: "Citronella oil, Andropogon." W. S. Piesse, in his "Art of Perfumery" (1855), p. 31, also refers to '*Citronella*,' saying: "Under this name there is an oil in the market, chiefly derived from Ceylon and the East Indies; its true origin we are unable to decide. In odour it somewhat resembles citron fruit, but is very inferior. Probably it is procured from one of the grasses of the Andropogon genus." Gladstone‡ (1872) and C. R. A. Wright§ (1874) were the first to examine, under the name of '*Citronella*,' the oil of *C. Nardus*, as is evident from their descriptions of the oil, but both referred it to '*Andropogon Schoenanthus*.' Even as late as 1880, it was confused with *C. flexuosus* and *C. citratus* by Bentley and Trimen,‖ who figured a specimen of the former as *Andropogon Nardus*. In 1883 'Citronella' was at last clearly confined to *Andropogon Nardus* by Watt,¶ who gives the average exportation of citronella from Colombo as amounting to about 40,000 lbs.; the exact return for 1864 was 622,000 ounces. In 1872 the export had risen to almost 100,000 lbs. (1,595,257 ounces), in 1887 to 551,706 lbs., and in 1899 to 1,478,756 lbs. Since then it has fallen to 1,282,471 lbs. in 1905. The area under cultivation is at present estimated at between 40,000 and 50,000 acres, and is almost entirely confined to the Southern Province, mainly between the Gin Ganga in the north-west and the Walawi Ganga in the east.

Outside Ceylon *A. Nardus* has been in cultivation for some time in Penang, whence Citronella oil is mentioned as early as 1872 by Gladstone,** and in the Straits Settlements and Java. When it was introduced into the Malay Peninsula and Java is uncertain, but it cannot have been very long ago. McNair, in his book, "Perak and the Malays" (1878), p. 73, speaks of "the flourishing growth of citronelle and lemon grass, from which essential oils are extracted," as worth mentioning; but in 1886, Cantley†† complains of the insufficient attention which the cultivation of these two grasses receives in the Straits, and in 1900 the total area of citronella estates in the peninsula was estimated at only 2,000 acres at the highest.‡‡ In Java it is mentioned by

* Pereira, Elem. Mat. Med., ed. 3 (1850), p. 1027.
† Pharm. Journ. & Trans., vol. xi. (1852), pp. 18 and 19.
‡ Gladstone in Journ. Chem. Soc., vol. xxv. (1872), p. 1.
§ C. R. A. Wright, in Year Book of Pharm. (1874), p. 631.
‖ Bentley and Trimen, Med. Pl. tab. 297.
¶ Dict. Econ. Prod. India, vol. i., part iv., p. 5.
** Gladstone, Pharm. Journ., ser. 3, vol. ii. (1872), p. 746.
†† Straits Settl., Rep. Forest Dept. (1886), p. 15.
‡‡ Gildemeister and Hoffmann, Vol. Oils (1900), p. 299.

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Romburgh* in 1892 as 'Roempoet sereh wangi' under *A. Iwarancusa*, and is stated to have been introduced into the 'Cultuurtuin' in 1891. He drew the attention of Schimmel & Co. to the oil prepared from the Javanese crop; this reference eventually led to the establishment of citronella distilleries in Java. According to Gildemeister and Hoffmann,† both the Malay Peninsula and the Java grass represent the 'Maha Pengiri' variety. Quite recently experiments in growing Citronella grass have been made in the West Indies.

VARIETIES OF CITRONELLA GRASS.—Two kinds of Citronella grass‡ have recently been distinguished by the growers: 'Maha Pengiri' (the Great Pengiri), and 'Lenabatu or Lana Batu Pengiri,' or briefly, 'Lenabatu.' The former is also known as 'Old Citronella Grass,' or 'Winter's Grass,' because it is now almost exclusively grown by Messrs. Winter & Son; the other is spoken of as 'New Citronella Grass." Specimens of both varieties received at Kew from Galle, so far as they go, do not show any morphological differences. I must, however, add that the inflorescences of both are very defective, and one is distinctly diseased, so that no complete comparison is possible. The Old Citronella Grass is described§ as a surface feeder which soon grows out of the ground and gets exhausted, dying off after 10 or 15 years of cultivation; and it "has somewhat broad leaves, and the bushes formed are larger than the second" (*i.e.*, Lenabatu). It yields a finer oil, but the necessity of frequent replanting has led to its being more and more replaced by the Lenabatu variety. The chemical differences of the oils derived from the two varieties are mainly in the proportional amount of citronellal and geraniol, Maha Pengiri containing 50·45 per cent. of citronellal and 38·15 per cent. of geraniol, and Lenabatu 28·2 per cent. and 32·9 per cent. respectively.

ORIGIN OF CITRONELLA GRASS.—*C. Nardus* in its typical form—that is, the form represented by Hermann's specimen—is only known in the cultivated state. It is an awnless grass, the valve or flowering glume of the hermaphrodite spikelet being either entire or more or less bifid, with a minute point or a very fine and short bristle from the sinus. The flowers are usually apparently normal, but do not seem to set freely, and in some cases all the spikelets are male or otherwise imperfectly developed, or they are infested with *Ustilago*. On the whole, the reproductive system seems to be debilitated. This is the case with all the specimens I have seen, irrespective of their origin, and is evidently the result of the treatment the grass has experienced from the grower, in whose interest it is that they should not flower, as, according to Gildemeister and Hoffmann,† "otherwise the tufts become too dense, become yellow within, and spoil." Still a certain amount is allowed to seed for renewing the plantations, the usual mode of propagation being apparently by dividing the bushes. The reduction or suppression of the awn is no doubt in correlation with the partial sterility of the cultivated *C. Nardus*,

* Romburgh, Plantentuin de Buitenz.. 1817–92 (1892), p. 388.
† Gildemeister and Hoffmann, Vol. Oils (1900), p. 291.
‡ Winter in Chemist and Druggist, lii. (1897), p. 646; Gildemeister and Hoffmann, Vol. Oils (1900), p. 291.
§ Tropic. Agricult., vol. xvi. (1897), p. 269, and vol. xvii. (1898), p. 794.

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the wild ancestor of which we have to seek among the awned forms. It has very generally been assumed that the Citronella grass is a descendant of the wild 'Mānā' grass of the Ceylon Patanas, but it is unfortunate that there is no specimen at Kew which is definitely stated to have been collected in the wild state. Sir Joseph Hooker, however, who had the grasses of the Peradeniya herbarium at his disposal when working out the *Gramineae* for Trimen's 'Handbook of the Flora of Ceylon,' says* that there were three specimens of the wild Mānā in that collection from Galle, Maoya, and Peradeniya, and they were all Hackel's *Andropogon Nardus*, var. *nilagiricus*. Willis also states that the Mānā of the Patanas is distinct from the cultivated Citronella grass, but does not say how it differs. Now there is at Kew a suite of excellent specimens of the cultivated awnless *C. Nardus* from Mr. Jowitt's estate at Bundarawalla, and, sent with them at the same time and from the same locality, and numbered concurrently with the first, is another set which is undoubtedly '*Andropogon Nardus*, var. *nilagiricus*.' Whether they grew wild on the estate or were in cultivation is not stated. A careful comparison of both sets has convinced me that this '*Andropogon Nardus*, var. *nilagiricus*' is, as Sir Joseph Hooker has stated, actually the mother plant of the Pengiri Mānā or Citronella grass. I shall treat of the wild 'Mānā' in the next section. Here I would only add a few words concerning the Maha Pengiri and Lenabatu Pengiri. Gildemeister and Hoffmann† state, on Mr. Winter's authority, that the Maha Pengiri came from Malacca. As the Citronella grass is a comparatively recent introduction to the Malay Peninsula, and certainly does not occur there in the wild state, this can only mean that it has, possibly as an improved race, been reintroduced into Ceylon from Malacca; but as the Maha Pengiri is at the same time put down as the old or original Citronella grass of Ceylon, it is more probable that the statement is due to some mistake. As to the Lenabatu variety we have more precise information. It originated about 1885 near Matura,‡ in South Ceylon, presumably in a plantation, and in a short time almost entirely replaced the old grass on account of its being so much hardier. Mells§ says of it, "it is in general appearance very like the Mānā grass found on patanas up country." Not having seen normal inflorescences of Lenabatu, I am unable to say whether it actually comes nearer to the wild Mānā than to the Maha Pengiri.

4. Cymbopogon confertiflorus, *Stapf.*

(*Andropogon confertiflorus*, Steud.)

Mānā (Sing.).

In the preceding section I mentioned '*Andropogon Nardus*, var. *nilagiricus*, Hack.' as presumably the mother-plant of the Citronella grass. It inhabits an area extending from the Nilgiris to Ceylon. Such specimens of it as have been collected or observed

* Part v., p. 243.
† Gildemeister and Hoffmann, Vol. Oils (1900), p. 291.
‡ Tropic. Agricult., vol. xvii. (1898), p. 794.
§ Mells in Tropic. Agricult., vol. xvi. (1897), p. 269.

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in Ceylon have generally been put down as *Andropogon Nardus*, whilst from the north of the area it first became known through Hohenacker's collection as '*Andropogon nilagiricus*, Hochst.' This name has remained, however, a 'nomen nudum,' for when Steudel* described the grass from Hohenacker's specimens in 1855, he called it *Andropogon confertiflorus*. On the other hand, Hackel† in his monograph of the *Andropogoneae*, has revived the name '*nilagiricus*,' but merely as that of a variety of *Andropogon Nardus*.

Compared with Citronella grass, this differs in the normally developed (therefore on the whole "fuller") and awned spikelets. It is a coarse, erect grass with long, tufted, rather broad and internally reddish, persistent sheaths, very long stiff blades, erect, dense, though often interrupted, panicles, brownish or sometimes purplish-brown sheaths which are as long as the racemes and rather conspicuous, and pale or dark, closely-set spikelets. Nothing is known of the conditions under which it occurs in the Nilgiris, Anamallai and Palni Hills; but in Ceylon we know it to be one of the most conspicuous elements of the vegetation of the patanas; here, according to Pearson,‡ it "is found abundantly from 5,000 feet downwards, and frequently forms a belt at the edge of the patana parallel with the forest boundary; it attains a height of five feet or more. In strong sunshine it emits a sickening and almost overpowering odour of Citronella oil." Tennent, in "Ceylon" (vol. i., p. 25), also mentions the oppressive perfume of the grass, which he calls "lemon-grass (*Andropogon Schoenanthus*)," and adds that the odour makes it "distasteful to cattle, which will only crop the delicate braird that springs after the surface has been annually burnt by the Kandyans." According to Willis, it yields a good oil, but in small quantities, and there is no evidence that it is used commercially. The Singalese name is "Mānā," whilst Hohenacker gives "Bāmbe" as the Nilgiri vernacular. He also observes, on the label, that it is used for thatching.

(Nees) W. Wats 1882

5. Cymbopogon flexuosus, *Stapf.*

(*Andropogon flexuosus*, Nees ex Steud.)

Malabar or Cochin Grass.

Early History and Foundation of the Species.—Rheede,§ in his Hortus Malabaricus, figured and described under the name '*Kodi-pullu*' a grass of which he says that it has aromatic leaves, and that a drink is made of its roots to stop salivation in certain fevers. Lamarck‖ referred it under γ to '*Andropogon Schoenanthus*'; but most botanists ignored it or quoted it without any further remark under '*Andropogon Schoenanthus*' or '*Andropogon Iwarancusa*.' Yet the plate is a very faithful representation of a grass evidently very common

* Steudel, Syn. Pl. Glum., vol. i. (1855), p. 385.
† Hackel, Androp. in DC. Monogr. Phaner., vol. vi. (1889), p. 604.
‡ Pearson, in Journ. Linn. Soc., vol. xxxiv. (1899), p. 326.
§ Rheede, Hort. Malab., vol. xii. (1703), p. 107, t. 57.
‖ Lamarck, Encycl., vol. i. (1783), p. 375.

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throughout Travancore and the adjoining district of Tinnivelli. Rottler knew it and put it down, though with some doubt, as *Andropogon Nardus*, which it resembles very much indeed. Ainslie* (1813) mentions it as 'Sukkanaroo-pilloo' and 'Ginger-grass' (the exact equivalent of the Tamil name), and says of it: "This is a variety of the grass which is well known in lower India by the name of the lemon-grass; it differs, however, from it in this respect, that on being chewed, it has a strong flavor of ginger. It is very common on the Courtallam Hills in the Tinnivelli District, where the natives consider an infusion of it as stomachic and febrifuge," and later on (1826)† he adds: "the natives occasionally prepare with it an essential oil." This, I believe, is the first record of oil being prepared from Malabar grass. Klein collected the grass in 1818 on the same hills, and his specimens, which are also marked '*Suckunari pillu*, Tam.; *Ginger-grass*, Ang.; *Andropogon Nardus* (?),' leave no doubt as to its identity with the plant from which the Travancore or Cochin lemon-grass oil is produced. Wight subsequently distributed specimens of the same grass as '*Andropogon flexuosus*, N.E.' It was not, however, described until 1855, when Steudel‡ published a description retaining for it Nees' name; but not much notice was taken of Steudel's species which, if mentioned at all, was usually cited as a synonym of *Andropogon Nardus*, as for instance by Bentley and Trimen,§ who moreover figured it as *Andropogon Nardus*. In 1889, Hackel‖ distinguished it as a variety of the typical *Andropogon Nardus* (Citronella grass), and the same place was given to it by Hooker in the Flora of British India,¶ but neither author connected it with the Lemon-grass oil of Travancore, which very generally was treated simply as "Lemon-grass oil."

Morphologically, *C. flexuosus* differs from the other species of the *Nardus* series by its large, loose, greyish or slate-coloured panicles, the branches of which are particularly slender, long, flexuous and often drooping, and by the less conspicuous spathes and the smaller, usually very slender and acute spikelets. The basal leaf-sheaths are rather narrower than those of *C. Nardus* and *C. confertiflorus* and are not reddish within.

Malabar Grass Oil.—When the Malabar Grass-oil—this name, which is used in Barber's collection, is preferable to the name Travancore Lemon-grass oil—was first exported, I do not know precisely; but the "lemon-grass oil" mentioned by Pereira (1850) as imported into England from Cochin was very likely the oil of *C. flexuosus*, and not of *C. citratus*. In 1859, Major Heber Drury, writing to D. Hanbury and referring to a specimen of *C. flexuosus*,** which he had sent him, says: "From this species (and from this only) Lemon-grass oil is distilled in Travancore."

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* Ainslie, Mat. Med. (1813), pp. 115 and 116.
† Ainslie, Mat. Med., vol. ii. (1826), p. 50.
‡ Steudel, Syn. Pl. Glum., vol. i. (1855), p. 388.
§ Bentley and Trimen, Medic. Pl. (1880), tab. 297.
‖ Hackel, Androp. in DC. Monogr. Phaner., vol. vi. (1889), p. 603.
¶ Hook. f., Fl. Brit. Ind., vol. vii. (1897), p. 207.
** Drury did not, however, use that name. In 1858, in his Useful Plants of India, he includes the Travancore grass in *Andropogon citratus*, and six years later, in his Handbook of the Indian Flora, vol. iii., p. 640, in *Andropogon Schoenanthus*.

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Four years later Hanbury received the same plant from E. G. Waring, with this note: "Andropogon (?) which yields the Lemon-grass of Travancore—abundant on the plains—is not cultivated." The statement in the Pharmacographia Indica, vol. iii. (1893), p. 565, that the oil is distilled in Travancore from Anjengo northwards, and that the grass is burnt at the end of the dry weather, no doubt also refers to *C. flexuosus*, and not to *C. citratus*, as the authors of that work believe. It is probably due to this confusion that Gildemeister and Hoffmann say, quoting Dymock, Warden, and Hooper as their authorities, that "the grass is *cultivated* on a large scale only on the Malabar coast in Travancore, on the western slope of the mountains, north of Anjengo." Mr. T. F. Bourdillon writes quite recently from Quilon that only within the last year or two extensive areas have been planted up with the Malabar grass. As the Travancore grass oil is not, in commerce, specifically distinguished from the oil of *C. citratus*, both being sold as 'lemon-grass oil,' it would be interesting to know how far the analyses of 'lemon-grass oil' refer to the one or the other. Certain discrepancies in the results obtained by chemists may have their origin in the indiscriminate use of the term.

Assuming that the whole of the 'lemon-grass oil' exported from the Malabar Coast is referable to *C. flexuosus*, the figures for the export of that oil were, for 1896–97, 270,000 kilos, or 595,080 lbs.

6. Cymbopogon coloratus, Stapf.

(*Andropogon coloratus*, Nees, ms.)

Under the name of '*Andropogon coloratus*, N.E.,' Wight distributed a grass (numbered 1703) which although similar to *C. flexuosus* differs from it distinctly in its much smaller stature, narrow blades and leaf-sheaths, dense and erect panicles, more conspicuously bearded rhachis-joints and pedicels—the white hairs contrasting vividly with the brownish spathes—and much swollen pedicels at the base of the racemes. No description of it as a species was published; but in 1896 Hooker* distinguished it as a variety of *Andropogon Nardus*. A similar form, but taller with longer, stiff and dense panicles and paler spathes was issued by Wight at the same time as "*Andropogon* (*Cymb.*) *caesius* γ *elatior*, *culmo erecto firmo*," No. 1700*c* and in a diseased form under No. 1700*d*, the panicles of the latter being infested with an *Ustilago* and barren. The state represented by No. 1703 was also collected by Klein on the 9th of July, 1808, but where, is not stated; the taller form both in its normal and diseased states has been repeatedly gathered throughout the Carnatic from the extreme south as far as the Cuddapa District, and from the Tinnivelli hills to the Anamallais. This is also almost certainly the plant which, as I shall have to point out in another place, Roxburgh had figured (No. 1095 in his duplicate collection of drawings, now at Kew), and erroneously identified with his own *Andropogon Martini*. It is very likely that the original drawing was made at Samulcotta which might suggest an extension of the area of *C. coloratus* towards the Circars.

* Hook., Fl. Brit. Ind., vol. vii. (1897), p. 206.

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Practically nothing is known of the conditions under which this grass grows; but it has a distinctly xerophytic habit. It is a highly aromatic grass. There is, however, no evidence that it is used for extracting oil or for any other purposes, unless it is one of the 'lemon-grasses' of the Malabar district to which the following* refers: "The natives of Ernad and Waluvanad empirically distinguish no fewer than 27 species of lemon-grass, but say that only five of these varieties possess a commercial value. They also state that the most valuable of these varieties does not blossom. Ernad and Waluvanad, I am reliably informed, are full of hills on which lemon-grass grows wild and could be had virtually for the collecting." The variety which does not blossom is, I may add, very probably *C. citratus.* The vernacular names which I have been able to collect require further confirmation and revision. They are to be found in the second part of this paper under *C. coloratus.*

7. Cymbopogon citratus, *Stapf.*

(*Andropogon citratus DC.*)

Lemon Grass (κατ' ἐξοχήν); Sereh (Malay).

Early History in India.—In 1695, Petiver announced in his 'Museum' (p. 55, no. 586) a "Gramen *citratum* fragrantissimum e Madraspatan." A few years later Plukenet referred to the same grass in Almag. Mant. p. 97 (1700) in these words: "Gramen cyperoides citratum, Ind. Or. foliis odore corticum Citri; Vasnapillee Malabarorum." The sender of the grass was Dr. Samuel Browne, Surgeon at Fort St. George, and he, in his 'Seventh Book of East Indian Plants,'† edited and commented on by Petiver, gives the following account of it: "This is a most delicate sort of *fragrant Grass* which being rubbed smells like *Baume* and *Lime* or *Limon peel* together. The *Portuguese Women* fume their children with it, and give the *Decoction* of it with other things for *Fevers* and to strengthen weak stomachs; but the Natives use it not, which together with its growing in *Gardens* on the Sea coast and not up the Country, as I can yet observe, makes me think the Portuguese brought this from other parts and planted it here; certainly, so excellent a Plant of such *Fragrant* and *Aromatik taste* must have many *Vertues.* I use it in many cases, and generally with success. While I was writing this, in came a Person, who says, that about 30 years ago, viz., about 1666, one Antonio Palia, brought 3 Pots of this Grass from Batavia to Paliacut, one of which he sent to a Garden, here at Madrass." Browne's specimen is no longer in existence; but there can be no doubt as to what the plant was. From a note on a label in Rottler's herbarium, we know that the Portuguese in India called it 'Herba cheirosa,' the Portuguese equivalent of the Tamil Vasana-pillu, and Roxburgh in an early manuscript‡ of his Flora

* Reprint from the Madras Mail in Tropic. Agricult., vol. xxiii. (1903), p. 351.

† Petiver, Samuel Browne, his seventh Book of East Indian Plants, in Phil. Trans., vol. xxiii. (1702), pp. 1251–1252.

‡ This manuscript was long in the possession of the Govan family and is now at Kew. It is, as compared with the published "Flora Indica," much abridged.

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Indica, remarks : "Siree of the Dutch and native Portuguese in India," 'Siree' (recte Sereh) being the Malay name by which the grass was then known—as it is now—in Java, whence Antonio Palia brought it to Paliacut. Browne's account with its almost dramatic actuality was entirely lost sight of. Yet, it is evident that the name "lemon-grass" arose either out of the "*Gramen citratum*," or more probably concurrently with it out of the same association of ideas; in print it appeared for the first time in 1804, in Donn's third edition of his Hortus Cantabricensis (p. 183). There it was applied to a grass which in 1786 had been introduced by Banks from the East Indies, as we know from Aiton's second edition of his Hortus Kewensis (vol. v., p. 427). Under the same name it was grown at Kew in the beginning of the last century, and Wallich* relates that Dr. Maton, Physician to Queen Charlotte "has repeatedly been treated with a dish of Lemon-grass tea by Her Majesty who used to be very fond of it and was supplied with the plant from the Royal Gardens at Kew." There are no specimens of that plant at Kew or at Cambridge; but there is a sheet at the British Museum, evidently from Banks' herbarium, written up "Hort. Dr. Roxburgh," and below that "Novis. culta (Mr. Lambert) Lemon-grass," which contains two identical specimens. My explanation is this:—in 1786, Roxburgh was in Samulcotta where he had established a garden, and it is from this garden (Hort. Dr. Roxburgh) that Banks had the seed from which the lemon-grass of Cambridge and Kew was raised. Later on, Lambert too had some plants of the lemon-grass in his garden. They flowered, and a panicle from these was preserved and placed along with Roxburgh's specimen. There is no date ; but the handwriting on the back of the sheet is that of Dryander, and therefore not later than 1810. Those specimens allow us to establish with absolute certainty the identity of the "lemon-grass" of the English gardens of those days. In India itself, the name "lemon-grass" may, as I suggested above, have originated and spread even earlier. In any case, Fleming† says, that "many Europeans (viz., in India) have given the name of lemon-grass" to what he calls '*Andropogon Schoenanthus* (W),' whilst Ainslie‡ (1813) quotes it under the Tamil name, Vasana pillu. At the same time, the term soon assumed the character of a nomen genericum, as people in India became aware that there were, besides the garden grass, other wild grasses of similar appearance and properties. Thus we find Heyne (probably before 1812) using, on a label with a specimen of *C. coloratus*, the expression : "*a* lemon-grass." Similarly, Ainslie § (1813) speaks of the Travancore grass (*C. flexuosus*) as a variety of lemon-grass. Others spoke of "lemon-grasses," and a recent writer in the Tropical Agriculturist‖ uses the phrase "27 species of lemon-grass." Others, neglecting the differences between the various kinds of lemon-grass, differences which were never clearly stated, admitted only one lemon-grass and implicitly postulated the identity of, for instance, the citronella grass with the "Gramen

* Wallich, Plant. As. Rar., vol. iii , p. 48, tab. 280.
† Fleming in Asiat. Research. vol xi. (1810), p. 156.
‡ Ainslie, Mat. Med. (1813), p. 128.
§ Ainslie, l. c., p. 116.
‖ Tropic. Agricult., vol. xxiii. (1903), p. 351.

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citratum," or of the Malabar grass with the "Gramen citratum." The result of all this was, of course, much vagueness in the term and great confusion. This becomes particularly obvious in collating the vernacular names which have been identified with "lemon-grass." There were other causes also which tended to obscure the history and the characters of the original "lemon-grass," and finally made it possible that a grass which is so widely, though not intensely cultivated, not in India only but all over the tropics should, in Hackel's great Monograph of the *Andropogoneae* (p. 605), be hiding under the cloak of an American variety of *Andropogon Nardus*, whilst its botanical name, *Andropogon citratus*, by which it has been known to Indian botanists and most pharmacists, is simply referred to with the words: "aut ad *A. Nardum* aut ad *A. Schoenanthum* pertinet" (p. 608).

Although Browne tells us that at his time the Madras natives did not take to the lemon-grass, it subsequently became fairly popular throughout the Carnatic and finally all over India. Roxburgh,* writing about 100 years after Browne, was able to say: "On the coast (of Coromandel) I have only found this elegant valuable species in a state of cultivation, few gardens being without it." Similarly, Rottler says on a label, written probably at the end of the 18th or the beginning of the 19th century, and attached to a specimen collected in the extreme south of the Peninsula: "Frequentissima in hortis." When it was introduced in Bengal is uncertain. It was in cultivation in the Botanic Gardens, Calcutta, in Roxburgh's time; but apart from this, Roxburgh seems to have only known it from the 'coast' (of Coromandel). Carey's† observation that it covers extensive tracts in Northern Bengal is wrong and refers probably to *C. pendulus*, Stapf. It is true that Fleming,‡ as well as Roxburgh,§ quotes Bengali name for it, *Gundbel* or *Gundha bena*, but that name occurs as early as the middle of the 15th century as a Hindi synonym of 'Izkhir' in the Ulfaz Udwiyah,‖ and most probably was originally applied to *C. Martini* or possibly also to one or more of the other aromatic Andropogons which are indigenous in Northern India. The Sanscrit names, *Malatrinukung* (*Malatrina*) and *Bhoostrinung* (*Bhutrina*), which Roxburgh§ quotes for the lemon-grass, are in a similar position. Concerning these I would refer the reader to my chapter on *C. Martini*. Royle,¶ in his 'List of Articles of Materia Medica obtained in the Bazars of the Western and Northern Provinces of India,' does not enumerate the lemon-grass, but he mentions it in his 'Illustrations of the Botany of the Himalayan Mountains,' p. 425 (1840), under Roxburgh's name, '*A. Schoenanthus*,' as "only found in gardens in Northern India." From the West Coast it is first mentioned by Graham** (1836). When it reached Ceylon is unknown; Moon†† (1824) mentions it, but as identical with Pangiri Mānā.

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* Roxburgh, Fl. Ind., ed. Carey & Wall., vol. i. (1820), p. 278.

† Carey in a footnote in Roxburgh, Fl. Ind., ed. Carey & Wall., vol. i. (1820), p. 278.

‡ Fleming in Asiat. Research., vol. xi. (1810), p. 156.

§ Roxburgh, Hort. Beng. (1814), p. 7, and Fl. Ind. l.c.

‖ Ulfaz Udwiyah, transl. Gladwin.

¶ Royle in Journ. As. Soc. Beng., vol. i. (1832), p. 458.

** Graham, Cat. Pl. Bombay, p. 238.

†† Moon, Cat. Pl. Ceylon (1824), p. 72.

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The name, however, by which, in Ceylon, it is distinguished from the latter is Sera or Saira (the Malay Sereh), and it seems to me therefore most likely that the grass was introduced into the island during the Dutch occupation of Ceylon.

The comparatively recent date of the cultivation of the lemon-grass in India is also evident from the nature of the established vernaculars. I have already pointed out that the Tamil Vasana-pillu is merely the equivalent of the Portuguese "Herba cheirosa," under which name it was probably introduced. The term was taken up unchanged, or almost so, in Malayalim, Canarese, and Telugu. Another Tamil name, Karpūra-pullu (Camphor grass), is equally descriptive, and the same applies to the Gujerati and Marathi vernaculars, which mean 'Green tea,' whilst the Dukni name given by Ainslie,* namely, 'Naring ke bās ka ghans,' is a direct translation of "lemon-grass."

Introduction into America and Africa.—The properties which recommended the grass to the native gardener of India also contributed to its early introduction into the colonies of those European Powers which then had possessions in India. W. Hamilton† has pointed out that the 'lemon-grass' was introduced into Jamaica most probably in 1799. From there it soon spread to the other British islands in the West Indies "as an elegant and powerful diaphoretic under the popular name of lemon-grass." It also found its way into the Spanish possessions. La Sagra‡ (1853) enumerates it under '*Andropogon Schoenanthus* (*Cymbopogon citriodorus*),' and states that it is cultivated in gardens in Cuba as 'Yerba Limon.' Grosourdy§ (1864) indicates it from Portorico as 'Limoncillo,' under which name Sintenis collected it in that island in 1884. More recently it has also been reported from Mexico as 'té limon.'‖ In the French Antilles and in French Guiana it was known in the forties, if not earlier, as *Citronelle*,¶ a name applied by the French to various aromatic herbs. Under the same name it is recorded from Mauritius by Bojer** as early as 1836, but there is no doubt that Desfontaine's†† '*A. citriodorum*' (1815) from Mauritius (Isle de France), which he identified with '*Andropogon Nardus*, Pers.,' was also lemon-grass. Very probably it was introduced under Poivré's active administration (1767–1773). "Citronelle" is also very generally grown as a garden herb in Réunion, and Baron found it in Central Madagascar in 1883. Through the Portuguese it reached East Africa—when, I do not know—and subsequently also West Africa. Welwitsch‡‡ found it, in 1859, frequently cultivated near Mossamedes, where it had been introduced from Mozambique by a Dr. Sales in 1855. He also came across it in 1854 in Loanda, whither it was said to have been brought from Sierra Leone. It is

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* Ainslie, Mat. Med. (1813), p. 128.
† Hamilton in Pharm. Journ., vol. vi. (1897), p. 369.
‡ La Sagra, Fl. Cub., vol. iii., p. 321.
§ Grosourdy, Med. Bot. Criollo, vol. ii., pt. i., p. 161.
‖ Schimmel & Co., Semi-Annual Reports, Oct.–Nov., 1903, p. 27.
¶ Guibourt, Hist. Nat. Drog. Simpl., vol. ii. (1849), p. 114.
** Bojer, Hort. Maurit. (1837), p. 375.
†† Desfontaines, Tabl. École. Bot., ed. 2 (1815), p. 15.
‡‡ Welwitsch in sched.; *see also* Cat. Afr. Pl. Welwitsch, vol. ii., p. 155.

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equally grown in the Portuguese islands in the Bay of Guinea,* where it is called 'Capim de Gabão' (evidently because it originally came from the Gaboon), in the Cameroons,† in Old Calabar, and probably in other places in West Africa. With the Portuguese it also went—probably at an early date—to Brazil, where it is recorded, in the cultivated state as well as semi-naturalized, from the States Porto Allegre, Rio de Janeiro, Minas, and Alagoas, and under the name of Capim de Cheiro and Capim Siri.‡

Early History in the Malay Region.—Having traced the 'lemon-grass' to its introduction into the Indian Peninsula and its subsequent spread to the colonies in America and Africa, I now turn to its history in South-Western Asia, whence it came to the Peninsula. From what has been said in the preceding lines it is sufficiently clear, and it has in fact never been disputed, that the 'lemon-grass,' as understood originally, is identical with the Malay 'Sereh.' This, throughout the Malay region, is universally grown as a medicinal and kitchen herb. Its history goes back no doubt far beyond the arrival of the first European invaders. We hear of it almost simultaneously from the Philippines and from Java as early as the first half of the 17th century. In 1635, Juan Eusebius Nieremberg,§ a Spanish Jesuit in the Philippines, describes it quite unmistakably under the name of 'Tanglat,' a term still in use for 'lemon-grass' in the Tagalog and Visayan dialects (spelt Tañglad‖). The passage, which is worth quoting, reads: "Tanglat. It is a herb springing from a bulbous root, the swollen base of the leaf tufts, whitish-red without, yellowish within; from it rise 10–12 leaves, about 1 m. long, rather rough and moderately green; there is, however, neither a (flowering) stem nor fruit. The whole plant has a scent like that of lemon flowers, but stronger. Cooked, it improves the taste of stale boiled fish; put into wine it gives a pleasant flavour, and it imparts a delicious odour to sauces and spices. The liquor distilled from it is almost scentless until exposed to the sun; but this being done, it usually exhales a pleasant odour, and applied to the face seems to sharpen and invigorate all senses and the head."

Jacobus de Bondt (Bontius¶), a Dutch doctor, who died in Batavia in 1631, mentions in his notes, which were published after his death, that the Javanese used to add a small bundle of a highly aromatic grass to their dishes of boiled fish to improve the flavour, and in another passage that the Malay women diligently in their gardens cultivate the same grass, using it for baths and fomentations, particularly in female complaints, and he winds up with the exclamation: "Who would deny that this highly aromatic grass possesses still more excellent virtues?" De Bondt does not give the vernacular name of the grass which he identified with Orta's '*Juncus odoratus*' (*i.e.*, *Herba Schoenanthi*), but his account of the uses of the grass, and the critical observations which some

* Moller in Tropenpflanz., vol. iii. (1899), p. 165.
† Schimmel & Co., Semi-Annual Reports, Oct.–Nov., 1903. p. 27.
‡ Peckolt, Hist. Pl. Medic. Braz., pt. iv. (1891), p. 618.
§ Nieremberg, Hist. Nat. (1635), lib. xv., cap. xix., p. 343.
‖ Merrill, in Bull. Philipp. Gov. Lab. Bur. viii. (1903), p. 110; xxvii. (1905), p. 92.
¶ Bontius, Hist. Nat. et Med. Ind. Or., Comment. G. Pisone (1658), lib. vi., p. 148.

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50 years later Herbert de Jager made on De Bondt's unfounded identification, leave no doubt that the grass was the Sereh of the Malays. De Jager's criticism was contained in a letter to Rumphius, dated Batavia, 6th July, 1683,* where De Bondt's grass is referred to as '*Sire*' or "*Gramen Melissae Odore*," the earliest passage I can find for the use of the word "*Sire*" (now usually spelt "Sereh"), which was even then widely used throughout Malaya, for Rumphius says "Malaice, Balayice, &c.; ubique in hisce insulis." Rumphius had become acquainted with it in Amboina, where he resided from 1653 onwards, and in the neighbouring islands. He drew attention to it in a short note published in 1684,† but probably written earlier under the influence of De Jager's letter quoted above. In this note he speaks of the grass as '*Schoenanthum Amboinicum*,' and gives in an accompanying plate an excellent figure of the 'root' as he calls it, that is the heads of the branches of the rhizome with the base of the leaf-tuft springing from them, evidently just in the condition ready for use. Comparing it with the Arabian '*Schoenanthum*,' he remarks: "Schoenanthi nostratis Amboinici radices ab Arabico nonnihil discrepant. Nostrum sterile est: Arabicum floret. Radices hae odoratae sunt et acres." Then there followed, written before 1695, in the fifth volume of his Herbarium Amboinense, that long chapter‡ on 'Schoenanthum Amboinicum, Siree,' which from Linnaeus onward has been often quoted, but, I am afraid, rarely read with the attention it deserves. It is, like almost all that Rumphius has written, pervaded by that charm of directness and lucidity with which the phenomena of nature reflect themselves only to the clear and open mind of a great and unbiassed observer and sincere lover of nature such as Rumphius was. It is no exaggeration to say that there is, in his account of the Sereh, more information concerning the general features and the biology of the grass than in any other publication dealing with it. The chapter is accompanied by a figure, which represents a plant evidently taken from a garden, one-fourth natural size, and as faithful as can be. The fragment of an inflorescence which is added is less satisfactory, unless it was drawn—as is almost certain—from a diseased or anomalous panicle. I quote the essential part of Rumphius' description, translating from the Dutch text:—

"The Siree of Amboina is no doubt a *Schoenanthum*. From the Arabian *Schoenanthum* it differs in that it emits fewer stems and is sterile, or at least produces flowers only very rarely; nor is it so aromatic. It forms a dense bush of so many leaves that they hide the stem, the root and the ground immediately around them.

"The leaves are very long, narrow and thin, like those of a sedge, 3–3½ feet long, scarcely as wide as a finger, finely ribbed lengthwise, rough to touch, somewhat cutting if stroked backwards, bluish-green, and so lank that they are all bent over on to one

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* Herb. de Jager in Valentini, Hist. Simpl. (1732), p. 392.

† Rumphius in Miscell. Cur. sive Ephem. Acad. Nat. Cur., Dec. ii., Anno iii. (1684), p. 80, tab. 3.

‡ Rumphius, Herb. Amboin. (cura Burmanni, 1750), vol. v., p. 181, tab. 72, fig. 2.

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another, and so form a great ball or intricate bush. A span above their insertion they are geniculate. Below that the leaf is narrow and convolute, resembling a stalk; up to that point they were originally firmly adpressed against their stem. Above the knee the leaf is flat and reflexed though the middle nerve is fairly stiff. Crushed between the hands the leaves emit a strong aromatic odour, and chewed they taste similarly, with a noticeable acridity, but without causing any burning sensation in the throat.

"The bases of those leaves form a stout and ventricose stipes or stem, closely clasping each other, resembling skins, whitish in colour and more aromatic than the leaves themselves, smelling somewhat like dried roses; and that is considered the best part of the plant.

"Although those leaves thus clasp each other and form a roundish or sometimes flattened stem, there is nevertheless inside them nothing that could be compared with a reed or rush. . . . I also observed that the odour of the Arabian plant approaches distinctly that of roses; whilst in the Amboina grass it is mixed with that of fennel. The root resembles that of Acorus, but is much shorter, thinner and more woody, divided into distinct annular joints and sparingly branched. The branches generally rise obliquely out of the ground, attached to it by hard and thin rootlets, and bearing at their ends 2, 3 or 4 of the ventricose stalks mentioned above. The remainder of the root does not penetrate much into the soil, in which it is fixed by means of numerous woody fibres. . . . Its aromatic odour and taste is more intense than in the (remainder of the) plant; it is acrid, hot, not burning, with a pleasant bitterness, and the rose odour is more distinct in the dry state. . . .

"In Amboina, the Siree is usually kept barren so that one does not see it in flower or fruit. Still it has happened, though rarely, that flowers have been observed on certain specimens, and they are of two kinds, genuine and fabulous. The genuine flowers are nothing but a panicle, as in Tuhu Sala, and in Kulong.

"The whole panicle inclines always to one side, is a span long or even longer, and composed of long tops or oblong headlets (spikelets) like oats, which are empty and have short yellowish-brown glumes, which, however, do not produce any distinct seed unless it were the inner chaffy points which, however, do not germinate. These flowers may frequently, or rather commonly, be seen in old Siree plants in Ternate, Motira and Mackian, where they form larger bushes than in Amboina, and produce leaves almost five feet long. Here a slender, straight and firm stem grows out from the centre, bearing a few leaves and the panicle described above.

"That never occurs in Amboina or very rarely. For when in 1678 some old pieces of the same kind as those of Ternate were planted in the Island of Nussatello (Nussa laut), and when about the same time suckers were taken from some gardens not far from the Galghoek near Castle Victoria (where under a rich brown soil some sharp cliffs run, and where the Siree which had been planted near by had been left uncut) and planted in other gardens near the houses, they would not behave in the same way (*i.e.*, did not flower). Similarly the Siree plants on Siree Hill, although

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they grow there spontaneously, have never been seen to flower, possibly because they are annually burnt down together with other weeds. There are however, in Leytimor, hills which also produce the grass and are not so frequently fired, and yet the Siree growing there never flowers. . . .

"*Name.* In Latin *Juncus odoratus* or *Schoenanthum Amboinicum*; but as it is common in many provinces, it might well be called *Schoenanthum Indicum sterile*, to distinguish it from the Arabian.

"(The Schoenanthum) which we describe here, occurs in all the Malayan provinces, Java, Balaya and here in the Eastern region, in gardens as well as spontaneously on breezy mountains among sedges, particularly where the soil is brown and sharp rocks underlie it as on Siree Hill, east of Castle Victoria, and on another near Naco on the south side of Leytimor, where there have been no gardens. The flowering *Schoenanthum* grows in Ternate, and several other islands in the Moluccas, as for instance in our neighbourhood in Nussatello, everywhere planted in gardens.

"On account of its pleasant aroma it is in these islands more used for culinary than medicinal purposes, and almost exclusively the bottom part of the leaf-tufts which form the ventricose stalks and can easily be pulled from the root whilst the tops are cut off to a hand's length.

"Two or three of those stalks are tied together and cooked with all sorts of fish; this imparts a pleasant scent to the gravy and is wholesome for the stomach as well as the bowels; for the *Schoenanthum* owing to its acrid and attenuating powers dilutes the slimy humours which one contracts in this country from the daily fish food. It also drives out urine, sweat and the menses; but if the system by daily use gets inured to it these effects make themselves felt less strongly unless it is used in larger quantities.

"They treat the Amboina tree-wine 'Sagueer' with it so that it keeps several months and can be shipped over sea. This is done by adding to each pot of 16 cans of fresh 'Sagueer' two handfuls of the stout stalks mentioned above, a few pieces of ginger, one or two nutmegs cut up in slices, and three or four eggs, all boiled together, and afterwards pouring the wine off into casks. It is a fierce drink, but very wholesome for mariners; and soldiers who are camping out and commonly contract dropsy, ought to derive much relief from that beverage.

"The root together with the bottom part of the stalks if half-boiled with water makes an excellent gargle for rinsing the mouth of a person who suffers much from toothache and swelling of the gums, which may be recognised from the swelling being hard and tight, but unaccompanied by sharp pricks.

"Herr Herbertus de Jager takes our Siree by no means for the true *Schoenanthum*, nor do I, but merely as a species of *Schoenanthum*."

Since Rumphius practically nothing has been added to our knowledge of the Sereh grass as it is found and used in Malaya. Its universal distribution in the archipelago, as a garden herb, has been confirmed, but no proof has been forthcoming as to it having

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been observed anywhere in a wild state. Statements to that effect have occasionally been made; but they have arisen from the confusion of the cultivated Sereh with other similar and truly wild species of *Cymbopogon*. Dr. De Vry in a letter to D. Hanbury says distinctly that it is not found in a spontaneous state in Java, and Dr. Koorders gives me the same assurance, so far as Java and Celebes are concerned; and the fact that Rumphius never found the grass in flower on Siree Hill nor on the hill near Naco, where he thought it to be wild, makes me rather believe, that here too we have merely a case of escape and secondary establishment.

East of the Malay Archipelago the Sereh has been found in native gardens or as an escape in their neighbourhood in Kaiser Wilhelmsland, in the Bismarck Archipelago,* and in Samoa and Fiji.† According to Balansa,‡ '*Andropogon Schoenanthus*, Roxb.' (that is lemon-grass), also occurs in New Caledonia rather commonly on uncultivated and arid hill-sides, flowering very rarely. The colonists, he says, prepare from the highly aromatic leaves a much appreciated drink. I have not seen Balansa's specimen; Hackel, who has, considers it as very closely approaching his '*Andropogon ceriferum*' (also a synonym of lemon-grass); but the sample was too incomplete for accurate determination. If Balansa's plant is actually lemon-grass, as is very probably the case, it is no doubt an alien in New Caledonia where it has locally established itself. When the cultivation of the grass spread to Polynesia it is so far impossible to say; probably the introduction is of old date. The derivation of the Fiji name Ca-boi (*Horne*), or Co-boi (*Seemann*) = Co-grass which Seemann§ found in use in 1860, might throw some light on it.

Turning from the Malay Archipelago to the mainland to the north and north-west of it, we find the lemon-grass in general cultivation from the Malay peninsula to Lower Burma on one side and to Canton on the other. In the Malay Peninsula, particularly near Singapore, it is grown on a larger scale for the distillation of oil, but elsewhere mostly for culinary purposes. The earliest record of it from this area is that by Loureiro,‖ who observed it growing in gardens in Canton and Cochin China under the name of Mao-hiam (correct Mao-hsiang, *i.e.*, fragrant Mao). In Mergui it was collected by Griffith "in aquosis" in 1834.

Uncertainty of the Taxonomic Position.—Considering how widely it is distributed over the tropics of both Hemispheres, it is remarkable that the characters and the affinity of this grass have till now remained so obscure. It would indeed be quite unintelligible, but for the fact, already well known to Rumphius, that it flowers so extremely rarely, and on that account has been persistently neglected by collectors. It is true that a clue to it was given in the two specimens from Roxburgh's herbarium and Lambert's garden in the British Museum, but for some reason they remained entirely unnoticed, and such specimens as existed in other herbaria were, in the absence of sufficient

* Schumann & Lauterb., Flora Deutsch-Schutzg. Südsee, vol. i. (1901), p. 173.
† Seemann, Fl. Vit. (1865), p. 320. Horne, A year in Fiji, p. 69.
‡ Balansa in Bull. Soc. Bot. France, vol. xix. (1872), p. 321.
§ Seemann, l.c.
‖ Loureiro, Flor. Cochinch. (1790), p. 646.

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information by the collectors, never connected with the 'lemon-grass.' After the necessarily somewhat lengthy exposition of its history, it will, however, be comparatively easy to establish the systematic position of the grass.

When, soon after the publication of the first edition of the 'Species Plantarum,' the first copy of Rumphius' 'Herbarium Amboinicum' reached Sweden, Linnaeus' pupil, O. Stickman, set to work to identify Rumphius' plants as far as possible with Linnaeus' species, so that they might be added as synonyms. The result was a dissertation by Stickman under the title 'Herbarium Amboinense,' originally published in May, 1754, but reprinted in an augmented form in 'Amoenitates Academicae' (vol. iv., pp. 112–143) in 1759. In this dissertation (p. 19 of the original, p. 130 of the reprint) we find Rumphius' '*Schoenanthum Amboinicum*' for the first time identified with *Andropogon Schoenanthus*, L. Burmann adopted this reduction at once; but Linnaeus may have hesitated, for although he accepted it in the 10th edition of his 'Systema Naturae,' p. 1304 (1759), it is absent from the second edition of the 'Species Plantarum' (1763). It reappeared, however, in the 11th and 13th editions of the Systema (1767 and 1774). Subsequently Lamarck* and Willdenow† followed Linnaeus in assuming the identity of the Malayan Siree with '*Andropogon Schoenanthus*, L.,' but also further confused the conception of the latter by throwing in Rheede's Kodi-pullu and Ramacciam (Lamarck), and some of Klein's and Rottler's specimens from the Southern Peninsula (Willdenow). Hence it is not surprising that Roxburgh,‡ too, relying on Willdenow's 'Species Plantarum,' put down the scented grass of the Coromandel gardens, which he knew to be the Sereh of the Malays, as '*Andropogon Schoenanthus*, L.' Under that name the lemon-grass henceforth appeared very generally, until more recently the transference of the name "*Andropogon Schoenanthus*" to the Rusá grass made it necessary to look out for another name for the 'lemon-grass.' For some time it was sunk in *Andropogon Nardus* (see my observations under that species and under *Cymbopogon flexuosus*); but in 1883 it was definitely recognized as a distinct species by Watt§ and enumerated as '*Andropogon citratus*, DC.' This was a bold assumption, as nobody seemed to know what the plant was that De Candolle had so named, there being neither a description nor the original in existence. Yet, Watt was right. What De Candolle‖ says of '*Andropogon citratus*' is this: "*Andropogon? citratum.* Sub hoc nomine in hortis plurimis occurrit et in nostro etiam servatur gramen nondum florens etiamsi laete vigens, habitu fere *Andropogonis Schoenanthi* sed major et caldarium non requirens, distinctissimum in eo quod folia trita citri odorem grate spirant." As the grass is not mentioned in Broussonet's 'Elenchus Plant. Hort. Monspel.' (1804), and on the other hand is already referred to in 1811 by Roemer and Schultes,¶ who saw it growing in the

* Lamarck, Encycl. vol. i. (1783), p. 375.
† Willdenow, Spec. Plant., vol. iv., part ii. (1806), p 915.
‡ Roxburgh, Fl. Ind., ed. Carey & Wall., vol. i. (1820), p. 278.
§ Dict. Econ. Prod. of India, vol. i. (1883), part iv., p. 4.
‖ De Candolle, Cat. Plant. Monsp. (1813), p. 78.
¶ Roemer and Schultes, Systema, vol. iii. (1817), p. 833.

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aquarium of the Montpellier garden, it was probably introduced there between 1804 and 1811. This was the time when the 'lemon-grass' was in cultivation at Kew and Cambridge, and probably also in other English gardens. These facts, the equivalency of the names 'Lemon-grass' and '*Andropogon citratum*,' and the description of the odour of the Montpellier plant which exactly fits that of 'lemon-grass,' are enough to suggest very strongly that De Candolle's *Andropogon citratus* was actually 'lemon-grass.' He may have had it from England; but not necessarily so; for about the same time a grass was growing in the Jardin des Plantes at Paris under the name of '*Andropogon Nardus*, Pers. Syn. *citriodorum*,' which later writers admit to be the same as De Candolle's *Andropogon citratus*. Desfontaines* (1815) gives Mauritius as the country whence it came. The only Mauritius grass which might be taken for *Andropogon Nardus* is the 'lemon-grass,' which may very well have been in cultivation there at the beginning of the last century, although it is not actually mentioned as coming from there before 1837. Thus De Candolle and Desfontaines may easily have had it from the same source, namely, Mauritius. However this may be, the plant remained in cultivation for some time. It is mentioned in the Turin catalogue of 1821, the Berlin catalogues of 1821 and 1827, the catalogue of the Jardin des Plantes of 1829, etc.; but it does not seem to have flowered anywhere, until in 1833 it did at last flower at Berlin and in 1835 at Breslau. Link,† who records the flowering at Berlin, identified it with Ventenat's figure of '*Andropogon Schoenanthus*' (= *Andropogon pruinosus*, Nees) and reduced it accordingly to *Andropogon Schoenanthus*, L. Nees,‡ who was then Director of the Botanic garden at Breslau, also considered that it agreed with Ventenat's plate of *Andropogon Schoenanthus*, but, as he was well aware that Ventenat's plant could not have been what Linnaeus meant by that name, he took up De Candolle's name, and reduced *Andropogon Schoenanthus*, Vent. (non Linn.), as a synonym to *Andropogon citratus*. He, however, also gave a description of the plant, as it grew at Breslau, and this at once excludes the identity of his and Ventenat's plants, the latter of which he evidently knew only from the figure. This description was buried away in an article in the 'Allgemeine Gartenzeitung' of 1835, pp. 265–267, and became so entirely lost sight of, that except for a citation in Pereira's 'Materia Medica,' I can find no reference to it. Unfortunately, no specimen seems to have been preserved of the Breslau plant. Nees was convinced that his and De Candolle's *Andropogon citratus* were identical. On the other hand, his description also agrees well with the *Andropogon Schoenanthus* of Roxburgh, that is, the 'lemon-grass,' save as regards two characters. Firstly, he says the hermaphrodite (sessile) spikelets are awned, which they only very exceptionally are in lemon-grass; and, secondly, he describes the outer glume of the hermaphrodite spikelet as having 5–6 green nerves in the upper half, whilst I have hardly ever found more than two intracarinal nerves and more often find none at all. However, he may have counted the keels with the nerves, which would very nearly account for his number of nerves,

* Desfontaines, Tabl. École Bot. ed. 2 (1815), p. 15.
† Link, Hort. Berol., vol. ii. (1833), p. 303.
‡ Nees in Allgem. Gartenzeit., vol. iii. (1835), p. 266.

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and as to the awns, Sir Joseph Hooker and I myself have seen a very few perfectly and imperfectly awned spikelets in Griffith's Mergui specimen of 'lemon-grass.' Nees also insists on the striking citron odour of the leaves. In the absence of the originals, no absolute proof is possible that Nees's *Andropogon citratus* was the lemon-grass; but so far as circumstantial evidence is admissible, it appears quite reasonable to assume their identity until proof to the contrary is forthcoming, and consequently to adopt his name. If the occurrence of awns was actually general in the Breslau plant, it might have been a case of reversion to the ancestral form, which no doubt was awned. In corroboration of my view of the identity of Nees's '*Andropogon citratus*,' I may add, that Nees's brother, Theodor Friedrich, has also given a description of '*Andropogon citratus*' in 'Geiger's Pharmaceutische Botanik,' 2nd ed., vol. i., p. 147. This description is shorter, but in some respects is more precise and is thus supplementary to that in the 'Allgemeine Gartenzeitung'; he unhesitatingly identifies it with Fleming's 'lemon-grass.' Further, there is in the Turin herbarium a specimen of lemon-grass, collected by Bertero in Jamaica and received in 1821 by Balbis, who himself named it *Andropogon citratus*. As Balbis had been growing '*Andropogon citratus*, DC.' since 1812 or even before that date, his determination may certainly be accepted as another proof of the identity of 'lemon-grass' and '*Andropogon citratus*.'

Steudel evidently did not know of De Candolle's and Nees's *Andropogon citratus*. Being, however, aware of the fact that Roxburgh's '*Andropogon Schoenanthus*' is not that of Linnaeus, he tried to overcome the difficulty by dropping Linnaeus's name for the Arabian plant which he enumerates as '*Andropogon circinnatus*, Hochst.,'* retaining '*Andropogon Schoenanthus*,' with Roxburgh as author, for the other, that is, the 'lemon-grass'; but he forgot what he had done, and described the plant a second time, on p. 395, as '*Andropogon Roxburghii*, Nees (MSS.),' this time quoting *Andropogon Schoenanthus*, Roxb., as a synonym. *Andropogon Roxburghii*, Nees, is the name used on the distribution labels of Wight's No. 1699, which is undoubtedly 'lemon-grass.'

In 1883, Hackel† described specimens of a grass, termed 'Capim de Cheiro' by the Brazilians, as *Andropogon ceriferus*; four years later he reduced it as a variety to *Andropogon Nardus*, adding a number of West Indian specimens, among them Sintenis' 'Limoncillo' from Porto Rico; but these Brazilian and West Indian specimens are no more than typical 'lemon-grass.'

There are therefore the following names in the field for the lemon-grass:—1. *A. Schoenanthus*, Roxb. non L. (1820); 2. *A. citratus*, DC. (1813), emend. Nees (1835); 3. *A. Roxburghii*, Nees ex Steud. (1855); 4. *A. ceriferus*, Hack. (1883); and 5. *A. Nardus*, var. *ceriferus*, Hack. (1887). For the reasons stated above, I propose to adhere to the specific name *citratus*, so that the grass when transferred to *Cymbopogon* will have to be called *Cymbopogon citratus*.

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* Steudel, Syn. Pl. Glum., vol i. (1855), p. 387.
† Hackel, in Mart., Fl. Bras. vol. ii., part ii. (1883), p. 15.

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ORIGIN OF THE LEMON-GRASS.—As the lemon-grass is only known in the cultivated state, the question arises, what is its origin? I am afraid it is yet too soon to give a satisfactory answer. It is true there is not, among the Malayan species of *Cymbopogon*, so far as I know them from the collections at Kew and the British Museum, a single one which suggests itself to my mind as the spontaneous state of the lemon-grass, and Rumphius' statement that it occurs in the wild state in Amboina is, as I have already remarked, open to doubt; but our knowledge of the *Cymbopogons* of the Malayan region is still so imperfect that the possibility of the lemon-grass having originated there is by no means excluded.

The *Cymbopogon* most closely approaching *C. citratus* that I have seen is *Cymbopogon pendulus*, Stapf (*Andropogon pendulus*, Nees ex Steud.), collected by Wallich in Nepal, by Hooker, Kurz and Clarke in the Sikkim Terai, and by Griffith (No. 6763) in "Bengala." No vernacular name is given, there is no information concerning its properties and uses, nor has it ever been connected with the lemon-grass, and to do this in the light of our present knowledge of the history of the latter, would involve a hypothesis bolder than I dare to advance. Another allied form, presumably from the same region, but less like lemon-grass and distinguished therefrom by less hairy racemes, borne on long common peduncles, which are frequently exserted from the supporting sheath, and by smaller and relatively much broader spikelets, was figured as '*Andropogon Schoenanthus*' (qua 'lemon-grass') by Wallich, and referred to *Andropogon Nardus*, var. *exsertus* by Hooker. It was in cultivation in the Calcutta Botanic Garden, and may have been raised from the seeds of a fairly distinct *Andropogon* of the Nardus-series which extends from the Saharanpur Terai to the Garo Hills, and possesses very aromatic, citron-scented leaves. However this may be, neither Wallich's plant nor its presumably wild representative agrees sufficiently with the lemon-grass to suggest the derivation of the latter from either of these species.

OIL AND PLANTATIONS.—I have to add only a few words on the oil prepared from lemon-grass. We have seen that some kind of distillate was prepared from it in the Philippines as early as the beginning of the 17th century. In Europe it first became known about 1717, when Lochner* mentions 'Oleum Siree' as one of the most remarkable oils of the East Indies: "supereminet hoc inter reliqua ex orientali India allata"; but there is nothing to show that it was regularly imported into Europe as an article of commerce until the last quarter of the nineteenth century. Watt† in 1883 gives the export of lemon-oil from Ceylon where the lemon-grass is cultivated by the side of the Citronella grass, although to a very much smaller extent, as 1,500 lbs. Gildemeister and Hoffmann (1903)‡ estimate the production of lemon-oil in the Straits Settlements at 2,000–3,000 lbs. Lemon-grass oil in small quantities and for experimental purposes has also been produced in Java, Tonkin, West Africa, Brazil and the West Indies. It has

* Lochner in Ephem. Acad. Nat. Cur. Cent. v.–vi. (1717), Append., p. 157.
† Dict. Econ. Prod. India, vol. i., part iv. (1883), p. 5.
‡ Gildemeister and Hoffmann, Vol. Oils (1903), p. 289.

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repeatedly been pointed out by Schimmel & Co. in their Semi-annual Reports, that the West Indian, West African and Brazilian products are inferior to good 'East Indian' lemon-grass oil on account of their inferior solubility in alcohol, and their low citral-content. A recent note in the Tropical Agriculturist (August, 1906, p. 141) leads to the same conclusion with regard to the Ceylon lemon-grass oil, samples of which have been tested at the Government Experimental Station at Peradeniya. The explanation of those discrepancies lies evidently in the fact, that the good 'East Indian' lemon-grass oil is the oil of *C. flexuosus*, whilst the 'inferior' kind is the product of *C. citratus*.

8. Cymbopogon Martini, *Stapf.*

(*Andropogon Martini*, Roxb.)

Geranium Grass.—Rusá (*Hind.*).

FOUNDATION OF THE SPECIES.—During the war of 1790–1792 against Tipu Sultan, Claude Martin,* who joined the expedition in 1791 as a Commissioner of Provisions and Aide-de-camp to Lord Cornwallis, collected "in the highlands of Ballaghat" the seeds of a grass which had struck him owing to its excellence as a fodder-plant, as well as on account of its pungent taste and aromatic odour, which was so strong as to impart itself to the milk of the cows which fed on it. From the seeds he raised an abundant crop at Lucknow. He also supplied Roxburgh "with a small stalk, roots and seed." The "small stalk" is not preserved; but Roxburgh grew the grass from the seed in the Calcutta Botanic Garden, and of the specimens thus raised there are two at the British Museum, one from Roxburgh's herbarium, the other from General Hardwicke's collection. The first is named '*Andropogon Martini*' in Roxburgh's own hand, the other, under the same name, bears the date 18th February, 1789. The name did not appear in print until 1814,† whilst the description, although evidently written before 1799, was only published in 1820. The description is rather vague; but so far as it goes, it agrees fairly well with Roxburgh's type in the British Museum, and there would have been no difficulty in exactly identifying Martin's plant, but for the fact that there exists in Roxburgh's collection at Kew, a coloured drawing (No. 1,095) which is also written up as *Andropogon Martini* by Roxburgh himself; this drawing certainly represents another grass. Nees,‡ who seems to have seen the drawing, identified it with the plant distributed by Wight (No. 1,700*c*) under the name "*Andropogon* (*Cymb.*) *caesius*, N.E., γ. *elatior*, *culmo erecto*, *firmo*," but the name Nees gives it is "*Andropogon* (*Cymb.*) *Martini*, Roxb., γ. *elatior*, *culmo firmo erecto*." I am inclined to agree with Nees so far as the identity of the figure with Wight's No. 1,700*c* is concerned; but both names are certainly misapplied, the plant in question being actually *C. coloratus*, a member of the '*Nardus*' group (*see* p. 321). There is also another and very similar coloured drawing in Royle's collection

* Roxburgh, Fl. Ind., ed. Carey & Wall., vol. i. (1820), p. 280.
† Roxburgh, Hort. Beng. (1814), p. 7.
‡ Nees in Meyen, Obs. Bot. (Nov. Act. Leop. Carol. Nat. Cur. vol. xix., suppl. ii. 1843), p. 190.

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at Kew, written up as *Andropogon Martini* by Royle. This, apart from the usual exactness of Roxburgh's drawings, precludes the assumption that the Roxburghian figure is merely an instance of bad draughtsmanship. How the confusion came about I cannot say; but under the circumstances it is evidently only reasonable to connect the name *Andropogon Martini* with the Roxburghian type in the British Museum rather than with the drawing.

The exact locality where Martin gathered the plant is not known, "Ballaghat" in this case meaning merely the table-land "above the Ghats." Yet the fact that the military operations of 1791 and 1792 were confined to the country around and between Bangalore and Seringapatam, fixes the locality within narrow limits.

When the Rusá-oil grass of Nimar became known in 1824, Wallich* suggested that it was *Andropogon Martini*, and this has ever since been generally admitted. He, however, also assumed the identity of *Andropogon Martini* with *Andropogon Jwarancusa*, and in this he was no doubt wrong. Roxburgh's type must have been cut from an unusually robust plant. The culm is 6 mm. in diam.; the sheaths are up to 8 mm. wide, whilst the incomplete leaves are about 37 cm. long, and where broken off, 12 mm. wide, the maximum width near the base being 15 mm. The inflorescence is over 30 cm. long. I have seen no specimen exactly matching the type so far as dimensions are concerned; but one collected by Duthie at Asirgarh Fort, the locus classicus—as we shall presently see—of the Rusá-oil plant, is in every other respect a perfect counterpart of it, so that there can be no doubt as to the identity of *Andropogon Martini* and the Rusá-oil plant.

Complication of the Synonymy.—In 1837, Royle referred to the fragrant Nimar grass in his essay on the 'Antiquity of Hindoo Medicine.' As Hatchett had tried to prove that it was the 'Spikenard' of the ancients, so now Royle in an elaborate paragraph endeavoured to demonstrate that the grass was the classical *Calamus aromaticus*, and therefore proposed for it the name *Andropogon Calamus aromaticus*. Although it seems to me highly probable thot the ancient *Calamus aromaticus* was one of the aromatic Cymbopogons which form the subject of this paper, I doubt if it was the Rusá grass. This, however, is not the place to examine the question. Royle gave no technical description of his *Andropogon Calamus aromaticus*, though he figured it extremely well in his 'Illustrations of the Botany of the Himalayan Mountains' (1840), tab. 97, fig. 3. Here (p. 425) he defined the area of the grass as extending "north as far as Delhi, and south to between the Godavery and Nagpore," which is somewhat surprising, as he must have known it from the outer hills of the Himalayas, particularly from the neighbourhood of Saharanpur and Simla. In fact, it had already been collected in Nepal (probably the Nepal terai) by Wallich as early as 1820, and described by Trinius† from Wallich's specimens as *Andropogon pachnodes* in 1833, whilst an excellent figure by the same author‡ followed in 1836. The

* Wallich in Trans. Med. & Phys. Soc. Calcutta, vol. i. (1825), p. 368.
† Trinius, Andropog. in Mém. Ac. Pétersb. sér. 6, vol. ii. (1833), p. 284.
‡ Trinius, Spec. Gram. Icon. (1836), tab. 327.

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synonymy was further complicated by G. C. Nees, who named some specimens in Wight's herbarium (No. 1702) *Andropogon nardoides*, and in 1841 published a description of *Andropogon nardoides*,* at the same time reducing Trinius's *Andropogon pachnodes* to it as a synonym. There were thus four names in the field, more or less definitely connected with the fragrant Nimar grass: *Andropogon Martini* (1820), *A. pachnodes* (1833), *A. Calamus aromaticus* (1840), and *A. nardoides* (1841). They were all set aside, when in 1862 Munro† pointed out that the 'type' of *Andropogon Schoenanthus* in Linnaeus's herbarium was Roxburgh's *Andropogon Martini*. I have in another place shown the value of that 'type' and explained how little it has to do with the Rusá-grass. However, the fact was accepted as implying that Linnaeus had this grass in view when establishing his *Andropogon Schoenanthus*, and consequently Flückiger and Hanbury‡ (in 1874) put '*Andropogon Schoenanthus*, L.,' down as the source of the Rusá-oil, an assumption which has since then remained unchallenged. From what I have said, it is, however, perfectly clear that the Rusá-grass is actually identical with *Andropogon Martini* of Roxburgh, and has to stand as such, or, if transferred, to *Cymbopogon*, as *C. Martini*.

Area and Variation.—The area of *C. Martini* extends in India from the Rajmahal Hills on the bend of the Ganges to the Afghan frontier, and from the subtropical zone of the Himalaya to about 12° N., leaving out the desert and steppe region of the Panjab, the outer slopes of the Western Ghats, and, as would appear, a great portion of the Northern Carnatic. From the collectors' and writers' notes it appears to be locally very common, and a conspicuous feature, particularly in the late autumn when the panicles change colour and impart their rich brown-red tints to the hill sides. So striking is this colour effect that one is tempted to suggest that the two commonest vernacular names for the grass 'rusa' with its numerous variations, and 'mirchia gand,' take their origin from it; 'rusa' being possibly derived from 'ruh,' Sanscrit for "to be red," and 'mirchia gand,' having reference at the same time to the colour, the red of mirch (*Capsicum*) and to the scent (gandha). Within the greater part of its area the grass, although very uniform in the structure of the spikelets and the peculiarly soft and delicate texture of the leaves, is remarkably variable in stature and in the dimensions of the leaves. From less than 1 m. it grows to a size which is described as 'gigantic,' whilst the leaf-blades range from ·25 to probably quite 1 m. in length and from 8 (in extreme cases 5) mm. to 30 mm. in width. One of the most characteristic features of the leaf of *C. Martini* is that the greatest width is generally near the base of the blade, which is rounded off and suddenly constricted and frequently clasps the culm. This form is for example illustrated in Trinius's and Royle's figures and might be called the '*pachnodes*' type. In Roxburgh's type specimen the shape of the blade is somewhat different in so far as the width is almost the same for a very considerable distance from the base upwards, whilst the base itself is less constricted and not stem-clasping. The same

* Nees, Fl. Afr. Austr. (1841), p. 116.
† Munro in Journ. Linn. Soc. vol. vi. (1862), p. 52.
‡ Flückiger and Hanbury, Pharmacographia (1874), p. 660.

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type is repeated on a smaller scale in Duthie's specimen from Asirgarh Fort and in Wight's No. 1702, and on a still smaller scale in the slender form which is prevalent in the southern and south-western part of the area. How far those differences are due to the conditions of the habitat can only be decided in the field; but they certainly suggest edaphic influences, such as the conditions of soil and water supply. According to Malcolmson, the Rusá-grass, in the Deccan, affects particularly the trap, more or less avoiding the granite, so much so that he was able to trace the green-stone dykes across the granite by the luxuriance of the grass, whilst Fernandez writes that it grows on the hill sides as well as on plateau land and in periodically flooded plains, all of which indeed implies a considerable diversity of local conditions. Still it is noteworthy that in the ample material at my disposal the '*pachnodes*' type is not represented from any point south of 18° N.

Early records of Rusá oil and Rusá grass.—It was Dr. N. Maxwell,* Assistant Surgeon at Asirgarh Fort in Nimar, who in 1824 in a letter to the Medical Board of the East India Company called attention to a fragrant grass which was "found in great abundance on the sides of the Hill fort, as well as all over Malwah. From it," he says, "is extracted a highly pungent essential oil (when in its pure state), which I can from experience confidently recommend as of the highest benefit, when applied by friction in rheumatic affections," and further, that "it is prepared by a very rude process under Jaum Ghaut, in the vicinity of the station of Mundlaisir." The specimens which he sent with his letter were submitted to Wallich, who, in his reply to the Medical Board, reported as stated above, adding that he himself had found the plant abundant in Nepal. In the following year, J. Forsyth,† who had been directed to investigate the matter on the spot, presented a paper to the Medical and Physical Society of Calcutta, in which he gives a detailed account of the preparation and the sale of the oil and the conditions under which the grass grew and was gathered. He also gives 'Roosa-ka-Tel" as the native name of the oil. Of the grass, he reports that it "is met with in frequent distinct patches in the jungle throughout the province of Nemaur, but in greatest abundance along the foot of the Vindhya range, near Nalcha, at which two places‡ only I believe it is prepared, at least to any amount. About the latter end of August, it begins to bud, and continues to flower in tolerable vigour till the end of October, during which period alone it gives out the oil in sufficient quantity to cover the expense and trouble of its preparation, as after this it speedily dries up, and what little oil it does yield is extremely acrid, and unfit for use. . . . The oil is obtained from the grass by distillation . . . the plant is cut across where it begins to give out its flower, and bound up into small bundles. . . ." A few years later (in 1830), Charles Hatchett, F.R.S., a prominent chemist, received a sample of oil from a Mr. Samuel Swinton, who had been in the East India Company's service for many years and had resided for some time in Malwa. Hatchett made the grass which

* Maxwell in Trans. Med. & Phys. Soc. Calcutta, vol. i. (1825), pp. 367–368,
† Forsyth in Trans. Med. & Phys. Soc. Calcutta, vol. iii. (1827), pp. 213–218.
‡ Viz., Jaum and Nalcha.

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yielded this oil the subject of a somewhat confused paper, entitled 'Spikenard of the Ancients' (1836), which I do not intend to discuss here, confining myself to Swinton's information embodied therein. Swinton, like Maxwell, first became acquainted with the oil (which he says is called "Rhonsee-ke-Tell" by the natives) as an effective remedy in severe attacks of rheumatism. He also stated "that although the plants are found in other parts of India as well as in Malvah, yet those which grow about the Jaum Ghaut are preferred, and gathered in the month of October, when the seeds forming the ears or spikes have become fully ripe. At that season, however, in the places where this gigantic grass is produced, the jungle fever is so prevalent that the peasantry who collect it will not expose their health . . . unless tempted by very high remuneration. . . ." Hatchett further adds, "Mr. Swinton was informed by them (the principal natives) that it has been prepared in and about Malvah from time immemorial, at first probably by the Parsees, although at present it is entirely in the hands of the Borahs, a very commercial people, forming a sect of Moslems, whose chief resides at Surat. The oil is obtained from the spikes which, when ripe, are cut with a portion of the stem about one foot in length, and are then subjected to distillation. Only a small comparative quantity of the oil is consumed by the natives, the greater part being now, as was the case in very remote times (according to tradition), sent as an article of commerce to Arabia." Finally it is stated that "the odour of the plant is so powerful, that although camels will eat almost any vegetable, yet they will not browse on this. . . ." Neither the production nor the export of the oil can, however, have reached any considerable dimensions, as Jacquemont, who, in the spring of 1832, visited Nalcha and Jaum, and gave a very full account of Malwa, does not mention the grass or the oil. The grass, it is true, might have escaped him, as at that season it must have all been dried up.

How far there is any truth in the tradition that oil has been distilled from the Rusá grass 'from time immemorial,' we do not know. The authors of the Pharmacographia Indica (vol. iii., p. 558) merely suggest that "the industry commenced in the 18th century whilst Khandeish was in a flourishing condition under its Mahometan rulers." However this may be, there is sufficient evidence that the grass must have been known to the Aryan peoples of India for a very long time. 'Rohisha,' the Sanskrit equivalent of the Hindi 'Rusá,' occurs in Suśruta and in some of the earliest Sanskrit dictionaries. Another name in Sanskrit, evidently from the same root, is 'Rósem.' Variants of these terms are generally recognised vernacular names in the Hindi, Gujerati, and Mahrati dialects. Curiously enough, the name does not appear in the earlier Persian Pharmacopœias, the first record of it 'Rús' being apparently in the Makhzan-el-Adwiyah† (1771). According to the authors of the Pharmacographia (vol. iii., p. 557), *C. Martini* is also "the Bhustrina or Bhutrina 'earth grass' of the Raja Nighanta," and among the synonyms, which it bears, we may mention Gandha-Khéda and Gandha-trina 'odorous grass,' Su-rasa

* Royle, Antiquity of Hindoo Medicine (1837), pp. 31–34, 82–83, 143.
† *See* Dymock, Veget. Mat. Med. Western India, ed. 2 (1885), p. 851.

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'well-flavoured,' and Su-gandha 'having an agreeable odour.'" 'Bhustrina' is also mentioned in Suṣruta. Roxburgh* identified it with his '*Andropogon Schoenanthus*,' that is 'lemon-grass,' (*C. citratus*), which, having regard to the origin and history of that species can hardly be correct. The same applies to the other Sanscrit name which he refers to the 'lemon-grass,' namely 'Malatrinu Kung,' or rather Mālā-triṇi (Stolz) or Mala-trinaka (Hessler), another term used in Suṣruta and interpreted as connoting '*Andropogon Schoenanthus*.' Of other vernacular names which have been connected with *C. Martini*, I would mention here only two, 'Mirchia-gandh' and 'Gandh-bel.' 'Mirchia-gandh' has already been alluded to. Its derivation from 'Mirch'=*Capsicum annuum* or *Piper nigrum* and 'gandha'= odour, perfume, is obvious. There is not much in the grass to suggest pepper, but the bright colour of the fruiting panicles might well be compared to the red of chillies. If this is the meaning, the name cannot, of course, be old. It occurs, however, already in the Talif Sherif,† where it is mentioned in connection with 'Gundheel' as something kindred. 'Gandh-bel' (given as 'Gundbeyl' in Gladwin's translation) occurs as a Hindi synonym of 'Izkhir' as early as the middle of the 15th century in the Ulfaz Udwiyah,‡ again in the Talif Sherif† ('Gundheel' in Playfair's translation) and in the Makhzan-el-Adwiyah‡ (1771, 'Gundbel' and 'Gundhiz' in the Pharmacographia Indica). By this time 'Izkhir' seems to have become a nomen genericum with the Arab and Persian physicians in India, and similarly 'Gandh-bel' may have been applied to several of the fragrant Andropogons of Northern India, including ultimately also the 'lemon-grass,' for which Roxburgh, Fleming, and Ainslie found it in use at the beginning of the last century. The derivation of 'Gandh-bel' and its variants is, save as regards the appellation 'Gandh' (gandha, *Sansc.*=odour, perfume), still obscure. 'Gandhi' by itself is, according to Drummond,‖ used in the Panjab for *C. Schoenanthus* (Khavi), and, according to Duthie,§ in the north-west part of that province for *C. Martini*¶.

Present extent of Rusá-oil Industry. Motia and Sufia.—At present the principal places of production of Rusá-oil are Pimpalner, Akrani, Nandurbar, Shahada, and Talada, all in Khandeish; but it is also prepared in the Nagpur, Sagar, Jubbulpur and Karnul districts, and at Ajmere (Rajputana). Considering the wide distribution of the Rusá-grass, it is surprising how limited the area of its exploitation is. The principal reason is no doubt the quite recent development of the demand for the oil. In 1879 the total production was estimated at 3600 kilos, or 7934 lbs. Since then it has risen enormously and may at present amount to about 20,000 kilos, or 44,080 lbs.** There may, however, over certain areas, be differences in the constitution of the grass due to

* Roxburgh, Fl. Ind., ed. Carey & Wall., vol. i. (1820), p. 278.
† Taleef Sherif, trans. Playfair, p. 129.
‡ Ulfaz Udwiyah, transl. Gladwin.
§ *See* Dymock, Veg. Mat. Med. Western India, ed. 2 (1885), p. 851.
‖ *See* Duthie, Fodd. Grass. N.W. Ind. (1888), p. 36.
¶ Duthie, l.c.
** Gildemeister & Hoffmann, Vol. Oils, (1903), p. 285.

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racial variation or to conditions of the station resulting either in a reduction of the amount of oil obtainable or in such a modification of its quality as to render it unfit for the market. As an instance, I may mention that Madden*, a very careful observer, remarks that the "seeds (of *C. Martini* from Kumaon) seem different from those of the Neemar oil-grass, and have neither the same pungent odour or oily feel." Similarly the predilection of cattle and other animals for it in some districts, and their aversion to it in others may be accounted for by the existence of some such variation, unless indeed the observations on this point have been made indiscriminately from the young and the old grass. For there seems to be little doubt that the amount and the constitution of the oil in the plant undergo certain changes as the grass passes through its yearly cycle of development. Forsyth† has already remarked that the grass has to be cut during a certain period, to cover the expense and trouble of the preparation of the oil, as the amount obtainable subsequently diminishes, while the quality deteriorates at the same time. The distinction between the two kinds of Rusá-oil, viz., 'Motia' (Motiya) and 'Sufia' (Sofiya), which the distillers of Khandeish and the neighbouring districts recognise, apparently depends on similar conditions, although the accounts concerning them are to some extent conflicting. The authors of the Pharmacographia Indica (vol. iii., p. 558) say: "The oil distillers in Khandesh call the grass *Motiya* when the inflorescence is young and of a bluish white colour; after it has ripened and become red, it is called *Sonfiya*. The oil obtained from it in the first condition has a more delicate odour than that obtained from the ripened grass. The *Motiya* oil is usually mixed with the second kind, which by itself would not fetch a good price in the European market." On the other hand, Mr. E. G. Fernandez reports in a letter to Kew: "The *motiá* species (or variety) is usually confined to the higher hill slopes, while the *sufiá* grass is more common in the plains and on plateau-land in the hills, but they are not unfrequently found growing together. The *sufiá* is much more strongly scented, but the odour of the *motiá* is preferred, and this latter commands double the price of the former. It is chiefly or exclusively the *motiá* that is exported to Turkey for mixing with otto of roses." The samples of both forms supplied by Mr. Fernandez do not show any morphological differences, and as to age, some of the *motiá* samples are in a more advanced stage than the *sufiá*.

9. Cymbopogon caesius, *Stapf.*

(*Andropogon caesius*, Nees, in part.)

Kāmātci-(Kāmākshi-) grass (Tamil).

CHARACTER OF THE GRASS.—I have already pointed out that the Rusá-grass extends over the Deccan as far south as 12° N., with the exception of the western Ghauts and a portion of the Carnatic, and further, that in the southern part of its area it is represented mainly by a narrow-leafed state. In the Carnatic, it

* Madden, in Journ. As. Soc. Beng. vol. xvii. part i. (1848), p. 439.
† Forsyth, in Trans. Med. and Phys. Soc. Calcutta, vol. iii. (1827), p. 215.

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is replaced by a closely allied form with more slender and more branched culms, usually from $\frac{2}{3}$–1 m. high, with narrower, thinner, often almost flaccid and very glaucous leaves and with generally smaller panicles, which seem to retain their glaucous colour, or merely turn strawcolour when mature. The structure of the spikelets is, however, that of *C. Martini*, and so closely does the Carnatic grass in some instances approach the narrow-leafed state of *C. Martini*, that there would be no difficulty in constructing a chain of intermediate stages, linking together both forms as completely as possible. Those transition forms are, however, so far as I can see, confined to the border districts where the two grasses meet, elsewhere they are sufficiently distinct.

EARLY HISTORY.—The oldest specimens of the Carnatic grass on record are a specimen in the Plukenet herbarium at the British Museum and several in the Du Bois herbarium at Oxford, all of them collected near Madras at the end of the 17th or in the early years of the 18th century; but it is very probable that a passage in a letter by Herbert de Jager* to Rumphius, dated 6th July, 1683, also refers to it. Contesting the view of Bontius and others that the 'Sereh' of the Malays is identical with the '*Schoenanthum*' of the herbalists and in support of his argument, he says: "I have become familiar with the true and genuine *Schoenanthum* in Persia, and particularly on the coast of Coromandel, where I have traversed whole fields of that grass, which is about $2\frac{1}{2}$ to 3 feet high and the scent of which may be noticed from afar, particularly during the night when dew falls or in day-time when it rains, whilst in sunshine and fine weather not much odour is perceptible. In Golconda this *Schoenanthum* ground into powder is used for washing the hands on account of the sweet scent it imparts to the water; though the odour does not persist when the hands get dry." Neglecting for the present the question as to what the '*Schoenanthum*' powder of Golconda was, there can be little doubt that the fragrant Coromandel grass, of which there were whole fields to traverse, was the Kāmāṭci-pillu of the Tamils. Of this name we hear for the first time in 'Samuel Browne's Seventh Book of East Indian Plants,' edited and commented on by Petiver† (1702). The plants which form the subject of the paper were collected "between the 15th and 20th June, A.D. 1696, in the ways between Fort St. George and Trippetee, which is about 70 miles off." One of them was 'Comachee pillee,' and of it Browne says: "This is Schoenanth, which the natives here have not in great Esteem; sometimes in the Moors' Camps, the Horses, Camels, and Oxen which carry burthens eat nothing else; it is generally 2 or 3 feet high here about (but near Color in reech soyl, I have seen it 8 feet high) [this gigantic grass is no doubt *C. Martini*] and thick as a Quill or small Reed; It's sometimes by the natives put into their Decoctions for Fevers, and with us is deservedly of more esteem." Petiver‡ identified the 'Comachee pillee' with Plukenet's '*Gramen Dactylon Maderaspatense*' figured on plate 119, fig. 2 of his Almagesta (1691), the type of which is in Plukenet's herbarium—it is the

* Herbert de Jager in Valentini, Hist. Simpl. (1732), p. 392.

† In Petiver, Mr. Samuel Browne, his Seventh Book of East India Plants in Phil. Trans. xxiii. (1702), p. 1252.

‡ Petiver, l.c., p. 1251.

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specimen to which I have referred above. That type is an exact counterpart of certain specimens in the herbarium of Ch. Du Bois, who had received them from Madras, partly from his brother Daniel and partly from Dr. Bulkley, the latter having put them down as 'Caumachipille pille,' *i.e.*, 'Kāmātči pillu.' Petiver also enumerated the same grass, as a specimen in the Du Bois Herbarium proves, as "*Schoenanthus Madraspatanus panicula minore, spicis villosis geminis*" in his 'Museum,' No. 576 (1695), and communicated a sample of it to Scheuchzer, who in his 'Agrostographia,' p. 98 (1719), gave a more detailed account of it under Petiver's phrase.

CONFUSION WITH 'ANDROPOGON SCHOENANTHUS, L.'—Petiver, in his commentary on Samuel Browne's plants, made the mistake of identifying the Kāmātči pillu with the '*Schoenanthum*' of the herbalists, and even upbraided Plukenet for figuring "this plant twice over . . . his first figure is much truer than the last," although it is quite clear that the 'first figure' (Almag. tab. 119, fig. 2) represents the Kāmātči pillu, whilst the other (l. c. tab. 190, fig. 1) illustrates, though badly, the '*Schoenanthum*.' I mention this mainly to show that, even in pre-Linnean times, the tendency had manifested itself of identifying other aromatic grasses with the one which had become so familiar to the botanists of those early days. We have seen that Linnaeus fell into the same error, and we need not be surprised that when, towards the end of the 18th century, Koenig and his pupils Rottler and Klein gathered the grass again, they too put it down as '*Andropogon Schoenanthus*.' Rottler and Klein supplied Willdenow with specimens of this grass, and Willdenow appears to have written out his extended description of '*Andropogon Schoenanthus*,'* partly at least, from these specimens. To show how confused the taxonomy of these grasses had by this time become, I may mention that there are three sheets in his herbarium under the name. Sheet 1 contains a panicle and leaves of the true 'Lemon-grass' or Sereh, a young panicle with some of the upper leaves of the officinal '*Schoenanthum*' (Camel's hay) and a small inflorescence of *C. coloratus*. Sheets 2 and 3 are the Kāmātči grass. Sheet 1 is initialled by Willdenow, and Sheet 3 is accompanied by a label with the name '*Andropogon Schoenanthus*' in his handwriting. Under the circumstances it is not surprising that the Indian botanists of the time, who depended on a few books and relied for the comparison of their species with those of extra-Indian floras on the support of their European colleagues, formed equally confused ideas concerning these fragrant grasses. Thus Ainslie, in his 'Materia Medica'† (1813), refers 'Comachee pilloo' to '*Andropogon Schoenanthus*,' and adds to it as synonyms vernaculars which in reality belong to the 'Lemon-grass' and to the 'Camel's hay.' Wight, who collected the grass repeatedly, distributed some of his specimens (No. 1806) under the same name. Others he submitted to Nees, who was then planning a monograph of the Indian *Glumaceae*, which, however, was never completed. Nees named Wight's grasses, which were subsequently distributed with his determinations, and described them as opportunity offered.

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* Willdenow, Spec. Plant. vol. iv., part ii. (1806), p. 915.
† Ainslie, Mat. Med. (1813), p. 75.

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FOUNDATION OF THE SPECIES.—Among the grasses thus distributed was the Kāmāṭči pillu (No. 1700*b*). It was named by Nees '*Andropogon caesius*, *β*.' Unfortunately, Nos. 1700, 1700*c*, and 1700*d* were also distributed under that name. No. 1700 was *Andropogon pumilus*, Roxb., No. 1700*c* *Cymbopogon coloratus*, and No. 1700*d* a diseased state of *C. coloratus*. The distribution of *Andropogon pumilus* as *Andropogon caesius* was obviously a mere accident, as it is evident from the original specimen in Wight's own herbarium that Nees really meant to apply the name *Andropogon caesius* to No. 1700*a*, which is the same as No. 1700*b*, but is a very weak, (shade ?) form. The description of *Andropogon caesius* appeared in Hooker & Arnott's 'Botany of Beechey's Voyage '* a few years later. Nos. 1700 (recte 1700*a*), 1700*b*, and 1700*c* of Nees' distribution are quoted, and it is obvious that the description was drawn up from all three indiscriminately. To make matters worse, Nees referred to this composite species specimens collected by Millett and Vachell near Macao, which are neither identical with Nos. 1700*a* and 1700*b*, nor with 1700*c*, but represent what is generally accepted as *Andropogon hamatulus* or *Andropogon Nardus* var. *hamatulus*. Nor was this all. In 1843, Nees revised his determinations of those grasses in Meyen's 'Beiträge zur Botanik' (p. 190), and reduced *Andropogon caesius* to *Andropogon Martini*, quoting Wight, No. 1700 and No. 1806 (the latter = Kāmāṭči), under *Andropogon Martini;* Nos. 1700*a* and 1700*b* (both = Kāmāṭči) under *Andropogon Martini*, *α* and *β* respectively; and No. 1700*c* (*C. coloratus*) under *Andropogon Martini*, *γ*. He further referred Millett's and Vachell's Chinese specimens to the latter, of which at least Vachell's—I have not seen the other—is *Andropogon hamatulus*, and he cited also Roxburgh's unpublished drawing, No. 1095, which evidently represents *C. coloratus*. The Kāmāṭči grass therefore remains connected with *Andropogon caesius*, or rather *Cymbopogon caesius*, in so far as the vars. *α* and *β*, and Wight's specimens Nos. 1700*a* and 1700*b*, are concerned. As the name '*caesius*' was no doubt originally chosen with regard to the glaucous appearance of the Kāmāṭči grass, and in so far is quite appropriate, it may, with the necessary restrictions, be retained for that particular grass.

AREA; PREPARATION OF OIL.—*C. caesius* seems to inhabit the greater part of the Carnatic, from the extreme south to the Chingalpat district. It is evidently common, on the whole, in that region, but little use seems to have been made of it so far, except as an occasional domestic remedy. There is, however, among the specimens communicated by Mr. Barber, one with a note to the effect that it is the "grass from which Mr. Proudlock has been distilling oil." A short account referring to it is contained in the 'Administration Report of the Government Botanic Gardens and Parks, the Nilgiris,' for 1901, p. 5. According to this report the grass was obtained from Arni, in the North Arcot district, where it is stated to grow in great abundance. The yield of oil from a freshly-cut sample, received at the end of December, was 0·431 per cent. Another and larger quantity which was received

* Nees in Hooker & Arnott, Bot. Beechey's Voy. p. 244.

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in April in a thoroughly dry condition yielded 0·711 per cent. of oil, the differences in the yield being attributed to the first lot being fresh, whilst the other was dry. No analysis of the oil has yet been made.

10. Cymbopogon polyneuros, *Stapf.*

(*Andropogon polyneuros*, Steud.)

Just as *C. Martini* is replaced in the south-east of the Deccan Peninsula by *C. caesius*, so another species takes its place in the south-west. This species, *C. polyneuros*, is, however, much better defined than *C. caesius*. It is a moderately robust grass with a tendency to copious branching from the collar so as to form dense tufts of culms, with somewhat persistent, narrow, basal sheaths, rather fat, smooth blades with a rounded base, more or less glaucous beneath and often suffused with purple along the margin, and with short, contracted, variegated panicles, the herbaceous sheaths being usually deep brown-green with a narrow scarious margin, the spikelets being green in the lower part, and more or less blackish-purple in the upper. It was first distributed by Wight (No. 1705) under the name *Andropogon versicolor*, N.E., a name chosen no doubt in allusion to the variegation of the inflorescence. Nees never published a description of it. On the other hand, Steudel has, in his 'Synopsis Plantarum Graminearum' (1855), (p. 388), an '*Andropogon versicolor*, Nees MSS.,' under which he quotes '*A. Schoenanthus*, Wall. Cat. n. 8794L.' Wallich's 'Cat. n. 8794L.' is in Wallich's own herbarium identical with n. 8794K., which Steudel (l.c.) cites under *Andropogon clandestinus*, Nees. Steudel's description of *Andropogon versicolor* agrees neither with Wight's No. 1705 issued as '*Andropogon versicolor*, N.E.,' nor with Wallich's n. 8794L. It is not clear what the plant, which Steudel had in mind, was; it cannot well have been Wight's '*Andropogon versicolor*, N.E.' Wight does not indicate the locality where his No. 1705 was collected beyond the general note "Peninsula Ind. Orientalis." It agrees absolutely, however, with a grass which has frequently been collected in the Nilgiris, among others by Hohenacker who distributed it as "933, *Andropogon* (*Cymbopogon*) *nardoides β. minor N. ab E.*"; this was made by Steudel* the type of his *Andropogon polyneuros*. That name being perfectly unambiguous, its specific component will have to be retained for the Nilgiri grass in question in preference to *versicolor*, although the latter has very generally been applied to it. Outside the Nilgiris, *C. polyneuros* has so far only been observed in Ceylon where it is, particularly at higher elevations (up to 1,500 m.), a locally common plant. Thwaites† has already called attention to the "rather agreeable aromatic odour" of the inflorescences of this species, adding "that the essential oil appears to be situated principally at the base of the spikelets." According to a note in the 'Tropical Agriculturist' for 1901 (p. 873), the odour of the crushed leaves resembles that of fennel or anise. There it is also stated that the grass

* Steudel, Syn. Pl. Glum. pars. i. (1855), p. 385.
† Thwaites, Enum. Pl. Zeyl. (1864), p. 367.

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(which was identified by Trimen as *A. Schoenanthus*, var. *versicolor*) is particularly common in the Island of Delft in Adam's Strait, and has, under the name 'Delft grass,' the reputation of being a good fodder for horses. I have seen no specimens from that locality.

In 1902, a volatile oil was prepared from a sample of the grass collected on the hills about Ootacamund by Mr. Proudlock. The average yield is given as 0·25 per cent.; but so far no analysis seems to have been made of it.

11. Vetiveria zizanioides, *Stapf.* Nash 1903

(*Andropogon muricatus*, Retz.)

Khas Khas (Hind. ?)—Vetiver (Tamil).

EARLY HISTORY.—If we admit certain deductions of the Sanscritists—and there is no objection to them from the botanist's point of view—this grass, best known as 'Khas Khas' or 'Vetiver,' must have been popular with the peoples of Northern India for a very long time. W. Jones,* as long ago as 1795, identified the *Usira* of Kálidása with 'Khas Khas,' and Hessler† did the same in his translation of the Ayurvedas, whilst among the more recent interpreters of Sanscrit plant-names Dutt‡ has come to the same conclusion. Other Sanscrit names which have been interpreted in the same sense are *Virana*, *Lámajjaka* (or *Lamaja*) and *Bálá*. According to the 'Pharmacographia Indica' (vol. iii., p. 571), "In Vedic times the ancient Hindus were instructed to build their houses in a place where the *Virana* and *Kusa* (*Desmostachya bipinnata*, Stapf) were abundant." *Lámajjaka* is, in the same work (l.c., p. 562), referred to 'Camel's Hay' (*C. Schoenanthus*), but the synonyms 'Dirgha-mulaka' (long-rooted) and 'Jalasáya' (aquatic) with which *Lámajjaka* is connected in the Nighandas, are much more descriptive of 'Khas Khas,' and Heyne's§ and Elliot's‖ interpretation of the term as connoting the latter is therefore more plausible. Hessler also renders the *Bálá* of Sušruta with *Andropogon muricatus*. According to Dutt¶ it stands for *Pavonia odorata*, another plant whose aromatic roots are frequently used in Hindu medicine. But the fact that *Bálá* in Hindi actually also denotes the roots of 'Khas Khas' and that the Bengali, Gujerati and Mahrati synonyms *Válá* and *Való* are applied in the same sense, supports Hessler's identification. In proof of the assumption that 'Khas Khas' was an article of some importance long ago, the authors of the 'Pharmacographia Indica' (vol. iii., p. 572) also refer to the discovery of some copper plates in the village of Basáhi in the district of Etawah, south-east of Agra, it being stated that on these copper plates, which are dated A.D. 1103 and 1174, the grass is mentioned among the articles subject to royalties. The actual term used is 'turushka-danda,' which

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* Jones in Asiat. Research. vol. iv. (1795), p. 306.
† Hessler, Sušruta's Ayurvedas, vol. iii. (1850), p. 174.
‡ Dutt, Mat. Med. Hind. (1900), p. 321.
§ Heyne, Tracts Hist. Stat. India (1814), p. 130.
‖ Elliot, Fl. Andh. (1859), p. 106.
¶ Dutt, l.c., p. 293.

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Babu Rájendrala'la Mitra* interprets as meaning "aromatic reed" (turushka = aromatic substance, danda = stick), and hence also 'Khas Khas.' The latter term, now so commonly used, is supposed to be of Persian origin, but this appears to me very doubtful. It is mentioned in the Makhzan-el-Adwiyah† as a kind of 'Izkhir' used in India, also known as 'Izkhir-i-Jami,' (Izkhir-i-Ajami, foreign Izkhir), and called by the Persians 'bikh-i-wála' (wálá root).

The 'Khas Khas' was long ago equally well known to the Dravidic peoples of the South. Rheede‡ described and figured the grass under the Malayalim name *Ramacciam*, which is still in use in Travancore (*Ramach-cham*, Moodeen Sherif; *Ramaccam*, Stolz). He states that the roots (but not the leaves) are fragrant and sold in the bazars for medicinal purposes to prepare lotions, infusions, and decoctions. It is, he remarks, very common throughout Malabar and diligently cultivated by the natives, who propagate it by dividing the tufts and planting them in loose soil. He further observes that the best *Ramacciam* grows near Tutocorim, the port which in our own day is still the principal place of export of the roots of 'Khas Khas' or 'Vetiver.' Rheede's figure represents a leaf-tuft with the leaf-tops cut off. Although somewhat crude, it is perfectly characteristic, and it is difficult to understand how the 'Ramacciam' of the 'Hortus Malabaricus' could ever have passed—as it so frequently has done—for the 'lemon-grass.' Hermann§ (1672–1677) also found the roots in similar use at Colombo in Ceylon, where they were known as '*Lumbutschi-veru* (radix odorata)' and the grass itself as '*Saewaendara*,' which name has survived to the present day. About 25 years later (in 1700) Dr. Bulkley sent it to Ch. Du Bois from Madras under the Tamil name 'Vettyveer' (= Vetiver), the vernacular name by which the grass is best known in Europe. Petiver‖ also received specimens of it from Samuel Browne of Madras at about the same time and announced them in his 'Museum' as "*Gramen Madraspatanum majus cujus locustae spinulis eleganter armatae sunt.*" Some of them he sent to Scheuchzer¶, who from them drew up one of those classic descriptions which for completeness and accuracy remained long unequalled in agrostological literature.

FOUNDATION OF THE SPECIES. SYNONYMY.—No notice was taken of Scheuchzer's description or of Petiver's and Du Bois's specimens, and when Linnaeus, about 1770,** received the grass from Koenig he described it as something new under the name *Phalaris zizanioides*. Koenig, however, also sent specimens of the grass to Retzius, who published it as *Andropogon muricatus*†† in 1783. This name, which was suggested by Koenig himself, was

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* Babu Rájendrala'la Mitra in Journ. As. Soc. Beng. (Hist. & Lit.), vol. xlii. (1873), p. 320; Proc. As. Soc. Beng. (1873), p. 161.

† *See* Dymock, Warden, and Hooper, Pharmacogr. Indica (1893), vol. iii., p. 572.

‡ Rheede, Hort. Malab., vol. xii. (1703), tab. 72.

§ Hermann, Mus. Zeyl. (1726), p. 51.

‖ Petiver, Mus. Petiv. (1699), p. 53, no. 559.

¶ Scheuchzer, Agrostogr. (1719), p. 103.

** Linnaeus, Mant. Alt. (1771), p. 183.

†† Retz. Observ., vol. iii. (1783), p. 43.

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subsequently adopted by Roxburgh and most other botanists. More recently,* however, it has been replaced by *Andropogon squarrosus*, a name adopted by the younger Linnaeus† for a plant, also communicated by Koenig, who found it "circa Zeylonam natans supra stagna profundiora," and entirely distinct from *Andropogon muricatus*. The specimen is still in Linnaeus' herbarium and was correctly identified by R. Brown‡ with his *Panicum abortivum*, that is *Chamaeraphis spinescens*, a characteristic floating grass of the Indo-Malayan region. Retzius§ himself is responsible for the erroneous reduction of *Andropogon squarrosus* to *Andropogon muricatus*, which recently has been revived, although Roxburgh‖ long ago drew attention to the confusion. '*Zizanioides*' being the earliest specific epithet, it will have to be adopted for the 'Khas Khas,' so that its name under *Vetiveria* must be *V. zizanioides*. p. 362.

Uses of the Roots.—Koenig, in a note reproduced by Retzius, remarks: "Tamulis Woetiwaer. Radices ab indigenis usitatissimae ob gratum odorem quem aqua irroratae spargunt. Ex his *Flabella* praecipue parantur quae pennis Pavonum ornantur." This property of the roots of 'Khas Khas' of emitting a pleasant odour as often as they are wetted and as long as they are wet was also mentioned by Jones¶ in 1795. It has led from early times to their being woven into screens and mats (tatties), which are hung over doors or set in windows; in hot weather, when frequently sprinkled with water, they cool and perfume the air. The fans (Tamil, visri) mentioned by Koenig act in the same way. The root, in the powdered state, enters into the composition of an *Abir*,** or perfumed powder used by the Hindus at the *Holi* festival. Such an Abir, *Abir Izkhir*, is already mentioned in the 'Ain-i-Akbari,'†† the Annals of the Emperor Akbar, the appellation 'Izkhir' standing here for 'Izkhir-i-Ajami,' that is 'Khas Khas.' The 'Schoenanthus' powder which Herbert de Jager‡‡ found in use at Golconda in the second half of the 17th century was also most likely 'Khas Khas' powder. For what he says is this: "In Golkonda, this *Schoenanthus* is used in powder-form for washing the hands on account of the very *pleasant odour it imparts very quickly to the water; but the odour ceases as soon as the hands are dry*."

While, however, the use of the roots of *Vetiveria zizanioides* for medicinal purposes and in perfumery has been universal in India for a very long period, I have failed to find, among the earlier writers, any definite and indisputable reference to the extraction of an oil from them. It is true that Hessler, in his translation of Suśruta, mentions (vol. i., p. 160) "*Andropogi muricati spiritus distillatus*"; but the word which he renders as "*Andropogi* (sic) *muricati*" is 'Mrinala,' which by others, as for instance

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* Hackel, Andropog. (in DC. Monogr. Phaner., vol. vi., 1889), p. 542.
† Linné fil., Suppl. (1781), p. 433.
‡ R. Brown, Prodr. Fl. Nov. Holl. (1810), p. 193.
§ Retz., l.c., vol. v. (1789), p. 21.
‖ Roxburgh, Fl. Ind., ed. Carey & Wall., vol. i. (1820), p. 270.
¶ Jones in Asiat. Research. vol. iv. (1795), p. 306.
** Dict. Econ. Prod. India, vol. i. (1885), p. 7.
†† Hooper, in Calcutta Review, Oct. 1904.
‡‡ Herb. de Jager, in Valentini, Hist. Simpl. (1732), p. 392. *See also* p. of this paper.

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by Dutt,* is interpreted as meaning the leaf-stalk of the Lotus, so that for this reason alone the passage quoted cannot be adduced as proof of an early knowledge of the distillation of oil from 'Khas Khas' or 'Vetiver.' Indeed, the distillation of Vetiver oil in India seems to be of very limited† extent and there is hardly any export, the oil being mainly produced in European distilleries from the imported root; but even the import of the roots as a regular article of commerce appears to be of comparatively recent date.

NATURAL AREA AND CULTIVATION.—The natural area of *Andropogon muricatus* in India and Ceylon includes practically the whole country, in the north up to altitudes of 600 m. Although common in many parts of the country, particularly on the banks of rivers and in rich, marshy soil, it is also at present, as in Rheede's time, occasionally cultivated, as for instance in Rajputana and in Chutia Nagpur. Eastwards the area extends into Burma. Throughout the Malayan region, however, it occurs only in the cultivated state or as an escape from gardens. It has also been introduced into the Mascarenes, the West Indies, and Brazil; but it seems that in these countries oil is not distilled to any appreciable extent, except perhaps in Réunion, where the grass must have been in cultivation for at least 100 years, as the first sample of Vetiver-oil that was chemically examined‡ (in 1809) came from there.

12. Andropogon (Sect. *Amphilophis*) odoratus, *Lisb.*

Usadhana.

This is a little-known grass which was discovered by Dymock at Thana in 1875 and mentioned on account of its strong odour of ginger under its vernacular name, Usadhana, in the first edition of his "Materia Medica of Western India" (p. 693). In the second edition of that work (p. 853) it was referred to *Andropogon Nardus*. Subsequently it was, however, recognised as a new species by Mrs. J. C. Lisboa,§ and described as *A. odoratus*. This very aromatic grass is used by the peasantry of the Thana district for medicinal purposes. An essential oil of a golden-yellow to a deep sherry colour, with a distinctive odour, was obtained from it by distillation, but it has not yet become an article of commerce. The odour is, according to the "Pharmacographia Indica," vol. iii., p. 570, at first that of cassia and rosemary, but afterwards that of oil of cassia or, according to Gildemeister and Hoffmann,‖ that of pine-needle oil.

GINGER-GRASS.

(Gildemeister and Hoffmann, Volatile Oils, p. 285.)

Gildemeister and Hoffmann mention in their work on volatile oils a "ginger-grass oil," of which they say that it is "an inferior quality of palmarosa oil, or a mixture of the latter with much (up

* Dutt, Mat. Med. Hind., ed. 2. (1900), p. 109.

† Duthie (Fodd. Grass. N. India, p. 37) mentions that at Bhira, in Oudh, a perfume called *itae* is extracted from the roots of *Vetiveria zizanioides*, and used medicinally under the name of *urayia*.

‡ Vauquelin, in Ann. Mus. Hist. Nat. Par., vol. xiv. (1809), pp. 28-31.

§ Lisboa in Journ. Bomb. Nat. Hist. Soc., vol. iv. (1889), p. 123.

‖ Gildemeister & Hoffmann, Vol. Oils, p. 299.

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to 90 per cent.) turpentine oil or mineral oils," and further, that "occasionally other grasses are also used in the distillation (*Andropogon laniger*?), for some ginger-grass oils possess a phelandrene-like odour, which is entirely wanting in the palmarosa oil." In the Semi-Annual Reports of Schimmel & Co. for October–November, 1902, Ginger-grass oil of good quality is, however, spoken of as available from a new source of production on the Madras coast. In the April–May number of the same Reports for 1904, it is stated that phellandrene was detected in the portions boiling up to 80°, geraniol was also obtained, and a new alcohol ($C_{10}H_{16}O$). Investigations into the composition of this oil were continued, and in the October–November number of the Semi-Annual Reports for 1904, Schimmel & Co. further indicate (p. 46) the presence of two turpenes (*d*-limonene and dipentene). The aldehyd has a peculiar odour, which suggests both œnanthic aldehyde and citronellal. In the complete absence of herbarium specimens it is, of course, impossible to trace the origin of this oil. It may, however, be useful to mention that the name 'ginger-oil' or its equivalents in various Indian languages has been in use for a considerable time. 'Ginger-grass' is, for instance, mentioned by Ainslie in his 'Materia Medica' (1813), p. 115, together with its Tamil equivalent, 'Shukkunari-pillu.'* In this case the grass was *Cymbopogon flexuosus* (*see* p. 319). Since then the name has been more frequently used for *Cymbopogon Martini*. Among the vernacular names, those derived from the Sanscrit name Soñt (dry ginger), and therefore equivalent to the English name 'Ginger-grass,' have been variously applied. Stolz has, for instance, *Çunthi-hulla* for *C. Martini*. Edgeworth, according to Duthie, has '*Sent* (*sentha*)' for *Vetiveria zizanioides*, whilst '*Sondhi*' stands as one of the Indian synonyms of *Izkhir* in the Makhzan el Adwiyah.

II.—CONSPECTUS OF THE OIL-GRASSES OF INDIA.

Key to the Grasses.

CYMBOPOGON.—Racemes of spikelets paired on a common peduncle which is supported by and often enclosed in a more or less boat-shaped bract (spathe); all the sessile spikelets alike, with the exception of one (or more) at the base of the racemes (at least of one of each pair).

Tardily flowering perennials; innovations intravaginal, forming dense tufts; culms from dense bunches of firm, persistent leaf-sheaths, more or less widened below; blades long, hard, rough-edged throughout, filiform to linear; the first (outer) glume of the sessile spikelet flat or concave between the keels:—

Panicle narrow, of short, dense fascicles of raceme-pairs; raceme-joints villose all over, hairs long, more or less concealing the sessile spikelets; awn usually a straight, very short bristle (Series *Schoenanthi*):—

Basal leaf-sheaths in dense tufts, tightly clasping, thickened below; blades more or less filiform and flexuous, except when very short; raceme-fascicles more or less simple . . . . . 1. *C. Schoenanthus.*

* Shukku, Tamil for the dried root of ginger.

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c c Basal leaf-sheaths ultimately loosened and curled ; blades flat ; raceme-fascicles compound . . 2. *C. Jwarancusa.*

Panicles more often large and very compound ; raceme-joints glabrous or pubescent on the back, bearded along the b b sides, hairs increasing in length upwards, but not concealing the sessile spikelets ; awns, if present (they are normally absent in the cultivated forms), distinctly geniculate with the knee exserted (Series *Citrati*) :—

Sessile spikelets lanceolate or ovate- or obovate-lanceolate ; back flat :—

d Lowest pedicel of raceme scarcely stouter than the upper :—

e All the spikelets awnless . . . . 3. *C. Nardus.*

e e Sessile spikelets awned :—

Panicle erect, dense, often interrupted, with rather conspicuous, frequently purplish-brown to blackish spathes . . . . 4. *C. confertiflorus.*

Panicle loose, with slender, long, flexuous, often drooping branches and comparatively inconspicuous spathes, the whole panicle often greyish . . . . 5. *C. flexuosus.*

d d Lowest pedicel of racemes much swollen ; panicles erect, narrow, often interrupted, the divisions short, dense ; spathes and racemes short, the white hairs of the joints and panicles often very conspicuously contrasting with the pale brown spikelets . . . . 6. *C. coloratus.*

Sessile spikelets linear to lanceolate-linear, awnless ; back distinctly concave in the lower part ; panicle usually loose ; branches slender, the ultimate branchlets more or less nodding ; spathes long and narrow ; hairs of joints and pedicels rather spreading . . . . . 7. *C. citratus.*

Perennials, sometimes flowering the first year (or sometimes a a annuals ?) ; innovations mixed (extravaginal and intravaginal), forming fascicles from a short collar or very short, slender, oblique rhizome ; old culms naked at the base or with the withered remains of the basal leaf-sheaths ; blades flat, 5–30 mm. wide, rounded to subcordate and stem-clasping at the base, of a soft texture, with smooth edges (at least in the lower part) ; the first (outer) glume of the sessile spikelet with a narrow groove from the middle downwards corresponding to a keel inside (Series *Rusae*) :—

Culms in loose, rather scanty fascicles, erect and simple or nearly so, usually tall and robust ; basal sheaths soon withering ; blades 10–30 mm. wide (rarely under 10 mm.), somewhat fat, rich green, at least above ; panicles 10–30 cm. long, rather loose, turning reddish (often very bright) when mature . . . . . 8. *C. Martini.*

b b Culms in somewhat loose, often copious fascicles, erect or geniculately ascending, very slender, frequently branched, the branches often in fascicles from the knees of the culms ; sheaths soon withering ; blades 2–6 mm. wide, thin, glaucous ; panicles usually loose, 10–20 cm. long, glaucous or straw-colour when mature . . . . . 9. *C. caesius.*

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Culms in compact fascicles, erect, simple, wiry; basal sheaths more persistent than in the two preceding species; blades 6–10 mm. wide, somewhat firm, rich green above, glaucescent below, often suffused with purple near the base and along the edges; panicle stiff, dense, 6–10 cm. long; spathes more herbaceous than in the other species, often with rudimentary blades, purplish-brown with yellowish scarious edges; spikelets usually green in the lower, purple in the upper part . . 10. *C. polyneuros.*

2 VETIVERIA.—Racemes panicled, peduncled, very slender, many-jointed, in copious whorls on the nodes of an often long rhachis; joints and pedicels filiform, glabrous or nearly so; spikelets laterally or dorsally slightly compressed; the sessile all alike, awned or awnless; first (outer) glume muricate or smooth.

Innovations forming dense, compressed bunches of leaves with equitant sheaths and keeled, fat (almost spongy) blades which are more or less V-shaped in cross section; spikelets muticous, muricate . . . . . 11. *V. zizanioides.*

ANDROPOGON Sect. AMPHILOPHIS.—Racemes fascicled or
3 panicled, peduncled, slender, few- to many-jointed; joints and pedicels linear, flat, usually translucent between the thickened edges; all the sessile spikelets alike, dorsally compressed, awned.

Innovations forming dense bunches of leaves with compressed, smooth sheaths and flat, bright green, somewhat strongly-nerved leaves, 4–8 mm. wide; racemes densely fascicled, often very numerous, 2·5–5 cm. long, flexuous, purplish, silky; sessile spikelets villous below the middle with a silky callus . . . . . 12. *A. odoratus.*

1. **Cymbopogon Schoenanthus**, Spreng. Pug. vol. ii. (1815), p. 15, non Schult.—Transferred from *Andropogon* (*A. Schoenanthus*, L.).

DESCRIPTIONS.—Hackel, Androp. p. 598 (under *Andropogon laniger*), and Hook. f., Fl. Brit. Ind., vol. vii., p. 203 (under *A. Iwarancusa*, subsp. *laniger*); for the anatomy of the leaves, Duval-Jouve in Ann. Sc. Nat., sér. vi., vol. i., p. 355, tab. 18, fig. 2 (under *A. lanigerum*), and Hoehnel in Sitzber. Akad. Wiss. Wien, vol. lxxxix., part i. (1884), pp. 6–15, with tab. (under *A. Schoenanthus*).

ILLUSTRATION.—Hooker's Icon. Plant., tab. 1871 (under *A. laniger*, from a specimen from Jedda, Arabia, distributed as *Cymbopogon circinnatus*);—not very characteristic.

SYNONYMS.

Cymbopogon arabicus, Nees ex Steud. Syn. Pl. Glum. vol. i. (1855), p. 387.—Quoted as a synonym under *Andropogon circinnatus.*

C. Arriani, Aitch. Cat. Punj. Pl. (1869), p. 174.—Transferred from *Andropogon* (*A. Ariani*, Edgew.).

C. circinnatus, Hochst. in Schimp. Pl. Arab., ed. 2 (1844), no. 789 (name only).—Quoted as a synonym by Hackel under *A. laniger.*

Andropogon Schoenanthus, L. Spec. Plant., ed. 1 (1753), p. 1046.—Based on '*Schoenanthi Herba*' officinarum.

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A. bicornis, Forsk. Fl. Aegypt. Arab. (1763), p. 173, non L. . —From specimens collected by the author in the Hedjas.

A. laniger, Desf. Fl. Atl. vol. ii. (1800), p. 379.—From specimens collected by the author at Gafsa, Tunis.

A. Olivieri, Boiss. Diagn. Pl. Or. ser. i. fasc. v. (1844), p. 76. —From specimens collected by Aucher in Mesopotamia, no. 2955.

A. circinnatus, Hochst. et Steud. Herb. Un. It., no. 789 (name only) ; Steud. Syn. Pl. Glum. vol. i. (1855), p. 387.—From specimens collected by Schimper near Jedda.

A. Arriani, Edgew. in Journ. Linn. Soc. vol. vi. (1862), p. 208. —From specimens collected by the author in the Panjab.

A. Iwarancusa, subsp. *laniger*, Hook. f. Fl. Brit. Ind. vol. vii., p. 203.

Gymnanthelia lanigera, Anderss. in Schweinf. Beitr. Fl. Aethiop. (1867), p. 310 (name only).—Quoted as a synonym by Hackel under *A. laniger*.

DISTRIBUTION.—From Morocco to the Panjab and Ladak. The area is broken up into a number of sometimes very distant sub-areas : (*a*) North Africa from south-west Morocco along the southern edge of the Atlas to Tunis; (*b*) Arabia, south of 18° N. ; (*c*) western and south-western outskirts of the Persian highlands from 36° N. to Daleki (29° N.) on the Persian Gulf ; (*d*) Kerman, up to 2000 m. or higher ; (*e*) from south-west Afghanistan and north-west Baluchistan to the Panjab and the Sikh States, and in the Indus valley up to 2000 m. or higher. The eastern limit is ill-defined, as here the areas of *C. Schoenanthus* and *C. Jwarancusa* overlap, and numerous transition forms occur. In the Panjab it is common in some of the desert tracts from Karachi to Peshawur and Ludhiana, growing on rocks, in sand or in hard, loamy soil.

HERBARIUM SPECIMENS EXAMINED.—SIND : Without precise locality, *Stocks*, 816, 690. WAZIRISTAN : *Duthie's collector*, 15,721, 15,738 ; Dera Ismail Khan, *Herb. Duthie*, 7224. PANJAB : Kuram Valley, Shalian plains, 1500 m., *Aitchison*, 6 ; Para Chenar, *Duthie's collector*, 14,800 ; Salt Range, Bhirpur, *Aitchison*, 59 ; Loodiana, *Edgeworth* ; Sikh States, Balawali, *Edgeworth*. CHITRAL : Dir, *Herb. Duthie*, 6762 ; Warai, 1350 m., *Herb. Duthie*, 17,609 ; Moikandi, 1740 m., *Herb. Duthie*, 16,763. KASHMIR : Province of Kashmir, Ramu, 1800 m., *C. B. Clarke*, 28,501 ; Gilgit, Astor Valley, 1800 m., *Duthie*, 12,301 ; Doyan, 2130 m., *Giles* ; Gilgit River, 1380 m., *Giles* ; Chalt, *Winterbottom* ; Niltar Valley, near Nomal, 1500–1800 m., *Duthie*, 12,335 ; Baltistan, near Scardu, *Thomson* ; *Duthie*, 12,045.

OIL.—(Camel-grass oil).—Production very limited and local in the Panjab, mostly for medical purposes. Yield about 1 per cent. of the dry grass as sold in bazaars (Dymock). Composition unknown. Specific gravity 0·905 at 29·5° (Dymock), 0·915 at 15° (Schimmel & Co.) ; angle of rotation, $\alpha_D - 4°$ (Dymock), $+ 34° 38'$ (Schimmel & Co.). Distills between 170–250°.

VERNACULAR NAMES.—*Arabic :* Izkhir (the grass as sold in the bazaars) ; Máhareb (Cairo, Schweinfurth) ; M'hâh (Hedjas, Forskal). *Persian:* Gor-giyah (Wild Ass grass ; Ulfaz Udwiyah, 1450). *Hindustani :* Khavi (Edgeworth, 1840) ; Ghatyari (Baden Powell).

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2. **Cymbopogon Jwarancusa**, Schult. Mant. ii. (1824), p. 458. Transferred from *Andropogon* (*A. Jwarancusa*, Jones).—Based on Blane's paper on the 'Nardus Indica or Spikenard' in Phil. Trans., vol. lxxx. (1790), p. 284, and on the accompanying figure (tab. 16) : the first technical description was by Roxburgh, Fl. Ind. (ed. Carey & Wall.), vol. i. (1820), p. 279, who spelt "*Iwarancusa*" instead of "*Jwarancusa*." Original in Herb. Smith, at the Linnean Society, London.

DESCRIPTIONS.—Trinius, Spec. Gram. Ic., text accompanying tab. 326 ; Hackel, Androp., p. 599 (var. *genuinus*) ; Hook. f., Fl. Brit. Ind., vol. vii. p. 203 (*A. Iwarancusa* "proper").

ILLUSTRATIONS.—Blane l.c. ; Trinius, l.c. ; Duthie, Fodd. Grass. N. India, tab. 23 (under *A. laniger*, a form approaching *A. Schoenanthus*).

SYNONYMS.

Andropogon Jwarancusa, Jones, in Asiat. Research. vol. iv. (1795), p. 109 (name and reference to Blane).

A. laniger, Duthie, Fodd. Grass. N. India, t. 23.

DISTRIBUTION.—Outer hillzone of the United Provinces, Kumaon, Garhwal (up to 3000 m. or over) and westwards as far as Peshawur ; mainly in the neighbourhood of watercourses.

HERBARIUM SPECIMENS EXAMINED.—PANJAB : Rawul Pindi, *Aitchison*, 97, 562 ; Jhelum, *Stewart*, 157 ; Lahore, *Thomson ;* Firuzpur, *Griffith*, distr. no. 6770 ; Spiti, *Lance*, 295. KASHMIR : Baltistan, between Khalse and Nurla, among rocks close to the river, *Thomson ;* near Leh, 3000 m., *Thomson*. UNITED PROVINCES : without precise locality, *Royle ;* bed of Jumna, *Falconer ;* Hurdwar, *Boyd ;* between Agra and Saharanpur, "radice odoratissima," *Jacquemont*, 352. Garhwal ; Tonse valley very common, *Jacquemont* 398 ; 900–1200 m., *Duthie*, 15,579, 14,499 ; without precise locality, *Stewart*, 404. Kumaon ; Almora, 1500 m., *Strachey & Winterbottom*, 5 ; *Thomson*. Oudh ; North Oudh, *Thompson ;* Rapti Valley, *Blane*. NEPAL : without precise locality, *Wallich*. BENGAL : Dinajepur Distr., Kantanagar, *Hamilton*.

OIL.—Unknown. The grass is very probably used along with *C. Schoenanthus*.

VERNACULAR NAMES.—*Sanskrit :* Jwarânkusa (*i.e.*, fever-restrainer). *Bengali :* Karankusa (Roxburgh, 1814 ; Dutt). *Hindustani* : Khavi (*see* A. Schoenanthus). For further vernaculars *see* Duthie, Fodd. Grass. N. Ind., p. 36.

3. **Cymbopogon Nardus**, Rendle, in Cat. Welw. Afr. Pl. vol. ii. (1899), p. 155.—Transferred from *Andropogon* (*A. Nardus*, L.).

DESCRIPTIONS.—Hackel, Androp. pp. 601–602 (subsp. *genuinus*), and Hook. f. in Trimen, Fl. Ceyl., vol. v., p. 242.

ILLUSTRATIONS.—None.

SYNONYMS.

Andropogon Nardus, L. Spec. Plant. ed. 1 (1753), p. 1046. Based on Hermann's specimen of 'Pengriman.'—Original at the British Museum.

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DISTRIBUTION.—Only known in cultivation: Ceylon, particularly in the South; Malayan Peninsula; Java.

HERBARIUM SPECIMENS EXAMINED. — CEYLON: without precise locality, *Macrae; Walker; Thwaites*, 2733: Watwalla, near Galle, cultivated, *Thwaites*, Nov. 1858 (Herb. Pharm. Soc.); Galle, cultivated as "Old Citronella grass" (Winter's grass), and other specimens as "New Citronella grass (Lanu Batu)," comm. *Breitenstein*; Bundarawalla, *Jowitt*, 2383–2386, 2388, 2389. PENANG: Batu Feringi, cultivated (?), *Curtis*, 91. JAVA: Buitenzorg, cultivated, *Treub*. JAMAICA: Hope Gardens, cultivated, *Harris*.

OIL.—(Oleum Citronellae; Citronella oil). — Production in Ceylon (1905), 1,282,471 lbs. (Tropic. Agricult., Aug. 1905) from 40,000–50,000 acres; in the Malay Peninsula (1903) about or under 30,000 lbs. from about 2000 acres (Gildemeister and Hoffmann). Yield in per cent. of the dry or fresh grass unknown; per acre about 352–440 oz. in the summer, 110–220 oz. in the winter. Composition: (*a*) *Maha Pangiri*, Citronellal 50·45–55·34 per cent., Geraniol 38·15–31·87 per cent., Methyl Eugenol 0·78–0·84 per cent.; (*b*) *Lenubatu Pangiri*, Citronellal 28·2 per cent., Geraniol 32·9 per cent., Methyl Eugenol 8·0 per cent. Specific gravity: (*a*) *Maha Pangiri* 0·886–0·900; (*b*) *Lenubatu Pangiri* 0·900–0·920. Angle of rotation: (*a*) Maha Pangiri, $\alpha_D = -0{\cdot}34$ to $-3°$; (*b*) *Lenubatu Pangiri*, $\alpha_D = -5°$ to $-21°$.

VERNACULAR NAMES.—*Singhalese*: Panagiri mana; Maha Panagiri mana (the original variety, also known as Winter's or Old Citronella grass); Lenubatu Panagiri mana (the new variety, New Citronella grass). *English*: Citronella grass.

4. **Cymbopogon confertiflorus**, Stapf.—Transferred from *Andropogon* (*A. confertiflorus*, Steud.).

DESCRIPTIONS.—Steud. Syn. Pl. Glum. vol. i. (1855) p. 384; Hook. f., Fl. Br. Ind., vol. vii., p. 206 (under *A. Nardus*, var. *nilagiricus*).

ILLUSTRATION.—None.

SYNONYMS.

Andropogon confertiflorus, Steud. Syn. Pl. Glum., vol. i. (1855), p. 384.—Based on Hohenacker, Pl. Ind. Or. (M. Nilagiri), no. 932, distributed as *A. nilagiricus*, Hochst.

A. nilagiricus, Hochst. in Hohenacker, Pl. Ind. Or. (M. Nilagiri) (1851), no. 932.—Name only, on the distribution label; quoted as a synonym by Hackel, Androp. (1889), p. 604.

A. nardoides, α *major*, Hochst. ex Steud., l.c.—Quoted as a synonym by Steudel, l.c.

A. Nardus, var. *nilagiricus*, Hack. Androp. (1889), p. 604.—Based on Hohenacker, no. 932.

DISTRIBUTION.—Nilgiris, Anamallai and Palni Hills; Ceylon, chiefly in the 'patanas' up to 1500 m.

HERBARIUM SPECIMENS EXAMINED.—MADRAS PRESIDENCY: Nilgiri Hills, *Schmidt*; *Hohenacker*, 932; *Thomson*; Madras

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Coll. 20, 36, *Gamble*; Coimbatore District, Anamallai Hills, *Beddome* (Brit. Mus.); Madura District, Palni Hills, Naduwattam; *Barber*, 2642, 2643. CEYLON: Bundarawatta, *Jowitt*, 2382, 2387, 2390, 2391; without precise locality, *Gardner*, 1037; *Maxwell.*

OIL.—Not produced commercially; 'good' according to Willis, but the yield is small. Properties unknown.

VERNACULAR NAMES.—*Singalese:* Mana. *Toda* (Nilgiris): Bāmbe (Hohenacker).

5. **Cymbopogon flexuosus**, Stapf.—Transferred from Andropogon (*A. flexuosus*, Nees ex Steud.).

DESCRIPTIONS.—Steud. Syn. Pl. Glum. vol. i. (1855), p. 388; Hack. Androp., p. 603 (under *A. Nardus*, var. *flexuosus*); Hook. f. Fl. Brit. Ind., vol. vii. p. 207 (under *A. Nardus*, var. *flexuosus*).

ILLUSTRATIONS.—Rheede, Hort. Malab. vol. xii. tab. 57 (Kodipullu); Bentley and Trimen, Med. Pl. tab. 297 (under *A. Nardus*).

SYNONYMS.

Andropogon flexuosus, Nees in Wight, Cat. (1833), p. 100 (name only); Steud. Syn. Pl. Glum., vol. i. (1855), p. 388.—Based on Wight, No. 1704 (171*a* of Wight's own herbarium).

A. Nardus, var. *flexuosus*, Hack., Androp. (1889), p. 603.

DISTRIBUTION.—Tinnivelli District and Travancore.

HERBARIUM SPECIMENS EXAMINED.—TRAVANCORE: "abundant on the plains," *Waring* (Herb. Hanbury); Cochin, *Barber*, 2934. MADRAS PRESIDENCY: Madura District, Palni Hills, at 1200 m., *Beddome* (Brit. Mus.); Naduwattam, *Barber*, 2695; Tinnivelli Distr., Courtallum, *Klein.* (A specimen of Klein's is in Wight's herbarium, placed with Wight, 1704, distributed as "*Andropogon* (*Cymb.*) *flexuosus*, N.E." They are so much alike that it seems probable the distributed specimens were made up from Klein's collection). A specimen of this flowered at Kew last year. Another cultivated specimen, grown in the A. H. Gardens at Madras is in the herbarium of the India Museum, Calcutta.

OIL.—(Malabar or Cochin Lemon-grass oil).—Export from the Malabar Coast (1896–97), 270,000 kilos = 595,080 lbs. (Gildemeister and Hoffmann). Yield in per cent. of the dry or fresh grass unknown. Composition: Mainly citral (70–75 per cent.); specific gravity: 0·899–0·903. Angle of rotation uncertain. Readily soluble in alcohol, even in dilute alcohol.

VERNACULAR NAMES.—*Malayalim* (?): Kodi-pullu (Rheede, 1703; can this be meant for the *Canarese* Kádi pillu = sour grass?) or Pullu (grass; Bourdillon); *Tamil:* Shukkunari pillu (Courtallam, Herb. Wight; literally ginger-grass; Ainslie, 1813).

6. **Cymbopogon coloratus**, Stapf.—Transferred from Andropogon (*A. coloratus*, *Nees*).

DESCRIPTIONS.—P. 321 of this paper; Hook. f., Fl. Brit. Ind., vol. vii., p. 206 (under *A. Nardus*, var. *coloratus*).

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ILLUSTRATION.—None.

SYNONYMS.

Andropogon coloratus, Nees, in Wight, Cat. (1833) no. 1703 (name only).

A. Nardus, var. *coloratus*, Hook. f., Fl. Brit. Ind., vol. vii., p. 206.

DISTRIBUTION.—From the Tinnivelli District to the Anamallai Hills and throughout the Carnatic.

HERBARIUM SPECIMENS EXAMINED.—MADRAS PRESIDENCY: Tinnivelli Distr., Courtallum, *Thomson* (Herb. Hanbury); Mandunthorai Ghaut, *Barber* Coll., 2765, 2769; Koilpatti, *Barber* Coll., 3437; Madura District, Palni Hills, 300–600 m., *Barton Wright* in Barber's Coll.; *Beddome* (Brit. Mus.); Coimbatore District, Anamallai, Poonachi Ghaut, *Barber* Coll., 3582, 3752; Trichinopoli Distr., Trichinopoli, *Griffith*; North Arcott District, *Beddome* (Brit. Mus.); Cuddapa District, *Beddome* (Brit. Mus.); without precise locality: "Sent from Fort St. George" (Madras), *Bulkley* (Herb. Du Bois); *Klein*, 9 July, 1808 (a specimen of Klein's is in Wight's Herbarium, placed with Wight, 1703, distributed as "*Andropogon* (*Cymb.*) *coloratus*, N.E.," and it is possible that the specimens distributed by Wight as 1703 were taken from Klein's material); *Wight*, 3087, 3094; Wight, 1700*c* and 1700*d* (the latter diseased); *Heyne* in Herb. Wallich, 8794, B, D.

OIL.—Unknown. The grass is possibly one of the 'lemon-grasses' of the Malabar District.

VERNACULAR NAMES.—*Tamil*: Manjen pillu (Bulkley, 1703); Manakru pillu (Klein, 1794); Senga manu mala pillu (Griffith); Sengana pillu (Herb. Barber).

7. **Cymbopogon citratus**, Stapf.—Transferred from *Andropogon* (A. citratus, DC.; Nees).

DESCRIPTIONS.—Rumphius, Herb. Amboin., vol. v., p. 181 (under *Schoenanthum amboinicum*); Nees in Allgem. Gartenzeit. vol. iii. (1835), p. 266; also my remarks on pp. 332, 333. 322

ILLUSTRATIONS.—Rumphius, l.c., tab. 72; and the plate accompanying this paper, presented by the Bentham Trustees.

SYNONYMS.

Andropogon Schoenanthus, L., Syst. ed. x. (1759), p. 1304, not of Spec. Plant.; Roxburgh, Fl. Ind., ed. Carey & Wall. (1820), vol. i., p. 278.—Original from Roxburgh's garden at the British Museum.

A. citratus, DC. Cat. Hort. Monsp. (1813), p. 78 (only very imperfectly described); Nees, in Allgem. Gartenzeit., vol. iii. (1835), p. 266 (full description).—Based on specimens cultivated in various European gardens as *A. citratus* or *A. citriodorus*, or 'Lemon-grass,' in the earlier part of the last century. A specimen of this 'Lemon-grass' from Lambert's garden (not later than 1810) is at the British Museum.

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☞ *A. citriodorum* (sic), Desf. in Tabl. École Bot., ed. 2 (1815), p. 15.—Quoted as a synonym under *A. Nardus*.

A. Roxburghii, Nees, in Wight, Catal. (1833), no. 1699 (name only); Steud. Syn. Pl. Glum., vol. i. (1855), p. 395.

A. ceriferus, Hack. in Mart. Fl. Bras., vol. ii., part iii. (1883), p. 281.—From specimens cultivated near Rio Janeiro, and distributed by Glaziou, 4296.

A. Nardus, var. *ceriferus*, Hack. Androp. (1889) 605.—*A. ceriferus* reduced to a variety of *A. Nardus*.

Schoenanthum amboinicum, Rumph. Herb. Amboin. vol. v. p. 181, t. 72.

DISTRIBUTION.—Only known in the cultivated state. Most tropical countries.

HERBARIUM SPECIMENS EXAMINED.—MADRAS PRESIDENCY: South Coromandel, *Rottler*; Circars, Samulcotta, *Hort. Dr. Roxburgh* (Brit. Mus.). CEYLON: *Thwaites* (Herb. Hanbury). TENASSERIM: Without precise locality, *Helfer*, 934; Mergui, *Griffith*, 303 of Herb. Wight, Distrib. no. 6762 (Wight's specimens distributed as 1699 are evidently from Griffith's collection). JAVA: *De Vry* (Herb. Hanbury); Buitenzorg, comm. *Treub*. BORNEO: Labuan, *Burbidge*. HONG KONG: *Hance*, 255 (Brit. Mus.). FIJI: Uvea, *Gräffe* (?) (Herb. Hanbury). MAURITIUS: *Bojer*; *Bouton* (Herb. Hanbury). MADAGASCAR: Central Madagascar, *Baron*, 2737. PORTUGUESE WEST AFRICA: Mossamedes, *Welwitsch* (Brit. Mus.); Loanda, *Welwitsch* (Brit. Mus.). WEST INDIES: S. Vincent, *Guilding* (Brit. Mus.); Jamaica, *Bertero* (Herb. Turin), *N. Wilson* (Herb. Hanbury); Portorico, Maricao, *Sintenis*, 222.

OIL.—(Oleum Sereh, O. Andropogonis citrati, Lemon-grass oil, Essence de Verveine des Indes).—Export from Ceylon (1883), about 1500 lbs.; from the Straits Settlements, 2000–3000 lbs. (Gildemeister & Hoffmann). Yield from the fresh grass (Brazilian), 0·24–0·4 per cent., according to season. Composition, similar to that of Malabar-grass oil (*C. flexuosus*). Citral content, 77 per cent. Specific gravity, 0·895; angle of rotation, $\alpha_D = 0° 8'$. Solubility in alcohol very much less than that of Malabar-grass oil.

VERNACULAR NAMES.—*Tamil:* Vāsana-pillu (S. Browne, 1696; literally 'perfume grass'); Karpūra pillu (Watt, 1869; literally 'camphor-grass'). *Telugu:* Vāsana gaddi (Stolz, 1881); Chippa gaddi (Elliot, 1859); Nimma gaddi (Elliot, 1859). *Malayalim:* Vāsanap-pullu (Mooden Sheriff, 1869). *Canarese:* Vāsane-hullu (Mooden Sheriff, 1869); Kāvanče hullu (Stolz, 1881); Majjige hullu (Stolz, 1881). *Mahrati:* Oleu cha and Hirva cha (Watt, 1889; both literally 'green' or 'greenish tea'). *Dukni:* Naring ke bās ka ghans (Ainslie, 1813; literally 'orange-grass'). *Gujerati:* Lili cha (Watt, 1889; literally 'green tea'). *Burmese:* Sa-ba-lin (Mason, 1860). *Chinese:* Mao-hsiang (Loureiro, 1790; literally 'fragrant Mao'). *Malay:* Sereh (De Jager). *Tagalog* (Philippines): Tañglad (Nieremberg, 1635). *Portuguese:* Herba cheirosa (Rottler), Capim de Cheiro (Peckolt). *Spanish:* Grama de limon and Limoncillo (Grosourdy, 1864). *French:* Citronelle; Verveine des Indes. *English:* Lemon-grass.

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8. **Cymbopogon Martini**, Stapf.—Transferred from *Andropogon* (*A. Martini*, Roxb.).

DESCRIPTIONS.—Roxburgh, Fl. Ind. ed. Carey & Wall., vol. i. (1820), p. 280; Trinius, in Mém. Ac. Pétersb. sér. 6, vol. ii., p. 284, and Spec. Gram. Ic., the text accompanying tab. 327 (under *A. pachnodes*); Hook. f., Fl. Brit. Ind., vol. vii., p. 204 (under *A. Schoenanthus*, var. *Martini*).

ILLUSTRATIONS.—Trinius, Spec. Gram. Ic., tab. 327 (under *A. pachnodes*); Royle, Illustr. Bot. Himal. tab. 280 (under *A. Calamus aromaticus*); Duthie, Fodd. Grass. N. Ind., tab. 26 (under *A. Schoenanthus*, L.).

SYNONYMS.

Cymbopogon Martinianus, Schult. Mant. ii. (1824), p. 459.—Transferred from *Andropogon* (*A. Martini*, Roxb.).

Andropogon Martini, Roxb. Fl. Ind. ed. Carey & Wall., vol. i. (1820), p. 280.—Based on specimens "raised from seeds collected by General Martin in the Balaghat."—Original at the British Museum.

A. pachnodes, Trin. in Mém. Ac. Petersb. sér. 6, vol. ii. (1833), p. 284, and Spec. Gram. Ic. (1836), tab. 327.

A. Calamus aromaticus, Royle, Essay Antiq. Hind. Med. (1837), p. 33 (name only); Illustr. Bot. Himal. (1840), tab. 280.—Intended for the Rusá grass.

A. nardoides, α, Nees, Fl. Afr. Austr. (1841), p. 116.

A. Schoenanthus Flück. and Hanb., Pharmacogr. (1874), p. 660, non L.—Intended for the Rusá grass.

A. Schoenanthus, var. *genuinus*, Hack. Androp. (1889), p. 609 (partly).—*See* p. 304.

A. Schoenanthus, var. *Martini*, Hook. f., Fl. Brit. Ind., vol. vii. (1897), p. 204, excluding certain synonyms which refer to African plants.—Intended to cover *A. Martini*, Roxb.

DISTRIBUTION.—From the Rajmahal Hills in Bengal to the Afghan frontier and from the sub-tropical zone of the Himalaya to about 12° N., excluding the desert region of the Panjab and the greater part of the northern Carnatic. The south-eastern and southern limit does not seem to be well defined, as the area there overlaps that of the closely allied *C. caesius*.

HERBARIUM SPECIMENS EXAMINED.—PANJAB: Hazara, Black Mountains, Susal Pass, *Duthie*, 7585 (*a*)*; between Dhamtaur and Mansera, 600 m., *Falconer's* coll. (*l*). Fatehabad (Peshawur District ?), *Falconer's* coll. (*i*), Beas—Chenab Doab, *Thomson* (*a*). Chamba, Manjir, *Lace*, 1291 (*l*), (Herb. India Mus.). Kangra, between Nurpur and Kotla, 600 m., *Watt*, 15,216 (*i*). Hissar, *Coldstream* (*l*), (Herb. India Mus.). Simla Hills, *Falconer's* coll. (*i*); 300–600 m., *Jacquemont*, 1516 (*a*). Bashahr, Rampur, *Thomson* (*i*). KASHMIR: Jhelum Valley, 600 m., *C. B. Clarke* coll., 13,721 (*a*). UNITED PROVINCES: Saharanpur, *Thomson* (*i*); Moradabad, *Thomson* (*i*). Garhwal, without precise locality, up to 105 m.,

* *a* designates narrow-leaved; *i* intermediate; and *l* broad-leaved forms.

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Stewart, 405 (*l*), 396 (*i*); Adh-badhri, 1350 m., *Strachey & Winterbottom* (*l*); Srinagar, *Thomson* (*l*); Kumaon; Almorah, *Madden* (*l*). NEPAL: *Wallich* (*l*). BENGAL: Monghyr, *Wallich*, 8795 (*l*); Rajmahal Hills, *Jacquemont*, 105, 166 (*a* and *l*). Chutia Nagpur, Singhbum, Nonda, *C. B. Clarke*, 34,251 (*l*). RAJPUTANA: Mhairwara, *Duthie*, 4921, 4921*a* (*i* and *l*); Ajmere, *Rep. Econ. Prod.*, 20,205 (*l*). GWALIOR: *Maries* (*l*), (Brit. Mus.). BOMBAY PRESIDENCY: Khandeish; Sholapur Hill, *Young* (*a*), (Brit. Mus.); Shendurni, *Young* (*a*), (Brit. Mus.); Malegaon, *Young* (*a*) (Brit. Mus.). Dharwar District, *Burkill* (*a* and *i*); *Young* (*a*); *Barber Coll.*, 6138 (*a*). CENTRAL PROVINCES: Nimar District, without precise locality, comm. *Duthie* (a number of specimens, varying from *a* to *l*); Asirgarh Fort, *Duthie*, 8464 (*i* to *l*); Nagpur; Warda, East Panch, *Rep. Econ. Prod.* 17,922, 17,923 (*l*); Chanda District, *Duthie*, 9901 (*l*). BERAR: Amraoti, *Fernandez* (several specimens, from *a* to *l*); Basim District, *Fernandez* (*a*); Buldana District, Pimpalgaon, *Young* (*a*), (Brit. Mus.). HAIDERABAD: Camp Rasanum, Kadangal Taluka, *Rep. Econ. Prod.* (*a*). MYSORE: Bangalore, drawing comm. by *Maj. Gen. Puckle* (*i*). MADRAS PRESIDENCY: Ganjam Distr., Gamsur, *Beddome* (*l*), (Brit. Mus.); Karnul District, *Barber Coll.*, 248 (*a*); Bellari, Bellari Farm, *Barber Coll.*, 6577 (*a*); Cuddapa District, *Beddome* (*a*), (Brit. Mus.); North Arcot, Arni, *Barber Coll.* (*a*); South Arcot, *Barber Coll.* 6060 (*a*); North Salem District, Pennagaram Reserve, 270 m., *Barber Coll.*, 6041 (*a*). BURMA: Southern Yoma, *Kurz* (*i*).

Without indication of locality: *Wight*, 1702; *Heyne* in Herb. *Wallich*, 8794 C.; Calcutta Bot. Gard.: *Roxburgh* (Brit. Mus.); *Hardwicke* (Brit. Mus.); *Wallich*, 8794 N.

OIL.—(Oleum Palmarosae seu Geranii Indici; Palmarosa oil; Rusá oil; East Indian Geranium oil).—Total production estimated at 20,000 kilos. per annum, = 44,080 lbs. (Gildemeister & Hoffmann, 1903). Principal district of production: Khandeish; yield about 0·3–0·4 per cent. from the fresh grass. Composition: mainly geraniol (76–93 per cent.). Specific gravity unknown. Angle of rotation varying from $\alpha_D = +1° 41'$ to $-1° 55'$. Soluble in three or more parts of alcohol.

VERNACULAR NAMES.—*Sanskrit:* Rohisha (Suśruta), Rosém (Sanskrit Dict.). *Hindustani*: Rusa (Makhzan-el-Adwiyah, 1771), Gandh-bel (Ulfaz Udwiyah, 1450) Mirchia gandh (Talif Sherif), Tikhari (Nagpur and Khandeish, Duthie, 1888). Suñthi, soñt (Makhzan-el-Adwiyah, 1772; literally, 'dry ginger'). *Marathi*: Rohish and Roshegavat (Duthie, 1888). *Gujerati:* Rhonse (Swinton, 1830), or Rauns (Duthie, 1888). *Canarese:* Çunthi hullu (Stolz, 1882; literally, 'ginger grass'); Kāci hullu (Stolz, 1881); Kasi hullu (Barber). *Tamil*: Kāvattam pillu (Stolz, 1881; Barber).

9. **Cymbopogon caesius**, *Stapf.*—Transferred from *Andropogon* (*A. caesius*, Nees).

DESCRIPTION.—Hook. f., Fl. Brit. Ind., vol. vii., p. 205.

ILLUSTRATION.—None.

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* *a* designates narrow-leaved; *i* intermediate; and *l* broad-leaved forms.

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SYNONYMS.

Andropogon caesius, α and β, Nees in Wight Cat. (1833), Nos. 1700, 1700*b*, (name only).

A. Schoenanthus, var. *caesius*, Hack. Androp. (1889), p. 610.

DISTRIBUTION.—Throughout the Carnatic.

HERBARIUM SPECIMENS EXAMINED.—MADRAS PRESIDENCY: Tinnivelli; Courtallam, *Barber* Coll., 3315; Aulancolam, *Barber* Coll., 3346; Trichinopoli, *Griffith*, 104; Coimbatore District, Coimbatore, *Barber* Coll., 2558, 2588; Sangamir, *Barber* Coll., 4455; Chingalpat District, Saidapet, *Thomson*, Madr. Coll., 298. Sent from Fort St. George (Madras), *D. du Bois*, *Bulkley* (Herb. Du Bois).—Without indication of locality: *Wight*, 1700 (Herb. prop. 173*c*), 1700*a* (Herb. prop. 178), 1700*b*, 1806, 3348, 3090; *Wight* in Herb. *Wallich*, 8796; *Thomson*, Madr. Coll., 16, 29, 102.

OIL.—Not produced commercially. Yield 0·43 per cent. from fresh, 0·71 per cent. from dry grass. Composition unknown.

VERNACULAR NAMES.—*Tamil:* Kāmāṭci or Kāmākshi-pillu (S. Browne, 1696): Mändap pillu (Rottler, about 1800; literally 'Temple grass'). *Telugu:* Kamanchi gaddi (Elliot, 1859). *Canarese:* Kāmancha-hullu (Stolz, 1881).

10. **Cymbopogon polyneuros**, *Stapf.*—Transferred from *Andropogon* (*A. polyneuros*, Steud.).

DESCRIPTIONS.—Steudel, Syn. Pl. Glum. vol. i. (1855), p. 385; Hook. f., Fl. Brit. Ind., vol. vii., p. 205 (under *A. Schoenanthus*, var. *versicolor*).

ILLUSTRATION.—None.

SYNONYMS.

Andropogon versicolor, Nees in Wight, Cat. (1833), No. 1705 (name only), not of Steud.—Based on Wight, No. 1705.

A. polyneuros, Steud. Syn. Pl. Glum. vol. i. (1855), p. 385.—Based on Hohenacker, Pl. Ind. Or 1851, no. 933, distributed as "*A. nardoides β minor*, N. ab. E."

A. nardoides β minor, Nees ex Steud. (1855), l.c.—Quoted as a synonym; not of Nees, Fl. Afr. Austr.

A. Schoenanthus var. *versicolor*, Hack. Androp. (1889), p. 610 (partly).—In the first place no doubt intended for the Nilgiri plant.

DISTRIBUTION.—Nilgiris and Ceylon.

HERBARIUM SPECIMENS EXAMINED.—MADRAS PRESIDENCY: Nilgiri Hills, *Perrottet*, 1269; *Schmidt:* Kaity, *Hohenacker*, 933; Ootacamund, *Proudlock*. CEYLON: *Thwaites*, C. P. 1335; Bundarawalla, *Jowitt*.—Without indication of locality, *Wight*, 1705 (Herb. prop. 164).

OIL.—Not produced commercially. Yield 0·25 per cent. from the fresh (?) material. Composition unknown.

VERNACULAR NAMES.—Unknown.

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Nash 1903.

11. **Vetiveria zizanioides**, Stapf.—Transferred from *Phalaris* (*P. zizanioides*, L.).

DESCRIPTIONS.—Hackel, Androp., p. 542 (under *A. squarrosus*, var. *genuinus*); Hook. f., Fl. Brit. Ind., vol. vii., p. 186 (under *A. squarrosus*).

ILLUSTRATIONS.—Pal. de Beauv. Agrost., tab. 22, fig. 10 (analys.); Duthie, Fodd. Grass. N. Ind., tab. 15; Duval Jouve, in Mém. Ac. Sc. Montpell. vol. vii. tab. 17, fig. 9 (anatomy of the leaf).

SYNONYMS.

Vetiveria odorata, Virey in Journ. de Pharm., sér. i., vol. xiii. (1827), p. 499.

V. arundinacea, Griseb. Fl. Brit. W. Ind. (1864), p. 559.—Based on West Indian specimens (from Jamaica and Trinidad).

V. muricata, Griseb. l.c., p. 560.—Transferred from *Andropogon* (*A. muricatus*, Retz.).

Phalaris zizanioides, Linn. Mant. Alt. (1771), p. 183.—Based on Koenig's S. Indian specimens. Original in Herb. Linn.

Andropogon muricatus, Retz. Obs. vol. iii. (1783), p. 43.—Based on specimens collected by Koenig in South India.

A. festucoides, J. S. Presl in C. B. Presl, Reliq. Haenk., vol. i. (1830), p. 340.—Based on Luzon specimens collected by Haenke.

A. squarrosus, Hack. Androp. (1889), p. 542 (var. *genuinus*), non L. f.

Agrostis verticillata, Lam. Ill. Gen., vol. i. (1791), p. 162.—From specimens "Ex. India, Ins. Franciae."

Anatherum muricatum, Beauv. Agrost. (1812) Expl. planch., p. 15.—Transferred from *Andropogon* (*A. muricatus*, Retz.).

DISTRIBUTION.—Tropical and sub-tropical India, Ceylon, and Burma, mainly near water, occasionally cultivated, as it also is in Malaya, the Mascarenes, the West Indies, and Brazil.

HERBARIUM SPECIMENS EXAMINED.—No particular localities quoted, the grass being well known and not easily mistaken.

OIL.—(Oleum Andropogonis muricati; Vetiver oil.)—Mostly produced in Europe from imported roots, also in Réunion. Yield 0·4–0·9 per cent from the dry root. Composition unknown. Specific gravity 1·015–1·030 at 15° (German oil), 0·982–0·998 at 30° (Réunion oil). Angle of rotation, $\alpha_D = +29°$ (German), $+36°$ (Réunion).

VERNACULAR NAMES.—*Sanskrit:* Bālā (Sušruta), Usira (Sušruta), Viranam (Mahabharata). *Marathi:* Vālā (Moodeen Sheriff, 1869), Ushir (Dymock). *Gujerati:* Való (Moodeen Sheriff, 1869). *Hindustani:* Vālā, Bālā (Watt, 1889), Usirbedh (Pharmacogr. Ind., 1893), Biran (the stems, Duthie, 1888); Panni (Panjab, Duthie, 1883); Gander or Gandel (Duthie, 1888). *Bengali:* Bālā (Watt, 1889); Bena (Duthie, 1883). *Persian:* Bikh-i-Wala (Makhzan el Adwiya, 1771). *Tamil:* Vetti-ver (Koenig; Roxburgh). *Telugu:* Vatti veru (Elliot, 1859); Avura gaddi (Elliot, 1859); Ouru (Elliot, 1859). *Canarese:* Bālāldde

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hullu (Stolz, 1882); Bálad véru (Pharmacogr. Ind., 1893); Mudivala hullu (Stolz, 1882). *Malayalim:* Ramacham (Rheede, 1703). *Tulu:* Mudyala (Stolz, 1882). *Singalese:* Savandra (Hermann, 1670–77). *Malay:* Akar wangi (literally, fragrant root). *Burmese:* Miya-móa (Moodeen Sheriff, 1869). *Spanish:* Yerba Moro, Raiz de Moro (Blanco; Philippines). The Anglo-Indians call it "Khas-Khas" (Jones, 1795), the derivation of which is uncertain.

12. **Andropogon odoratus,** *Lisb.* in Journ. Bomb. Nat. Hist. Soc., vol. iv. (1889), p. 123, with plate.—Based on specimens collected by Mrs. Lisboa near Lanowli, Bombay Presidency.

DESCRIPTIONS.—Lisboa, l.c. and vol. vi., p. 68 and p. 203; Hook. f., Fl. Brit. Ind., vol. vii., p. 177.

ILLUSTRATION.—Lisboa. l.c., vol. iv., plate opposite p. 118 (bad).

SYNONYMS.—None.

DISTRIBUTION.—Bombay; Thana and Poona Districts.

HERBARIUM SPECIMENS EXAMINED.—BOMBAY PRESIDENCY: Thana District, near Thana, *Dymock:* Lanowli, *Lisboa;* Puna District, Mawal, *Woodrow.*

OIL.—Not produced commercially. Composition unknown. Specific gravity, 0·931 (Dymock), 0·915 (Schimmel & Co.). Angle of rotation α_D: $-22{\cdot}75°$ (Dymock), $-23°\ 10'$ (Schimmel & Co.).

VERNACULAR NAMES.—*Marathi:* Veddi gavat (Lisboa); Usadhana (Watt, 1889).

EXPLANATION OF THE PLATE.

Cymbopogon citratus, *Stapf.*—Fig. 1, entire plant; 2, end of rhizome with tuft of sheaths; 3, upper leaves of a barren tuft; 4, part of an inflorescence; 5, pair of spikelets; 6, sessile spikelet; 7, outer (lower) glume; 8, valve (glume III.) of lower (barren) floret; 9, valve (glume IV.) of upper (fertile) floret; 10, outer (lower) glume of pedicelled spikelet.—Fig. 1, *much reduced;* 2–4, *of natural size;* 5–10, *enlarged.*

XLVII.—MISCELLANEOUS NOTES.

Cultivation of Citronella Grass in Java.—While Dr. Stapf's account of the Oil-grasses of India and Ceylon has been passing through the press various references to the industry involved have appeared in current journals. One of these, taken from the *Agricultural News*, vol. v., p. 335, is derived from a report by the Hon. Staniforth Smith, of the Australian Parliament, and refers to the cultivation of Citronella Grass in Java:—

"From Citronella Grass (*Andropogon Nardus*) a valuable scented oil is obtained that is used in the manufacture of superior soaps and other articles. In Java there are several large plantations—one of those I inspected being nearly 1,000 acres in extent.

"The grass, if planted in good fertile soil, and enjoying a heavy rainfall, grows very quickly. From 10 acres a yield of 12 tons should be cut, and four corps a year can be taken off, totalling 48 tons. This will yield about $\frac{1}{2}$ per cent. of oil, or $4\frac{4}{5}$ cwt., worth 3*s*. 10*d*. a kilogramme, say £46 16*s*. The grass lasts twelve

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years before it is necessary to plant again. To obtain the oil from the grass by distillation a small plant is required, consisting of one boiler costing £250, and a tank and condenser with pipe connection, costing £85. A round tank, 16 feet in diameter, would be sufficiently large to treat four crops a year off 200 acres, if worked day and night.

"While I would not recommend this as a principal crop in Papua, I think it should be cultivated, as in Java, as a catch-crop between the rubber and cocoa-nut trees."

Cultivation of Lemon Grass in the Malay Peninsula.—A second notice of the cultivation of a scented oil-grass, in the *Times of Malaya*, is here reprinted from the *Agricult. Bulletin, Straits and Federated Malay States*, vol. v. (given as viii.), pp. 282, 283.

The most remarkable feature in this reference to Lemon Grass cultivation is the great difference of view as to the yield expected as compared with that anticipated from Citronella Grass. The latter is supposed to be likely to give four crops a year, the former only two. Yet the produce of these four crops of Citronella Grass from ten acres is expected to realize only £46 16*s.* as against £266 13*s.* 4*d.* per acre from the two crops of Lemon Grass. The cultivation of Citronella Grass is only advocated as a catch-crop, but even on this assumption the first estimate seems low; the second is probably too high. The note is as follows:—

"A product for which there is at present a good demand in the London market, late quotations being from 8¼*d.* to 8½*d.*, is the oil of Lemon Grass. The value of the product has steadily increased from a trifle over Rs. 40 to Rs. 58 per gallon, and is likely to rise higher in the near future.

"Lemon Grass luxuriates in a well-drained sandy soil, but has been known to thrive also upon laterite provided the dry weather be not prolonged. It is also a lover of moisture in the soil but is unable to withstand waterlogging. For the highest purposes of its cultivation, however, the most suitable soil is an arenaceous clay, and the best climate one which presents distinct alternations of sunshine and shower.

"The crop will, under ordinary conditions, be ready for harvesting in the cold weather of the third year from planting it out. On cropping the grass it is committed to the still with as little delay as possible. The usual method adopted with the grass is aqueous distillation in copper stills. In plantation-grown grass at least two crops can be harvested in the season, so that, calculating on an average on a bundle of the grass (of six inches diameter) from each of the 5,000 clumps which may safely be counted upon to attain to maturity out of the 7,260 planted out, the yield of an acre may be estimated at 10,000 bundles. Fifty such bundles yield a quart (40 fluid ounces) of the oil, so that the 10,000 bundles would yield 200 quarts or 8,000 ounces. Valued at 8*d.* per ounce, which is the current average selling price of the oil in the London market, the produce of an acre would realise £266 13*s.* 4*d.* Even should the crop cost £66 13*s.* 4*d.* to raise, tend, harvest, distil and transport the oil to market, a profit of £200 per acre would be obtainable from it from and after the cold weather of the third year of its establishment."

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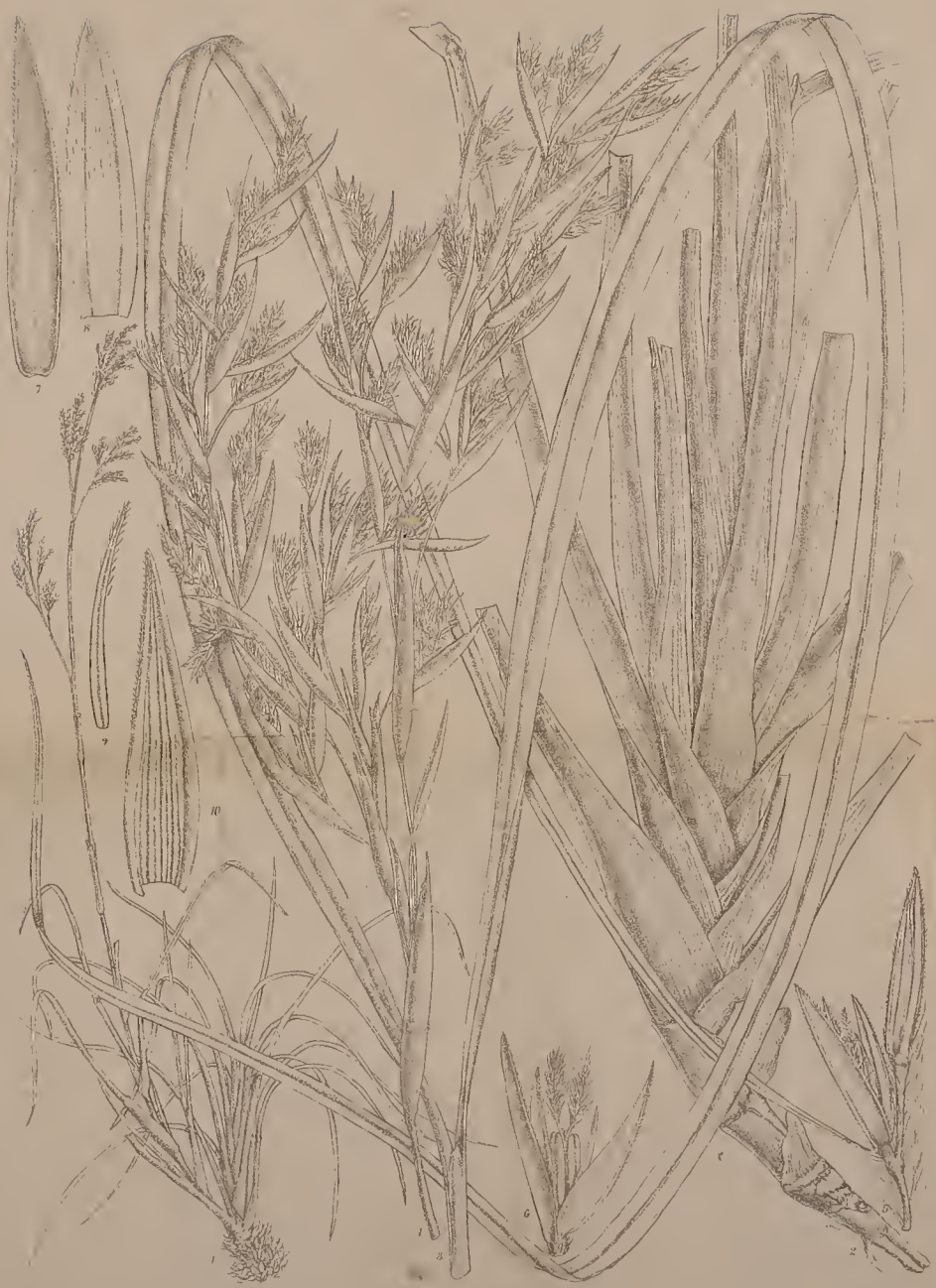

Andropogon citratus D C

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