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THE GENUS STIPA (L.) IN TASMANIA

Part I—Introduction and Identification

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(With five text figures and one plate)

ABSTRACT

This paper is the first of a series concerned with the revision of the genus *Stipa* in Tasmania. Criteria allowing a new approach to identification at the specific level, both in the herbarium and in the field, are described by means of a detailed study of patterns of hook and hair ornamentations found on the adaxial surface of leaf blades. Nine ornamentation patterns are illustrated in conjunction with their associated spikelet forms. *Stipa pubescens* R.Br. var *aphylla* Rodway is raised to specific rank and an amended descriptions is presented.

INTRODUCTION

The genus *Stipa* commonly called Speargrass is part of the tribe Stipeae (Hubbard in Hutchinson, 1959; Elias, 1942, 47-50) which also includes *Aristida* (the three-awned speargrasses occurring on the mainland of Australia), *Nassella* (the species *N. trichotoma* (Nees) Hack. Serrated Tussock occurring as a dangerous noxious weed in S Tasmania and introduced from New Zealand), *Oryzopsis* (represented in Tasmania by *O. miliacea* (L.) Benth. Rice Millet), and *Piptochaetium* a South American genus.

The world distribution of *Stipa* includes besides Australia and New Zealand, Russia, N and S America, Spain and Portugal, N Africa, and one native species occurs in S Africa (*S. dregeana* Steud.). Stapf (in Hughes, 1921) suggested that the Australian species are more or less unrelated to those from other world areas, and more recent studies on N American species (Hitchcock, 1950) and S American species (Matthei, 1965; Caro, 1966) confirm his view for America at least. Although *S. teretifolia*, a native Australian species, does occur naturally in the North Island of New Zealand (Cheeseman, 1906), on morphological and ecological grounds it would appear to be in a category of its own.

The genus in Tasmania is mainly distributed in dry sclerophyll and open or cleared areas with under 40 inches annual rainfall, largely below 1,500 feet altitude.

The earliest recorded specimens of *Stipa* in Tasmania and indeed in Australia generally are to be found amongst the collections of Labillardière (Labillardière, 1804) and Robert Brown (Brown, 1835), who deposited their material including many type specimens in herbaria outside of Australia, in Brown's case mostly at the British Museum and at the Royal Herbarium, Kew. The resulting difficulty of obtaining the type material for study in Australia has added to the problem of distinguishing between the superficially similar specific entities existing here. Major contributions to herbarium collections were later made by William Gunn in the 1840s, L. Rodway (ca. 1900), Dr W. Curtis (from 1940-), Dr N. Burbidge in 1949, and Drs M. E. Phillips and J. W. Vickery in 1962. Hughes (1921, 1922) has provided the main basis for work on the genus since the 1920s, and the only records of Tasmanian species of *Stipa* since then are available in Willis (1962) and Townrow (1969). Miss Hughes was much handicapped in her revision as the specimens she had to work on were often incomplete, immature, and of insufficient variety to give a true picture of the range of living plants within each entity.

The difficulty of sorting out entities is still acute, and the present paper is a portion of a larger programme of study concerned with the revision of the genus *Stipa* in Tasmania. A new approach to identification of related entities at the specific level is presented based on patterns of ornamentation of adaxial leaf surfaces. The method developed can be applied with equal facility in the field or in the herbarium, on fresh or dried material, with or without mature inflorescences.

CRITERIA

Hughes' (1921) taxonomic criteria are primarily:—

1. the length of the palea (valvule) relative to the lemma (valve);
2. possession of lemma lobes;
3. presence or absence of leaf blades;
4. longevity of plant—perennial or annual;
5. awn characters—
   the shape of the bristle,
   the hair ornament of the awn;

6. prominence of glume veins;
7. glume bulging in conjunction with turgidity of the floret,

and secondly:—

1. hairiness of panicle branches;
2. density and colour of lemma hairs;
3. glume length;
4. leafblades rough or smooth, hard or soft;
5. ligule length;
6. plants stout or slender;
7. awn length;
8. leaf sheath villous or glabrous.

These criteria were satisfactory when applied to the restricted range of material Miss Hughes worked with, but are much less so when applied to the larger more representative collections of material now increasingly available. Many species within the genus are superficially similar, and the living specimen in situ presents a very different appearance from the dried herbarium specimen. The unsatisfactory nature of the use of the earlier taxonomic criteria is demonstrated by:—

1. *Habit*: Only a few culms from any sizeable specimen will be preserved and these will give no real idea of the appearance of the living plant in the field. The size of clump, and height and robustness of a species of speargrass is in any event a variable feature.

2. *Leaves*: The true width of the blade varies up the culm and is obscured by rolling in dry conditions. The character of the ligule is variable but is useful in some cases, e.g., *S. pubescens* where it is finger-nail shaped, compared with *S. nervosa* where it is truncate with a ciliate margin. I suspect the lop-sided appearance of the ligule found in some specimens to be an indication of hybrid origin. The presence of hairs round the back of the leaf at the junction of blade and sheath ('collar') is variable in those species showing this feature. The density of hairs when present in this position, may be modified by exposure to abrasion, the hairs being easily rubbed off in windy situations.

3. *Inflorescence*: Some species in still air exhibit a characteristically-shaped inflorescence, e.g., *S. pubescens* is lop-sided, *S. nervosa* is more regularly pyramidal. This feature is almost completely obscured in herbarium specimens and rarely recorded on the label. The shape of the inflorescence also varies with its state of maturity and unless known from first emergence to senescence is an unreliable taxonomic feature.

4. *Glumes*: The glumes have hyaline fragile tips which tear off very easily, so that measurements of length are virtually useless unless made on completely undamaged specimens, a condition rarely found in herbarium material or in field situations. An apparent gaping of glumes which may not be present naturally is often produced during the pressing of specimens. Prominence of veining, although rightly emphasised by Hughes (1921), I find a character difficult to apply as it is frequently obscured by environmental bleaching or overpigmentation.

5. *Lemmas*: Hair ornament on the lemma body and awn is a widely-used character in identification. A true appreciation of hair-distribution, -length and -colour is possible only when based on a dry lemma which has been stored for some time. Any remnant of dampness causes hairs to remain appressed to the lemma surface. Awns develop characteristic curves or bends only when dry. Length of the bristle is unreliable because of its fragile nature. Maximum 'bulge', size, and colour of the lemma body are fully developed *only by lemmas containing a ripening caryopsis*. Inflorescences produced early or very late in the season produce very little if any fertile seed, and the lemmas remain pale-coloured and shorter and thinner. This has given rise to much confusion in identification. Lemma lobes (outgrowths from the top margins of the lemma at the awn base) are of minor assistance in Tasmanian identifications, the only species with lemma lobes visible to the naked eye being *S. teretifolia*. In the other species these structures are minute and variable both in presence and dimension.

6. *Leaf blade cross sections* are useful but difficult to interpret in practice, and other criteria are easier to use.

I have found that most of the Tasmanian speargrasses fall into nine major populations showing fairly wide variation within each. I also suspect that hybrid swarms occur between these populations which further complicate the situation, these being intermediate in all external features.

Further criteria were sought and are presented here.

A. Criteria for use in the herbarium:—
   1. Adaxial leaf surface ornamentation.
   2. Lemma characters.

B. Criteria for use in the field:—
   1. Adaxial leaf surface ornamentation.
   2. Lemma characters.
   3. Shape of inflorescence.
   4. Habitat.

A. In the Herbarium

1. *Adaxial Leaf Surface Ornamentation*: This consists of various arrangements of hooks, hairs, or tubercles borne on the upper surfaces of the leaf-blade ribs (figs 1, 2, plate 1). The following criteria are suggested:—

(*a*) Ornament.—Absence or presence of hooks, hairs or tubercles alone or in combination.

(*b*) Hairs.—Length, density, diameter, direction in which hairs are borne relative to the long axis of the blade, presence of swollen basal portion.

(*c*) Hooks.—Length, density, and direction of hook-tip relative to the long axis of the blade.

Actual measurements of length of hairs and hooks are not as helpful as are visual comparisons made between the major patterns described (figs 1, 2).

2. *Lemma Characters*: Bearing in mind the difficulties already noted, the characters used traditionally are satisfactory if the lemma studied contains a developing caryopsis and has been

stored dry for some weeks. The following criteria are suggested (figs 3, 4, 5):—

(*a*) Hair ornamentation.—Length, density, direction and colour of the hairs on the body, crown, callus and awn (bristle and column).

(*b*) Body.—Shape, dimensions (including callus in length measurement), colour as distinct from hair colour, surface sculpturing.

(*c*) Callus—

Scar.—The abscission scar on the lower surface of the sharp naked tip of the rachilla joint which is shed with the lemma shows variations in length, overall shape, and in the shape of the groove or trough down its adaxial surface. Groups of apparently closely related species have characteristically shaped callus-scars (see figs 3, 4, 5—*Stipa compacta, S. stuposa, S. semibarbata* and *S. mollis* compared with *S. teretifolia* or *S. variabilis*).

Hairtuft.—The densely hairy rachilla section between the lemma-base and the callus-scar varies in length and hair character according to the species.

(*d*) Awn.—Diameter of the column, if bent or curved when dry, number of times bent, length of column to the first bend.

(*e*) Lemma lobes.—Presence or absence, length, ornamentation.

N.B.: It is highly desirable to make accurate records of colour by means of the Munsell Color Chart system (Munsell, 1954).

The lemma characters of the nine Tasmanian species described are shown in Table 1.

B. Criteria for Use in the Field

1. *Adaxial Leaf Surface Ornamentation*: The appearance of the adaxial leaf surface at ca. x 15 (i.e., in the field) is highly characteristic for the species. But it is not the same as the appearance at x 40. Moreover, the lower power appearance is virtually impossible to describe or figure adequately even by photographs. Probably the best thing is for the investigator to devise his own terms, after examination and identification of his material, first at x 40, then at a lower magnification.

2. *Lemma Characters*:

(*a*) Hairs.—The distribution and length of hairs may be discernible if the lemma is mature and the air is dry. Distribution and length of the hairs on the awn is useful in distinguishing between *Stipa mollis* and *Stipa semibarbata* (fig. 3). The presence of a crown of longer hairs at the top of the lemma and the base of the awn is useful in separating *S. stuposa* and *S. compacta* from the other Tasmanian species (figs 3, 5), while the actual length of the crown hairs helps to distinguish between both immature and mature specimens of these two species.

(*b*) Dimensions of mature lemma body + callus.—The length of the lemma body can be used to distinguish some species from the rest, the shortest belonging to *S. variabilis* and the longest being found in *S. aphylla, S. pubescens, S. stuposa* and *S. teretifolia* (figs 3, 4, 5).

(*c*) Colour of the viable lemma.—The colour of hairs and body surface combined as seen by the naked eye is useful in some instances, e.g., in the identification of *S. compacta* which has a lemma with a bright coppery tint (Munsell Color dark reddish brown 5 YR 3/4).

3. *Inflorescence Shape*: Observations must be made in still air so that this character is of limited use.

4. *Habitat*: Identification may be assisted by a knowledge of groupings of species characteristic of various habitats, e.g., *S. compacta* and *S. teretifolia* are almost entirely confined to extreme coastal areas.

MATERIALS AND METHODS

(a) Material Examined

Specimens from three sources have been utilised.

1. *Specimens loaned from The Royal Herbarium, Kew.* These were stated to be duplicates of type material:—

Stipa aphanoneura Hughes. Kew No. H3908/67. 1.
Det. D. K. Hughes. Swanport. Coll. Mueller, 1877.

S. compacta Hughes. Kew No. H3908/67. 2. Melb. Uni. Herb.
Det. Ballard. Brighton Beach Victoria. Coll. E. Sonenberg 20.9.29.

S. elatior Hughes. Kew No. H3908/67. 3. Flora W. Aust. Ex Herb. Cecil Andrews.
Det. D. K. Hughes. Claremont near Perth. Coll. 15.9.02.

S. fusca C. E. Hubbard. Kew No. H3908/67. 4.
Det. ? Marino near Adelaide. Coll. J. B. Cleland H.491, 8.10.32.

S. pubescens R.Br. Kew No. H3908/67. 5.
Det. D. K. Hughes. New England Herb. F. Mueller, 1887.

S. pubescens R.Br. Kew No. H3908/67 6. Nat. Herb. N.S.W. No. 16577.
Det. ? Nowra North. Coll. E. F. Constable 8.12.50.

S. setacea R.Br. Kew No. H3908/67. 7. Ex Herb. Australiense CSIRO, Canberra.
Det. N. T. Burbidge. Hunter Valley, N.S.W. Coll. R. Story 6911, 25.11.59.

S. semibarbata R.Br. Kew No. H3908/67. 8.
Det. ? Pinery near Grange. Coll. J. B. Cleland H.487, 1.10.32.

S. stuposa Hughes. Kew No. H3908/67. 9. Herb. Australiense No. 3185, CSIRO, Canberra.
Det. N. T. Burbidge. Risdon, Tasmania. Coll. N. T. Burbidge, 18.1.49.

S. mollis R.Br. Kew No. H3908/67. 10.
Det. ? Blackmans Bay near Hobart. Coll. W. M. Curtis 112, 1.1.47.

S. eremophila Reader. Kew No. H3908/67. 11.
Herb. Hort. Bot. Reg. Kew.
Det. ? Mildura, Victoria. Coll. E. J. Sonenberg, 1937.

S. flavescens Lab. Kew No. H3908/67. 12.
Nat. Herb. N.S.W. No. 43.
Det. ? Belltrees via Scone. Coll. H. L. White, February 1910.

S. variabilis Hughes. Kew No. H3908/67. 13.
Queensland Herb., Brisbane Bot. Gard. Flora of W.A.
Det. ? Moora SW Division. Coll. S. T. Blake 18049, 1.9.47.

2. *Material Collected by the Author*

Over 200 specimens of which about 100 have been cultivated in buckets, have been preserved as herbarium material. These specimens were collected by the author, as part of a genus and species distribution survey, on routes crossing the major ecological areas wherever accessible throughout Tasmania. The routes covered a total distance of over 800 miles, with records taken every ½ mile, and collections were made during the growing seasons (October to late January) of 1966, '67 and '68.

3. *State Collections in Australian Herbaria*

The *Stipa* collections in the State Herbaria in Hobart (H), Adelaide (AD), Adelaide Waite Institute (ADW), Canberra (CANB. CSIRO and CANB. Botanical Gardens), Sydney (NSW) and Melbourne (MELB) have been examined with particular reference to species recorded for Tasmania, and to the criteria of leaf ornamentation and lemma characters suggested above.

(b) Methods of Study and of Illustration

1. *Kew Specimens*

Comparative tables of taxonomic detail were drawn up using observations on every available feature. Photographic records of whole herbarium sheets were made. A detailed study of leaf blade ornamentation of these specimens first revealed the possible significance of this character to the identification of species.

2. *Author's Material*

The specimens collected were sorted on the basis of leaf ornamentation and lemma characters (hairs, lemma lobes and callus). A representative specimen of each of the resulting nine groups of plants was selected from the material held in cultivation, and was used in the mature condition in the production of the drawings and photographs presented (figs 1-5, plate 1).

Seasonal changes in inflorescence and spikelet characters, growth rates and dates of flowering were observed during two years' growth for the material in cultivation.

Leaf surfaces were examined fresh and dry with reflected light using magnifications of up to x 40. The area of leaf surface chosen was the adaxial surface of the blade within 1 cm of the ligule (figs 1, 2 at 0). This is where the ornamentation is most developed and most protected, and it is equally well examinable in fresh and dried material. Adaxial leaf surfaces from a flowering culm of each representative specimen were photographed in order from the base (No. 1) of the culm upwards, using a Leitz binocular microscope with an Ultrapac (epi-illuminator) objective No. UO 4/0 10 modified with a No. 2 funnel stop. The drawings reproduced in figures 1 and 2 were made by tracing over these photographs (plate 1). The glumes and lemmas illustrated and described in figures 3-5 and Table 1 were dry and fully mature. Munsell color determinations were made in natural day-light using the naked eye and also x 20 magnification.

OBSERVATIONS AND CONCLUSIONS

(a) The Identity of Tasmanian Populations of Stipa

Nine discontinuous major populations hereafter referred to as species have so far been distinguished, and their identification is based on comparison with the Kew material listed above, and on material including type specimens examined in the various Australian Herbaria.

The populations may be ascribed to:—

1. *Stipa stuposa* Hughes—is apparently endemic to Tasmania, and abundant throughout its range, mostly along roadsides.
2. *S. semibarbata* R.Br.—is widespread along roadsides.
3. *S. mollis* R.Br.—is less widespread, extending to higher elevations than *S. semibarbata*, and often associated with early settlement sites.
4. *S. pubescens* R.Br.—common, is usually closely associated with more open parts of dry sclerophyll.
5. *S. nervosa* var. *neutralis* J. W. Vickery—often confused with *S. pubescens* in the past, it is associated with more open situations than that species.
6. *S. compacta* Hughes—is closely confined to and common on dune slacks and sandy areas within about a quarter of a mile of the shoreline.
7. *S. pubescens* var. *aphylla* Rodway from now referred to as *S. aphylla* nov. sp. (see Appendix for amended description)—is apparently endemic to Tasmania but with close affinities to the mainland *S. muelleri*, occurring in marginal parts of undisturbed areas of dry sclerophyll.
8. *S. variabilis* complex—the Tasmanian population is largely referable to *S. falcata* Hughes and part to *S. scabra* Lindl., the latter being characterised by retrorse hairs on the lower leaf sheaths. No attempt has been made to distinguish between these two groupings in the distribution survey work, but the leaf ornamentation pattern described here is that of the *S. falcata* section.

9. *S. teretifolia* Steud.—this species appears to be quite separate from the others, and is strictly confined to the strandline of the coast and salt water inlets.

A further very rare species showing similarities to *S. nivicola* J. H. Willis from alpine areas of Victoria and N.S.W., has been collected from the middle slopes of Mt Wellington (N. Burbidge in 1949). Other rare species are suspected to occur.

The following species previously recorded for Tasmania have not been found by the author:—

S. aphanoneura Hughes—the Kew specimen was incomplete and immature but still appeared unlike any Tasmanian material seen by me.

S. eremophila Reader—the TYPE at Melbourne is distince from any Tasmanian material I have examined.

S. elatior Hughes—in Tasmania is not distinct from juvenile forms of *S. compacta*.

S. hemipogon Benth—I have seen authentic specimens from West Australia and can state that this species does not occur in Tasmania.

S. flavescens Lab.—J. H. Willis (1967) suggests that Labillardière made the occasional mistake of writing Capite Van-Diemen (Tasmania) instead of Terra Van-Leuwin (W.A.). This situation very possibly applies to his record of *S. flavescens* (Labillardière, 1804). Certainly this species, as represented by the Kew specimen examined, is distinct from any Tasmanian material I have examined, and its callus-scar which is almost round in outline, is quite unlike those of Tasmanian species.

S. setacea Br.—this record is based on Rodway's data (Rodway, 1903, p. 262). His description would fit *S. falcata* in the *S. variabilis* complex. S. *setacea* has a long hyaline ligule up to 6 mm long like that of *S. teretifolia* and comes from N.S.W. and further west. I suspect that Rodway's specimen was mis-identified, but the specimen he described has no leaves and positive identification is now impossible.

The formal taxonomy of the Tasmanian species of *Stipa* is yet to be investigated fully and will be dealt with in a later publication.

(b) Material Located in Australian Herbaria Other than Hobart

(Not including W.A. and Queensland)

In each of the following groups (1-9) the figured specimen is cited first. These specimens are all in the collection of Department of Agricultural Science, (Univ. Tas.), and duplicates are at Kew. The other specimens cited are indistinguishable from the figured specimen, except for a few which differ in characters known to be unreliable taxonomically.

1. *Stipa aphylla* nov. sp. No. 4B.

S. pubescens var. *aphylla* Rodway. (MELB)
Pipetrack Fern Tree.
Coll. J. E. S. Townrow, 7.3.65.

2. *Stipa compacta* No. 94.

S. elatior Hughes SYNTYPE. West Australia. (MELB)
Coll. J. Drummond No. 959—is undistinguishable from young Tasmanian specimens of *S. compacta*.

S. compacta Hughes. Tower Hill (MELB)
at Trigpoint.
Det. J. H. Willis, 10.11.63.

S. compacta Hughes No. 96323274. (AD)
Lower Murray River.
Coll. R. Hindmarsh, 10.10.45—lemma hairs pale.

S. elatior Hughes No. 96324005. (AD)
No. 96323236—has both pale and coppery lemmas. (AD)

S. compacta Hughes ADW 28130 Pt (ADW)
Lincoln District.
Coll. R. French—has immature, pale lemmas.

S. elatior Hughes ADW 22056 Dune, (ADW)
Pt Fairy.
Coll. D. E. Symons No. 141, 8.11.59—has pale lemmas.

S. elatior Hughes F. V. Mueller Col- (NSW)
lection 959 W. A. Drummond.
According to J. W. Vickery this matches the type specimen. This specimen is indistinguishable from young Tasmanian *S. compacta*.

S. compacta Hughes—specimens poor (NSW)
but show the typical hooked adaxial blade pattern of *S. compacta*.

3. *Stipa mollis* No. 57.

S. hemipogon Benth. No. 2308 (MELB)
Coll. Muir, 13.10.61—a robust form.

S. mollis R.Br.—at bottom of Folder (MELB)
3 of collection loaned to P. F. Morris.

S. plagiopogon J. M. Black. TRS South (AD)
Aust. 65/2 334, 19.12.41.

S. hemipogon Benth.—specimens (ADW)
indistinguishable from Tasmanian *S. mollis*.

S. semibarbata R.Br. Herb. J. (NSW)
Vickery Loc. Lithgow, 2.1.36.

S. mollis R.Br. Launceston, Tas. (NSW)
Coll. J. B. Cleland, 11.1912.

S. mollis R.Br. Maroubra. (NSW)
Coll. L. A. S. Johnson, 26.10.46.

S. mollis R.Br. Tempe district. (NSW)
Coll. J. Boorman No. K431, 10/1899. According to J. W. Vickery 28.8.38, this specimen resembles the Kew Type.

S. semibarbata R.Br. Sandringham (NSW)
Coll. A. Meebold No. 21579, Nov. 1936. Det J. W. Vickery 26.8.38, formerly labelled *S. mollis*.

S. mollis R.Br. Cressy, Tas. (CANB. CSIRO)
Coll. R. M. Moore, 24.11.48. According to N. T. Burbidge 9.9.54, this specimen checks with Brown material from Port Jackson No. 6205 Kew.

S. semibarbata R.Br. Herb. (CANB. CSIRO)
Aust. 25099. Between Dunalley and Murdunna Tas.

Coll. N. T. Burbidge No. 3218, 20.1.49—this is very close to *S. mollis* as understood by the author.

4. *Stipa nervosa* No. 104.

S. nervosa J. W. Vickery. Christmas Hills 25 miles NE of Melbourne. Coll. H. I. Asten. (MELB)

S. nervosa J. W. Vickery in Folder 5 of collection loaned to P. F. Morris. (MELB)

S. nervosa var. *neutralis* J. W. Vickery. HOLOTYPE J. W. Vickery No. 8569 Katoomba. Col. S. T. Blake No. 13915, 22.1.39. (NSW)

S. nervosa var. *neutralis* J. W. Vickery. Orbost Vic. Coll. F. Robbins ex. herb. A. C. Beauglehole No. 7955, 11.37. (NSW)

S. pubescens R.Br. Herb. Aust. 2935. 6 miles E of Launceston, Tas. Coll. N. T. Burbidge, 8.1.49. (CANB. CSIRO)

S. nervosa J. W. Vickery— specimens from lower altitudes agree with Tasmanian material. (CANB. CSIRO)

Stipa aff. *pubescens* *R.*Br. Mathinna, Tas. Coll. Phillips and Vickery CBGH No. 1268. (CANB. B.G.)

5. *Stipa pubescens* No. 65.

S. pubescens R.Br. Coll. Muir No. 308. (MELB)

S. pubescens No. 692. Coll. Williamson, 2.5.1899 in Folder 4 of collection loaned to P. F. Morris. (MELB)

S. pubescens R.Br. Mt Lofty. Coll. F. M. Hilton No. 1170, 23.12.54. (ADW)

S. pubescens R.Br. Herb. Rodway 10578. Pieman R. Bridge, cliffs beside river. W Coast Tas. Coll. G. & C. Davis, 7.1.37. (NSW)

S. pubescens R.Br. 10577. Kingston Beach, Tas. 23-11.35. (NSW)

S. pubescens R.Br. No. 8565. Eaglehawk Neck, Tas. J. W. Vickery, 15.1.49. (NSW)

S. pubescens R.Br. Huonville, Tas. Coll. D. Martin. (CANB. CSIRO)

Stipa aff. *pubescens* No. 001267 Longley, Tas. Coll. Phillips & Vickery, 19.1.62. (CANB. B.G.)

6. *Stipa semibarbata* No. 61.

S. semibarbata R.Br. Coll. Muir, 1956. (MELB)

S. semibarbata var. *gracilis* Black. TYPE—is represented by some Tasmanian forms. (AD)

S. pubescens R.Br.—almost all the specimens so labelled are forms of *S. semibarbata* R.Br. (AD)

S. semibarbata R.Br. ADW 28122. (ADW)

S. semibarbata R.Br. Studley Park, Melb. Coll. I. B .Muir No. 519, 18.10.58. (NSW)

S. semibarbata R.Br. Herb. Aust. 15827 3 miles W of Mayanup, W.A. Coll. N. T. Burbidge No. 2551, 12.9.47. (CANB. CSIRO)

7. *Stipa stuposa* No. 123.

S. stuposa Hughes. Sandy Bay, Hobart. Coll. Maiden & Cambage, January 1902. (NSW)

S. stuposa Hughes. Herb No. 25096 Risdon, Tas. Coll. N. T. Burbidge No. 3185, 18.1.49. Burbidge notes that this specimen matches Gunn Species No. 1480 New Norfolk. (CANB. CSIRO)

S. stuposa Hughes. 6 miles E of Launceston, Tas. Coll. N. T. Burbidge No. 2934. (CANB. CSIRO)

8. *Stipa teretifolia* No. 6.

S. teretifolia Steud.—all specimens agree with Tasmanian material. (MELB)

S. teretifolia Steud.—all specimens agree with Tasmanian material. (ADW)

S. teretifolia Steud.—all specimens agree with Tasmanian material. (CANB. CSIRO)

S. teretifolia Steud.—Herb. No. 001274. Southport, Tas. Coll. Phillips & Vickery, 20.1.62. (CANB. CSIRO)

9. *Stipa variabilis* (≡? *S. falcata* Hughes) No. 33.

S. scabra Lindl. 8 miles NW of Ayers Rock. Coll. M. Lazarides 6152, 7.9.56. (MELB)

S. variabilis Hughes—in Folder 2 of collection loaned to P. F. Morris and labelled *S. falcata* by J. H. Willis. (MELB)

S. variabilis Hughes. Blacks' collection labelled *1 'falcata'*. (AD)

S. falcata Hughes. Blacks' collection with very fine hairy basal leaves. (AD)

S. scabra Lindl. ADW 31121. (ADW)

S. falcata Hughes—specimens in collection with notes sheath marginally ciliate, lemma circa 6 mm long'. (NSW)

The range of Tasmanian material falls between the following two specimens:—

S. scabra Herb. Aust. AR 227. 36 miles S of Bourke on Cobar Rd, N.S.W. (CANB. CSIRO)

S. scabra Coll. 15.9.45 from Barooga, N.S.W. (CANB. CSIRO)

(c) Descriptions—Notes to the Figures and Plate

The characters of the leaf ornamentation of the nine species illustrated are:—

Stipa compacta—Coarse hooks ca. 0.05 mm long orientated towards the tip of the blade, becoming progressively slightly finer on successive blades from the base of the culm upwards; up to five blades per culm (fig. 1, plate 1a).

S. stuposa—hooks and hairs. Hooks uneven in length, up to ca. 0.05 mm, retrorse; hairs up to 1 mm long, ca. 0.025 mm diam., shaggy on blade 1 but becoming shorter and sparser on successive blades; three to four blades per culm (fig 1, plate 1b).

S. semibarbata—fine teeth and hairs. Sharp points (teeth) vertical on the rib surfaces ca. 0.01

.nm long; hairs up to ca. 0.4 mm long, ca. 0.025 mm diam., mostly directed to leaf tip, becoming shorter and sparser on successive blades; up to four blades per culm (fig. 1, plate 1c).

S. mollis—very dense fine hairs ca. 0.15 mm long and 0.01 mm diam., springing out of the rib surfaces at right angles and mostly curving upwards at their tips, becoming denser and shorter on successive blades; ca. four blades per culm (fig. 1, plate 1d).

S. pubescens—moderately dense fine hairs ca. 0.15 mm long and 0.01 mm diam., strongly ascending, becoming shorter and finer on successive blades; ca. three blades per culm (fig. 2, plate 1e).

S. nervosa—hooks, teeth and coarse hairs. Hooks and teeth sparse, up to ca. 0.05 mm long, mostly vertical; hairs up to ca. 0.6 mm long, finely tapering from swollen bases up to 0.04 mm diam., somewhat ascending; ca. three blades per culm (fig. 2, plate 1f).

S. aphylla—coarse, sparse hairs, and shorter processes ranging from minute teeth or hooks 0.01 mm long to spikey, slightly ascending hairs up to 0.25 mm long, hairs with slightly swollen bases. Ribs 0.05 mm diam., about half to one-third the width of those of the other species; up to four blades per culm which are shed early (fig. 2, plate 1g).

S. variabilis—fine hooks and a few scattered coarse hairs. Hooks ca. 0.025 mm long; orientated towards the tip of the blade; hairs strongly ascending, up to 1 mm long and 0.03 mm diam., usually absent from blades higher up culm; ca. three blades per culm (fig. 2, plate 1h).

S. teretifolia—dense minute tubercles, somewhat ascending, with swollen bases and bluntly pointed tips, up to ca. 0.07 mm long and 0.025 mm at the base; up to four blades per culm (fig. 2, plate 1i).

All the hooks, teeth, hairs and tubercles described are colourless. Some variation within the patterns described above is found, and is usually expressed by different densities of hairs, in relation to hooks.

The characters of the lemmas are tabulated in table 1 (see pages 97-98).

The use of the above criteria has proved highly satisfactory in sorting out individual species both in the field and in the herbarium. The method of identification involving ornamentation patterns is particularly useful in large scale analysis of populations in the field, obviating the necessity for fully mature specimens for reliable identification.

It is possible that the identity of parents of suspected hybrids may be derived from an examination of the changes in hair pattern on the blades up a single culm of a hybrid. There is some indication that the pattern on the lowest blade conforms to one parent while that on the uppermost conforms to the other parent. However this aspect needs further examination.

SUMMARY

1. The unsatisfactory nature of Hughes' criteria (1921) in relation to the identification of larger more recent collections of speargrasses (*Stipa*) is explored. New criteria allowing the identification of populations both in the field and in the herbarium are suggested. These utilise hook and/or hair patterns on adaxial leaf surfaces.

2. The material examined includes an extensive Tasmanian collection made by the author, duplicates from the Royal Herbarium, Kew, and *Stipa* collections held in the herbaria in Victoria, N.S.W., A.C.T. and S.A.

3. The ornamentations on the adaxial surfaces of culm-leaf blades of the nine species most commonly found in Tasmania are described and figured. Lemma characters are also described in detail.

4. *S. pubescens* var. *aphylla* Rodway is redescribed and raised to specific rank.

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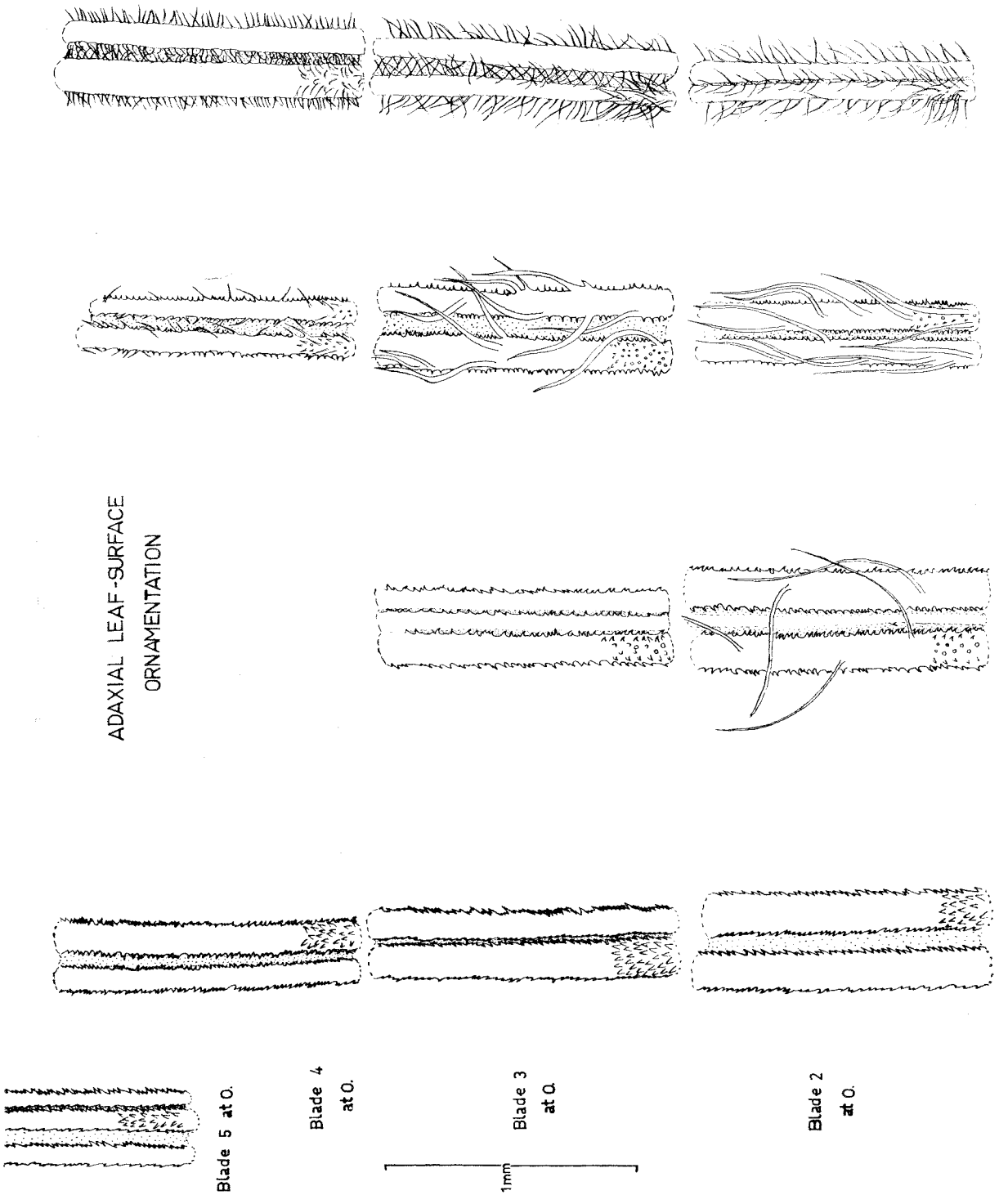

ADAXIAL LEAF-SURFACE ORNAMENTATION
Blade 5 at 0.
Blade 4 at 0.
Blade 3 at 0.
Blade 2 at 0.
1mm

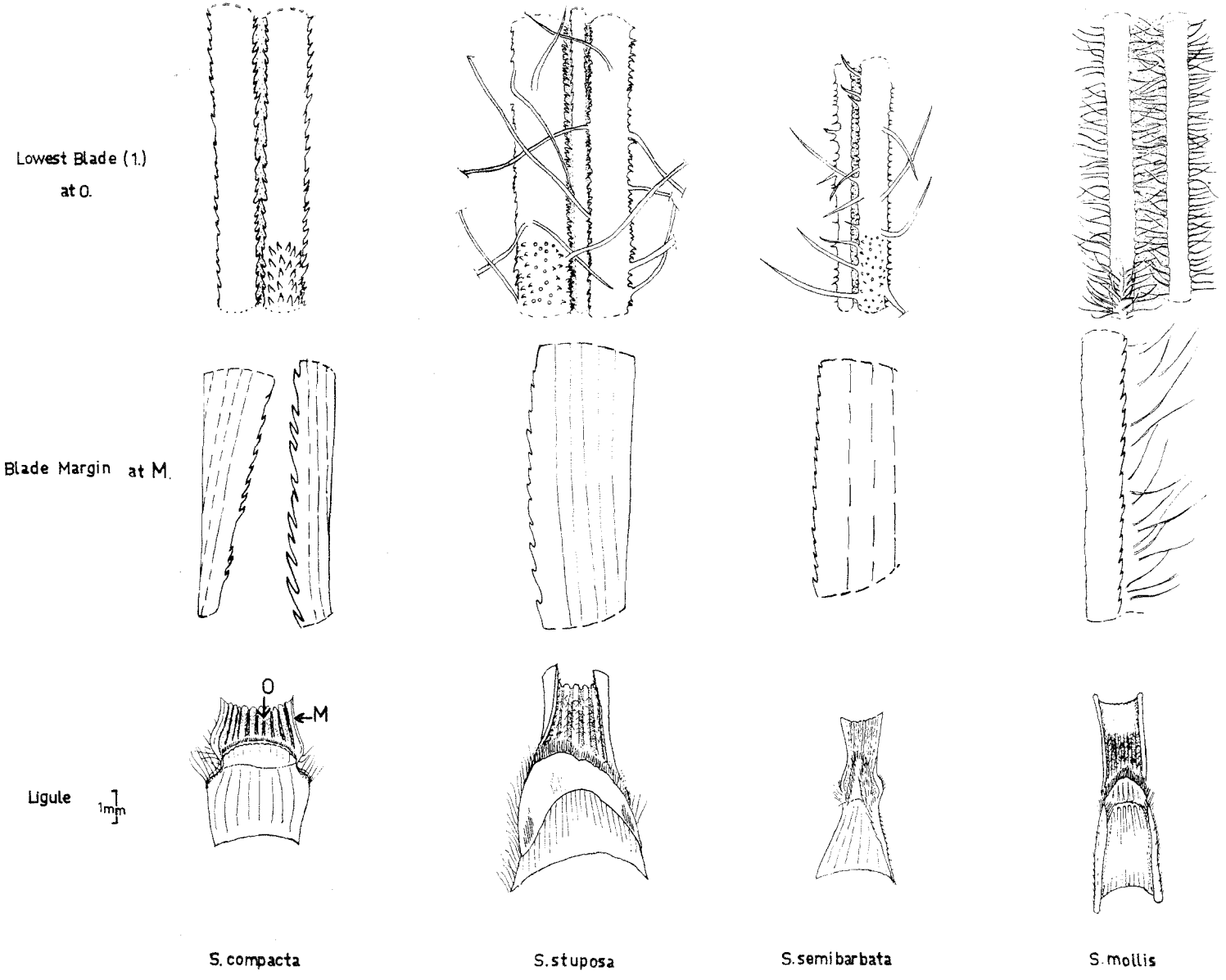
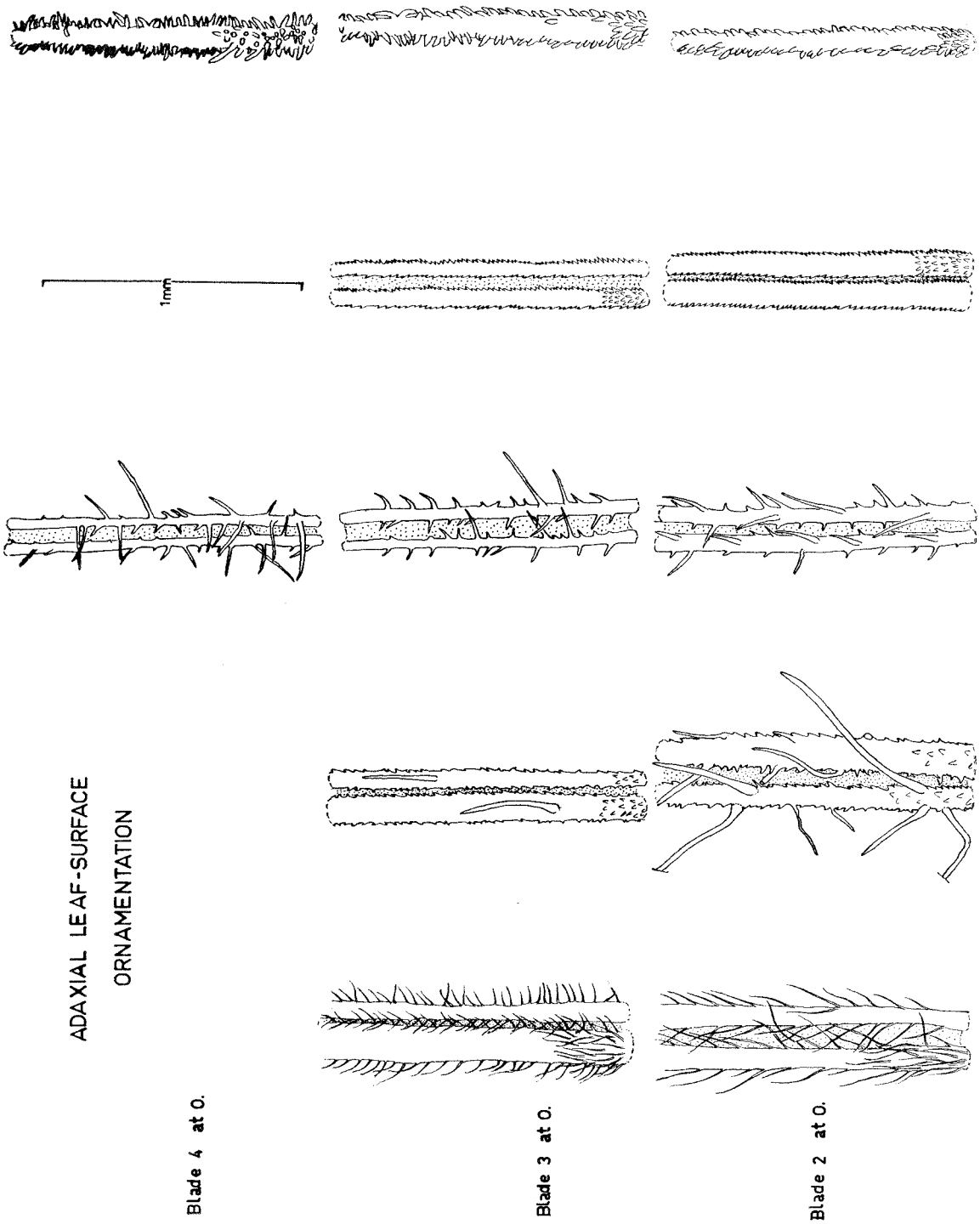


FIG. 1.—Blade characters:—Adaxial leaf surface ornamentation x 40. Blade margin x 40. Ligule x 5.


ADAXIAL LEAF-SURFACE ORNAMENTATION
Blade 4 at O.
Blade 3 at O.
Blade 2 at O.
1mm

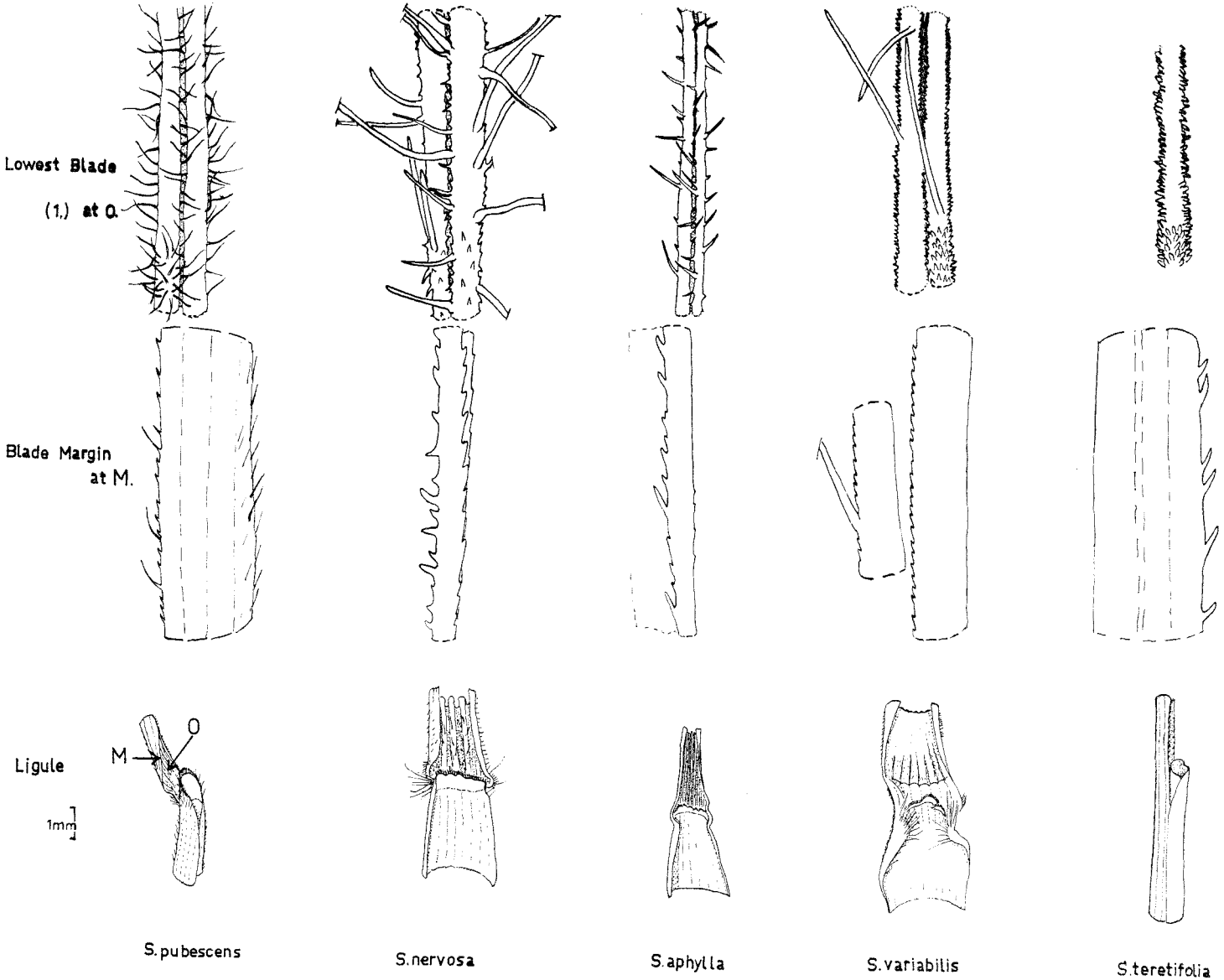
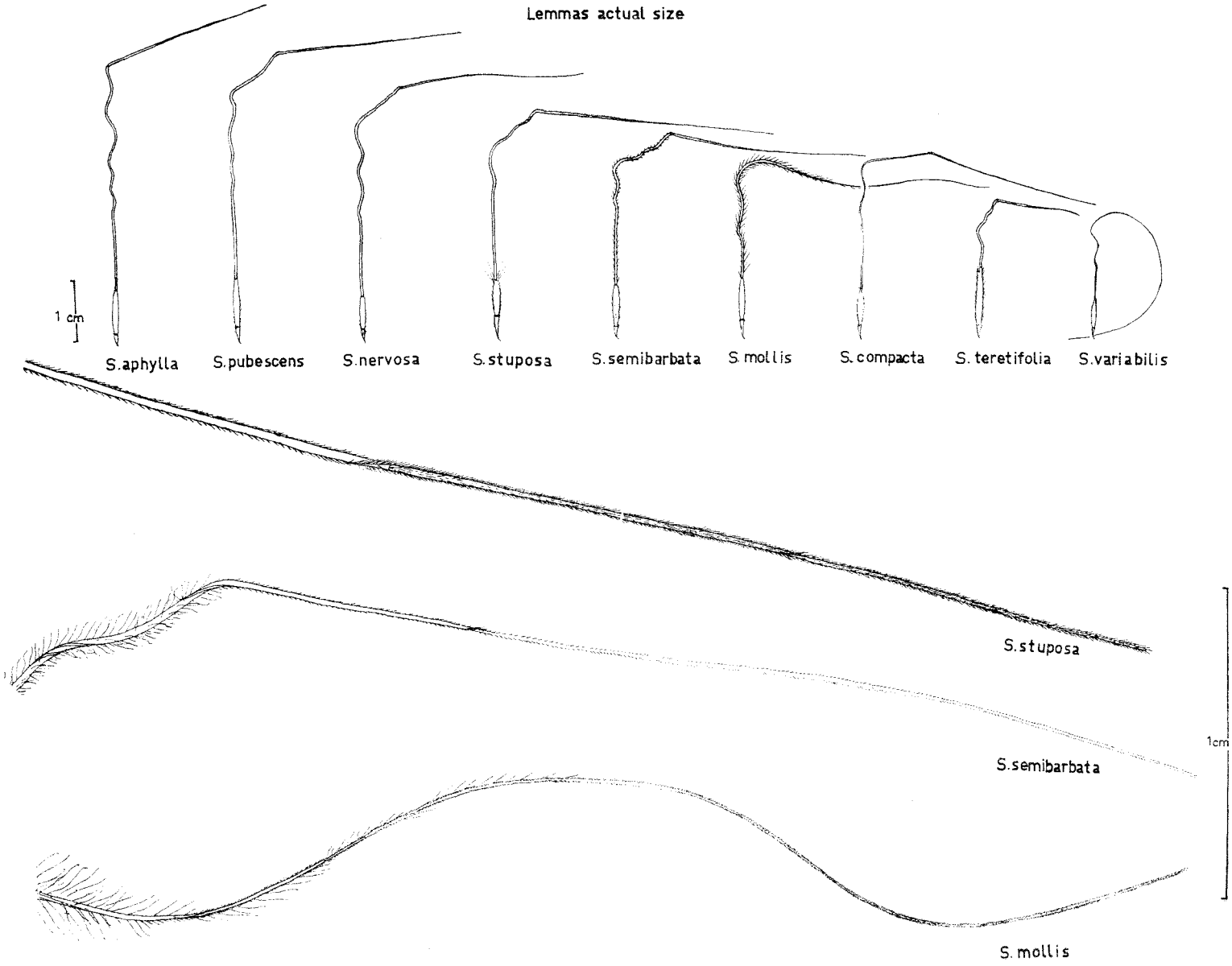


FIG. 2.—Blade characters:—Adaxial leaf surface ornamentation x 40. Blade margin x 40. Ligule x 5.


Lemmas actual size
1 cm
S.aphylla
S.pubescens
S.nervosa
S.stuposa
S.semibarbata
S.mollis
S.compacta
S.teretifolia
S.variabilis
S.stuposa
S.semibarbata
S.mollis
1cm

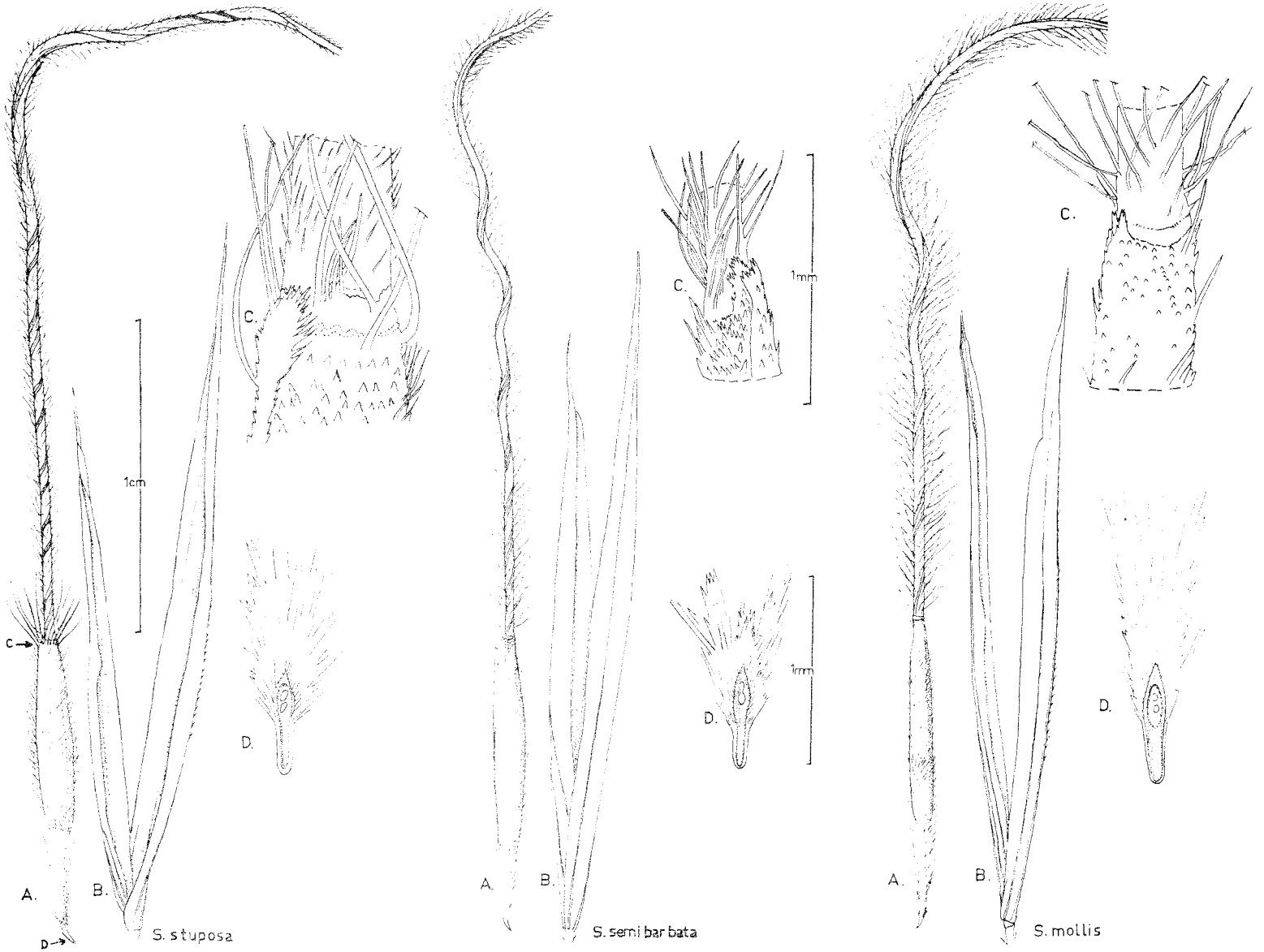


FIG. 3.—Spikelet characters:—Lemmas of Tasmanian species x 1. A—Lemma + awn x 5. B—Glumes x 5. C—Lemma lobes at junction of lemma and terminal awn x 40. D—Scar on adaxial surface of callus tip x 80.

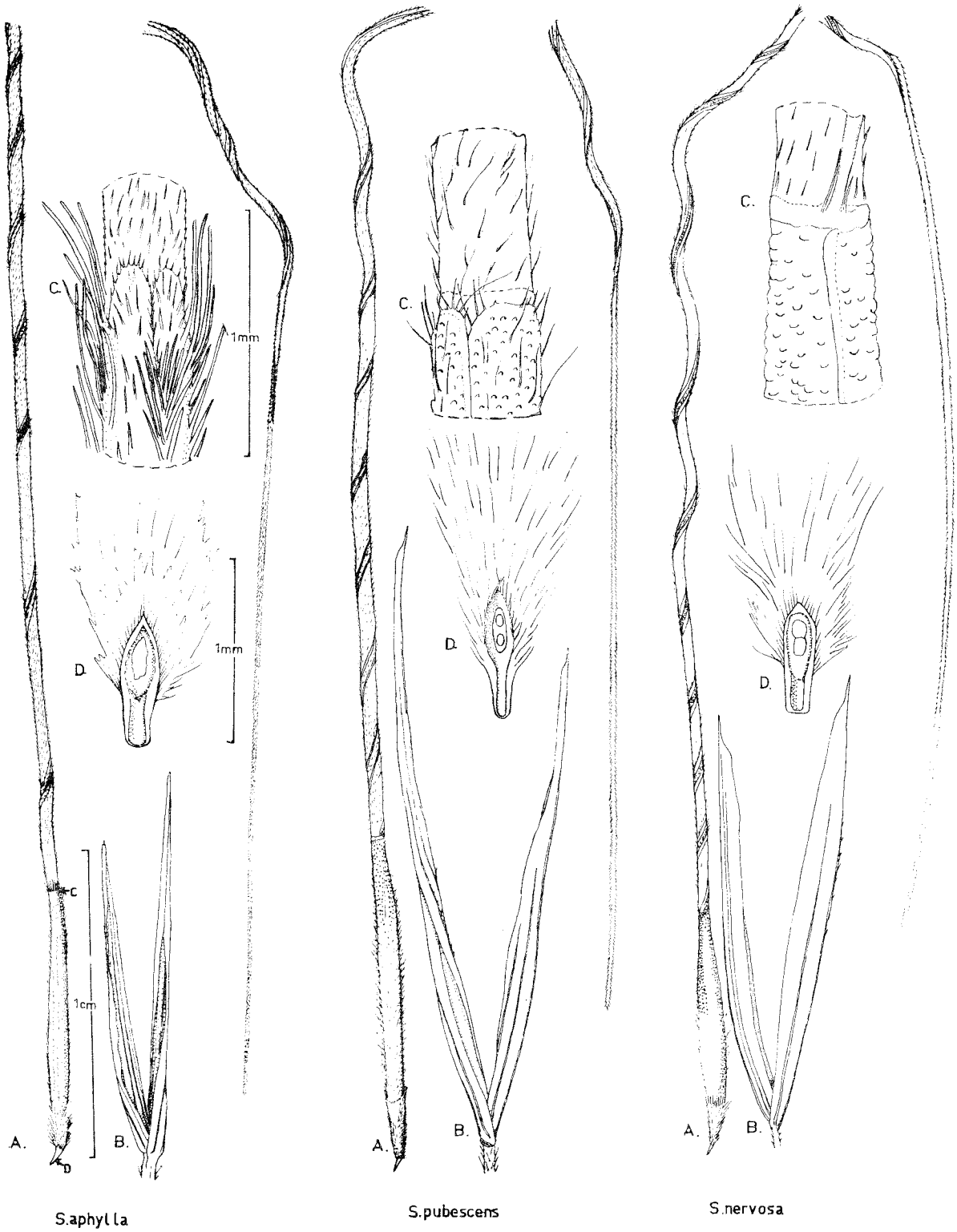


FIG. 4.—Spikelet characters:—A—Lemma + awn x 5. B—Glumes x 5. C—Lemma lobes at junction of lemma and terminal awn x 40. D—Scar on adaxial surface of callus tip x 30.

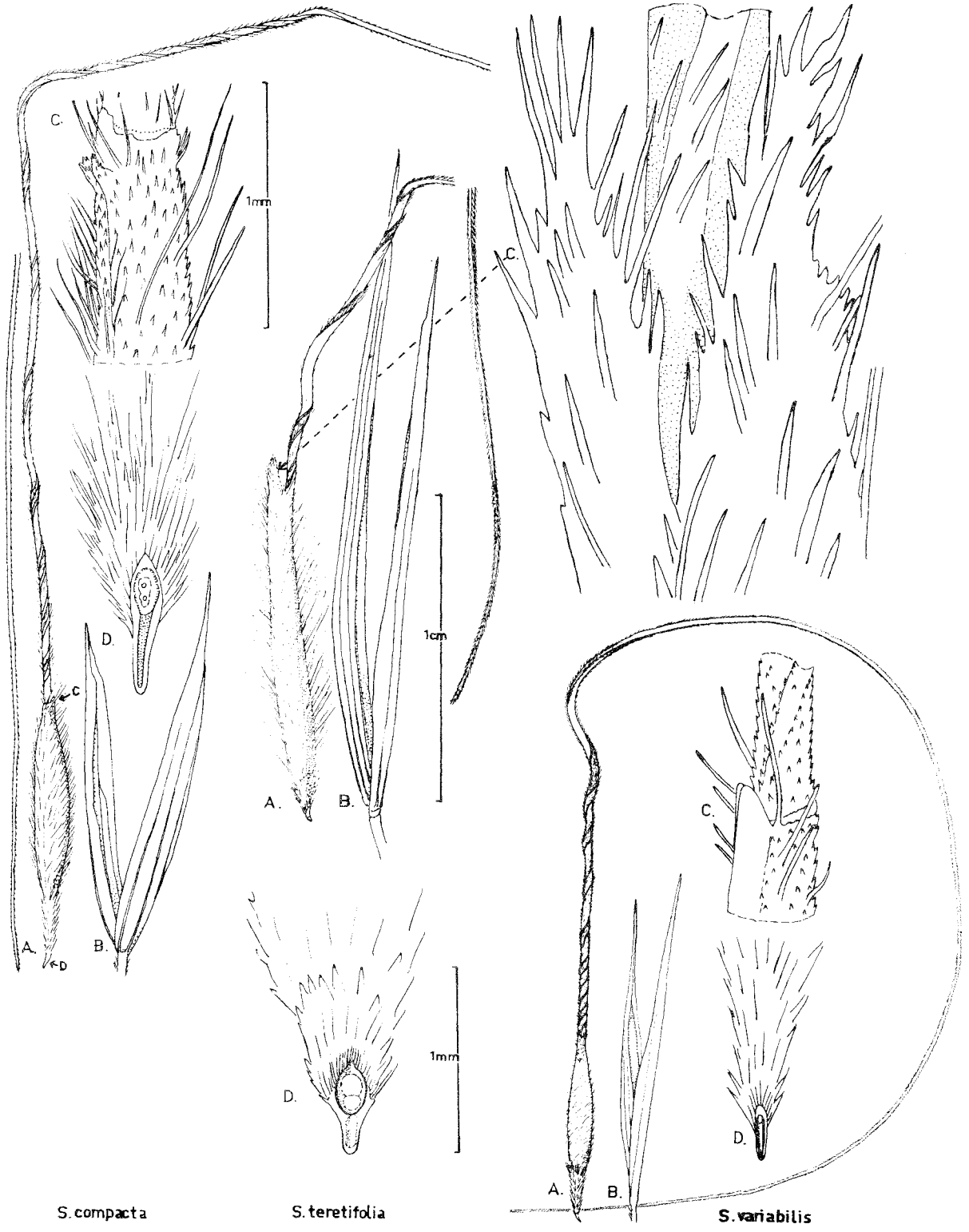


FIG. 5.—Spikelet Characters:—A—Lemma + awn x 5. B—Glumes x 5. (NOTE: *S. teretifolia*—the upper glume is longer than the lower.) C—Lemma lobes at junction of lemma and terminal awn x 40. D—Scar on adaxial surface of callus tip x 30.

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APPENDIX

Stipa aphylla (Rodway var.) n. sp.

SYNONYM: *Stipa pubescens* R.Br. var. *aphylla* Rodway (1903), p. 262.

Descriptio emend.:

Gramen perenne, caespitosum, gracile, erectum, usque ad 90 cm altum, cum rhizoma brevissima condensata; culmi rigidi, bambusae gracili similes, usque ad 1 mm diametro, leviter striati laeves, glabri, 3-4 nodes, viridis pallidi sed luteus 2 mm supra nodum; nodi brevissimi pubescentes; vaginae ca. dimidium internodorum, leviter striatae, glabrae, stramenescentes et aliquantum inflatae, ultimo exutae post laminas; ligula membrana minuta, ca. 0.1 mm longa, margine crenato minute ciliato; laminae usque ad 4.5 cm longae, rigidiusculae, involutae, rostratratae, ad bases explanatas 1.0 mm latae, exutae inflorescentia emmergente sunt, paginae abaxiales glabrae, paginae adaxiales costatae, costae ca. 0.05 cm latae, pilos sparsos longitudine 0.25-0.025 mm ferentes; panicula angusta ca. 17 cm longa et 3 cm lata, laxissima, in sicco aliquantum contracta, cum ca. 30 spiculis, axi primaria leviter scabra, ramis gracillimis, erectis, scabris, 1-2 natis, pedicellis 1-2 cm longis supraque clavatis; spiculae pallido-viridescentes vel stramineae usque ad fines sed infra purpureae, glumis maturescentibus valide divergentibus; glumae tenues, chartaceae, inaequales, anguste linearae-attenuatae, paullo involutae; inferior gluma longior ca. 13 mm, explanato statu ca. 0.7 mm lata, valide 3-nervata, superior gluma ca. 1.0 cm longa, explanato statu ca. 1.0 mm lata, 3-sub-5-nervata, nervis lateralibus utrinque nervis mediis cum validis; lemma firma, linearis, ca. 9.0 mm longa, cicatricem calli includens 0.5 mm longam, et supra cicatricem caespes pilorum argenteorum 1.3 mm longa, ca. 0.7 mm lata. Lemma est cum pilis argenteis (Munsell-White 10 YR 8/1) corpus brunneum (Munsell-10 YR 3/2) insidet, lemma marginibus in 2 lobos obtusos ca. 0.35 mm longos minute pubescet. Lemma minuta corona pilorum ca. 0.4 mm longorum circum basem aristata est; arista terminalis, minute pubescens, columna brunnea 0.4 mm lata, usque ad 6 cm longa, in sicco statu subtiliter torsiva et geniculata 1 cm infra setam, seta straminea useque ad 2.8 cm longa, arista aliquanto geniculata ad juncturam columnae setaeque; palea ca. 6 mm longa, firma infra marginalibus apiceque hyalinis, in dorso minute pubescens; antherae 3, lineares, ca. 4.5 mm longae; lodiculae 3, ca. 1.5 mm longae.

SYNTYPE: *Tasmania*: Huon Road (Hobart). Rodway, November 1897.

Sheet No. 995. Rodway Collection.

Slender, erect, caespitose perennial, up to 90 cm high, with very short condensed rhizomes; culms rigid, cane-like, up to 1 mm in diameter, finely striate, smooth, glabrous, 3-4 noded, light green but pale-yellow for 2 mm above the nodes; nodes minutely pubescent; sheaths about half the length of the internodes, finely striate, glabrous, becoming straw-coloured and somewhat inflated, ultimately shed after the blades; ligule a minute membrane 0.1 mm long with a crenate minutely ciliate margin; blades up to 4.5 cm long, stiff, inrolled, pointed, 1 mm wide at the base when flattened, shed as the inflorescence emerges, abaxial surface smooth, adaxial surface ribbed, the ribs about 0.05 mm wide and bearing scattered hairs 0.25-0.025 mm long; panicle narrow, very loose, somewhat contracted when dry, with about 30 spikelets, about 17 cm long and 3 cm wide, the main rachis minutely scabrous, the branches very slender, upright, scabrous, 1-2-nate, the pedicels 1-2 cm long and clavate above; spikelets pale-green to straw coloured above and purple below, with glumes widely divergent at maturity; glumes thin, chaffy, unequal, narrowly linear-attenuate, slightly inrolled, the lower glume longer, about 1.3 cm long and 0.7 mm wide when flattened, faintly 3-nerved, the upper glume about 1.0 cm long and 1.0 mm wide when flattened, 3-sub-5-nerved, the lateral nerves of both glumes as strong as the mid-nerve; lemma firm, linear, about 9.0 mm long including the callus-scar 0.5 mm long, and the silvery hair-tuft above the scar 1.3 mm long, lemma 0.7 mm wide, minutely thinly pubescent with silvery hairs (Munsell-White 10 YR 8/1) on a brown body (Munsell—Very dark greyish brown 10 YR 3/2) the margins of the lemma produced into 2 minutely hairy obtuse lobes about 0.35 mm long, the lemma bearing a minute crown of hairs about 0.4 mm long round the awn base; awn terminal, minutely pubescent, the column dark brown, 0.4 mm wide and up to 6 cm long, finely twisted when dry and geniculate 1 cm before the bristle, the bristle straw-coloured and up to 2.8 cm long, the awn slightly kneed at the junction of column and bristle; palea about 6 mm long, firm with hyaline margins and tip, finely pubescent on the back; anthers 3, linear, about 4.5 mm long; lodicles 3, about 1.5 mm long.

LOCALITIES: *Tasmania*: Waterworks (Hobart), Rodway, January 1895; Lower Pipetrack, Fern Tree, Townrow (Ag. Sc. Dept No. 297), 7.3.65; Open woodland, 2 miles N of Bicheno, Townrow (Ag. Sc. Dept No. 298) 13.1.65; Open scrub W side of Channel Highway opposite Alonnah, Townrow, 8.1.67; Bank by Ag. Sc. Dept glasshouse, Uni. Tas., Townrow No. 77, 29.11.67; Margin of open woodland, Barnes Bay, Bruny Island, Townrow No. 147, 1.12.68; Darlington, Maria Island, Townrow No. 205, 23.11.68.

This species, apparently confined to SE Tasmania, closely resembles *S. muelleri* Tate of Victoria and South Australia except that it is about half the size of the latter in all features. It may prove to be closely related, e.g., a member of a polyploid series containing both species, but is considered here as a separate entity because of its geographical isolation. It occurs in the marginal more open areas of undisturbed dry sclerophyll, and is often closely associated with, or growing out of clumps of *Lomandra longifolia* Labill.

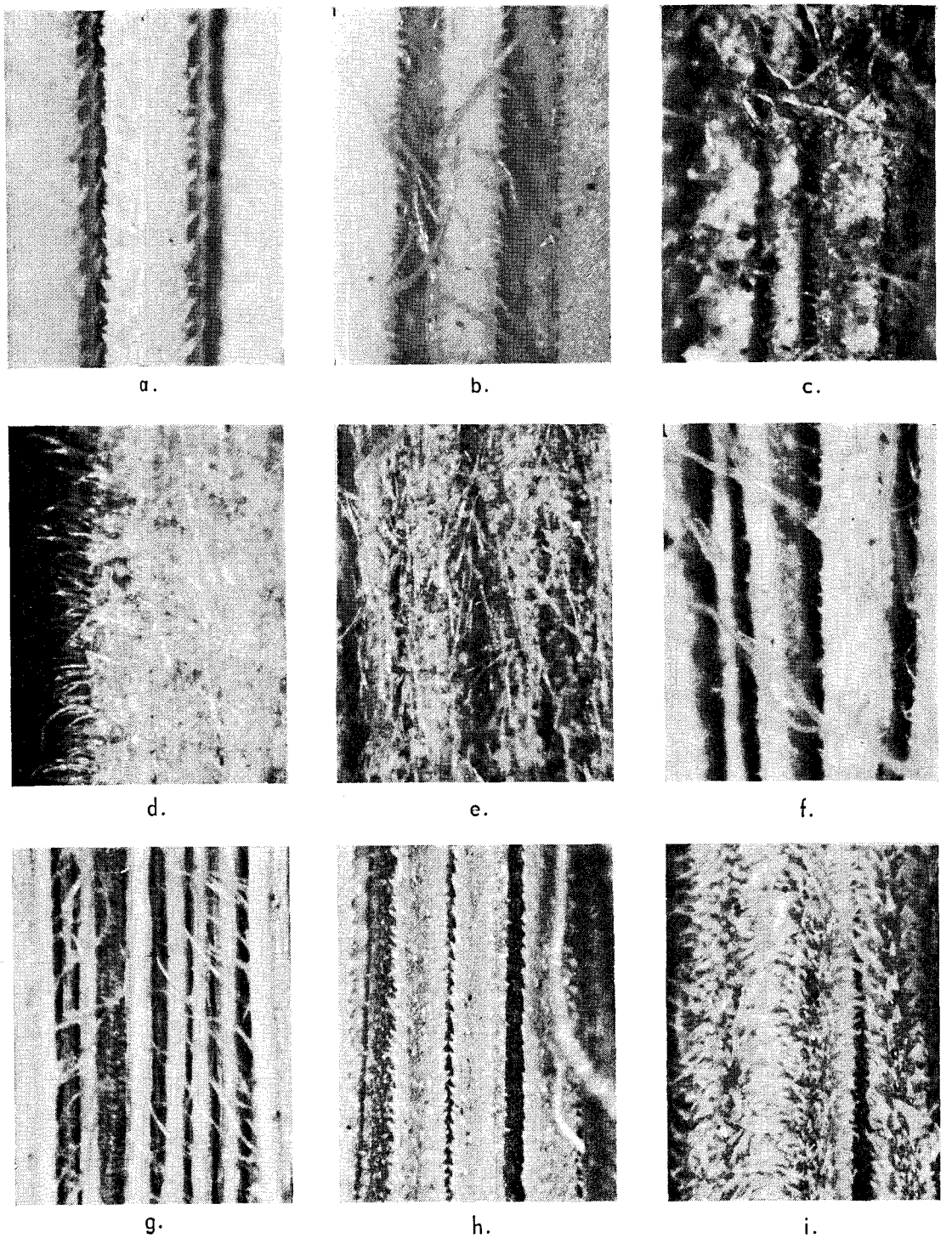

PLATE 1.—Adaxial leaf surface ornamentation within 1 cm of the ligule on the lowest culm-blade x 80.
a. *Stipa compacta* b. *S. stuposa* c. *S. semibarbata*
d. *S. mollis* e. *S. pubescens* f. *S. nervosa*
g. *S. aphylla* h. *S. variabilis* i. *S. teretifolia*