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THE GENUS ISEILEMA IN QUEENSLAND

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The Genus Iseilema in Queensland.

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[Read before the Royal Society of Queensland, 30th August, 1937.]

(Plates III. and IV.)

SPECIES of the genus *Iseilema* are well known to Queensland graziers under the collective name of "Flinders grass." In Hooker's *Icones Plantarum* tt. 3284-6 (1935) appears a monograph of the Australian species of this genus by C. E. Hubbard. Nine species are described, of which eight occur in Queensland. Of these, two are based on solitary specimens (*I. ciliatum* C. E. H., and *I. dolichotrichum* C. E. H.), and one (*I. convexum* C. E. H.) is based chiefly on cultivated specimens. Two supposed hybrids are also described.

As a result of intensive field work carried out over large areas of the State during the years 1934-6, knowledge of the genus has been considerably extended. In 1936 the species were particularly abundant over large areas and copious herbarium material was secured, while an excellent opportunity was afforded for working out the field relations between the species.

In the following brief account of the results of this investigation, the species are discussed collectively and individually. Two new species are described, two more hybrids are indicated, and a key to all known forms is included. In constructing the latter, characters have been employed which require some explanation as they were not mentioned by Hubbard.

The usual raceme of the *Andropogoneae* consists in *Iseilema* of a cluster of seven spikelets, of which the four outer are pedicelled with the pedicels fused together at the base. Within this group of involucrel spikelets is a short internode (the rhachis) bearing the sessile fertile spikelet (female in the Australian species) and two pedicellate male or neuter spikelets. The involucrel spikelets may be male or neuter, and in the latter case may be considerably reduced or represented merely by rudimentary pedicels. In most species they are contracted rather abruptly just below the junction with the pedicel, and in such cases there is a fairly prominent transverse furrow at the actual junction (as seen from the front). In some cases, however, the spikelet is attenuate at base with usually no transverse furrow, so that, when viewed from the front, the spikelet appears to pass gradually into its pedicel.

Each raceme is subtended by a spathe, and one or more spathes, each with its raceme, is more or less enclosed, at least when young, in a leaf-sheath. At maturity, the racemes of most species become laterally exerted and finally disarticulate, thus forming a special kind of "seed." In three species, however, the mature racemes remain more or less tightly embraced by the floral leaf-sheaths. The inflorescence breaks up at maturity, and the "seed" consists of the floral leaf with the raceme enclosed in its sheath. This is referred to as a "leafy seed."

The species are tufted, branched, shallow-rooted annuals, though under favourable conditions growth may continue for many months. For the most part they occur in soils of a heavy nature, and they are essentially summer-growing grasses. But it is interesting to note that on 11th May, 1936, at Kalkadoon Station, south-west of Winton, plants of *I. membranaceum* and *I. vaginiflorum* were collected which were evidently the result of a germination following a shower which fell nine days previously. Though scarcely an inch high, they were flowering. And in July, the Flinders grasses were in full vigour at Birdsville, where also *I. membranaceum* was found in a most unusual habitat, playing the rôle of coloniser on a low sandhill.

When in full vigour, the leaf is usually rather pale green in colour, rarely purplish, while the culms and sheaths are frequently highly coloured, reddish or purplish; sometimes the culms are slightly pruinose. As the plants dry off the leaf assumes a characteristic reddish-brown hue seen also in other *Andropogoneae* (*Themeda*, *Eulalia*, *Schizachyrium*, &c.). The precise shade of brown varies from species to species, while the tint is also influenced by local conditions. A few points of rain in winter bleaches the grass, rendering it very brittle and unpalatable. This "blackening," as it is generally called, is not confined to these grasses.

Several species, as indicated below, possess a very characteristic fragrance which is lost on drying. The scent is precisely that of the inflorescence of *Capillipedium parviflorum* Stapf. *I. dolichotrichum* has the peculiar resinous odour of the *Triodia* among which it grows, and which is also possessed by several other plants of the region, such as *Acacia costinervis* Domin, and *Cyperus Cunninghamii* (C. B. Clarke) C. A. Gardner.

Some of the species have been found attacked by the smut *Cintractia iseilematis* D. A. Herbert.¹

The Flinders grasses as a whole are considered to be among the most palatable and most nutritious of grasses, and they produce excellent hay. The one great drawback is their annual habit. On the Darling Downs, where they appear to be recent invaders, they are apparently not so valuable.

Most of what is known of the genus in this regard refers to the two most widely distributed species, *I. membranaceum* and *I. vaginiflorum*. Around the Gulf of Carpentaria *I. macratherum* is the common species, and is considered to be less valuable than the species further south. Whether this is due to local climatic conditions or is an inherent quality of the species remains to be proved, but it is worthy of remark that some grasses, including the Mitchell grasses (*Astrebla* spp.), definitely do depreciate in value in this region. Of the other species nothing is known beyond the fact that in August, 1936, I found *I. Windersii* to be closely grazed in good mixed pasture north of Hughenden.

There follow the descriptions of the two new species, the types of which are in the Queensland Herbarium, Brisbane.

Iseilema eremaeum S. T. Blake sp. nov. affinis *I. membranaceo* (Lindl.) Domin sed basibus racemorum pilis albis usque ad 5 mm. longis dense barbatis, pedicellis spicularum involueralium tantum leviter sulcatis, spathis parce glandulosis, gluma inferiore spiculae fertilis parce pubescente vix scabrida.

¹ D. A. Herbert: "Records of Queensland Fungi II." Queensland Naturalist X. (3), 59-60, 1937.

Gramen annuum usque ad 20 cm. altum, plerumque multo humilior. *Culmi* caespitosi, obliqui vel erecti, graciles, vix compressi, rigidi, ramosi (raro simplices), infra inflorescentiam plerumque 1-nodes, glabri laevesque. *Folia* plerumque pallide viridia (in sicco nec glaucescentia), saepe purpurascens, vetera brunnescentia; vaginae compressae et acute carinatae, laeves, haud glanduliferae, internodis saepe longiores, tenuiter nervosae, marginibus hyalinae; ligulae truncatae, tenuiter membranaceae, ciliatae, 0.7-0.9 mm. longae; laminae lineares vel superiores angustae lanceolatae, acutae, usque ad 6 cm. longae, sed plerumque breviores, carinatae, conduplicatae vel explanatae usque ad 4 mm. latae, rigidae, marginibus carinisque scabridulis exceptis glaberrimae laevesque. *Inflorescentia* foliacea, densa, 2-10 cm. longa; internodia primaria filiformia, inferiora usque ad 1.3 cm. longa, superiora gradatim breviora; foliorum vaginae 8-10 mm. longae, acute carinatae, herbaceae, pallide virides vel purpurascens tandem pallide brunneae, tenuiter nervosae, marginibus late hyalinae, carina superne scabridae, ceterum laeves haud glanduliferae; spathae ambitu lanceolatae vel elliptico-lanceolatae acutae, herbaceo-membranaceae vel demum papyraceae, tenuiter nervosae, marginibus late hyalinae, 6-10 mm. longae, acute carinatae, carina glandulas minutas sessiles paucas praedita superne hispida. *Racemi* tandem lateraliter exserti, 7-8 mm. longi, oblongi vel elliptico-oblongi, tandem a pedunculis disarticulantes; pedunculi filiformes 1.5-2.0 mm. longi, apice tuberculos minutos gerentes vel laeves; rhachis 0.5-1.0 mm. longa, pilis albis paucis ad 3.2 mm. longis praedita. *Spiculae* involucreales masculae (vel neutrae?) fere contiguae, ellipticae vel oblongo-ellipticae, acutae, 3-4 mm. longae, dorso compressae, pallide virides vel purpurascens; pedicelli graciles compressi, ca. 1.5 mm. longi, glabri, apice levissime transversim sulcati, basi connati et pilis albis sericeis ad 5 mm. longis dense barbati; gluma inferior dorso plana vel leviter convexa, tenuiter coriacea, marginibus angustis inflexis tenuiter membranaceis, 7-11-nervis, dorso sparse asperula vel fere laevis, carinis scabrida et interdum glandulis minutis sessilibus perpauca praedita; gluma superior oblanceolato-oblonga, acutiusecula, coriacea vel membranacea, 3-nervis, glaberrima, 3-3.6 mm. longa; lemma inferius anguste oblongum, obtusum, hyalinum, enerve, glabrum, usque ad 3.3 mm. longum; lodiculae cuneatae truncatae; antherae 0.8-1.0 mm. longae. *Spicula fertilis* femina lanceolata, acuminata, 5.0-5.5 mm. longa; gluma inferior coriacea, biloba, inferne marginibus incurva, superne bicarinata carinis scaberula, dorso in parte superiore parce et breve pubescens, ceterum glabra laevisque, 8-nervis; gluma superior lanceolata, acute acuminata, coriacea, marginibus incurvis, hyalina, 3-nervis; nervo medio apicem versus scabridula, ceterum glabra laevisque; lemma inferius ovatum, obtusum, emarginatum, hyalinum, enerve, 2.9-3.3 mm. longum; lemma superius lineare integrum, 3.5 mm. longum; arista 13-16 mm. longa, columna minute scaberula, 5.0-6.5 mm. longa; paleae desunt; caryopsis elliptica, 2.5 mm. longa. *Spiculae pedicellatae* masculae (vel neutrae?), lanceolatae, subcutae, 2-3 mm. longae; pedicelli filiformes 2.5-3.0 mm. longi, scabridi et pilis longis sericeis paucis praediti; gluma inferiora membranacea, 7-9-nervis, carinis superne scabrida nonnunquam parce glandulifera, ceterum laevis; gluma superior hyalina, 3-nervis; lemma inferius anguste oblanceolatum, hyalinum, usque ad 2.5 mm. longum.

Gregory North District: Marion Downs between Bedourie and Boulia on upper slopes of low stony hill ca. + 150 ft., 23-7-1936 *Blake* 12347. Gregory South District: Birdsville, on fine drift sand on gibber slopes 19-7-1936, *Blake* 12213 (type).

The species can be recognised by the complete absence of glands on culms, leaves and floral sheaths, the rather small long-bearded racemes, the pedicels of the involueral spikelets glabrous except at the very base, and the slightly hairy lower glume of the fertile spikelet.

Most interesting is the discovery of this species so far from the centre of concentration of the genus, and in a region of such low rainfall (5-8 in.). At Birdsville the plants were found on the slopes of the gravelly downs (Sturt's Stony Desert) at some few miles both to the east and to the north of the town in company with *I. vaginiflorum* and the hybrid swarm between them. In the former place the accompanying plants were chiefly *Bassia* spp. and *Stenopetalum lineare*. In the latter place they were associated with scattered trees of the peculiar almost *Pinus*-like "waddy" (*Acacia Peuce* F. Muell.), *Chenopodiaceae*, and scattered *Astrebla pectinata*. On Marion Downs the plants were found on the slopes of one of the flat-topped sandstone hills which are scattered over the gravelly downs in this region. Other annual plants were associated.

Iseilema fragile S. T. Blake sp. nov. affinis *I. vaginifloro* Domin, a quo differt inflorescentia fragillima, vaginis floriferis (induratis) subcylindricis convolutis, spathis inferne semicylindricis, spiculis involueralibus cum earum pedicellis semper ad squamas minutas redactis.

Gramen annuum fragillimum usque ad 20 cm. altum. *Culmi* caespitiosi, obliqui vel erecti, graciles sed rigidi, admodum compressi, laeves, ramosissimi, ramis saepissime fasciculatis. *Folia* pallide viridia, vetera rubro-brunnea; vaginae compressae carinatae, nervosae, superne scabridulae; ligulae membranaceae, laceratae vel ciliatae, ca. 0.75 mm. longae; laminae lineares usque ad 7 cm. longae et ad 4 mm. latae, acutae utraque pagina plus minusve scabridulae. *Inflorescentia* foliacea, partes ultimae densae 1-3 cm. longae; internodia primaria 3-5, facillime disarticulantia, gracilia, usque ad 4 mm. longa, superiora gradatim breviora, trigona, glabra, laevia; foliorum vaginae vix vel haud carinatae, subcylindricae, cartilagineae, marginibus tenuiores convolutae, 5-7 mm. longae, ca. 1 mm. diam., plurinerves, laeves. *Racemi* (aristis exceptis) cum spathis fere omnino obtecti, anguste lineares 8 mm. longi.; spathae ambitu linearo-oblancoolatae, acutae, plurinerves, cartilagineae, albae, apicem versus herbaceae vel subpapyraceae et nervis viridibus manifestis, marginibus anguste hyalinae, 8-12 mm. longae; pedunculi graciles 0.75-1.0 mm. longi, glabri laevesque; rhachis glabra ca. 0.75 mm. longa. *Spiculae involucales* nullae, earum pedicelli ad squamas minutas semper redacti. *Spicula fertilis* feminea, anguste lanceolata, acuminata, 7 mm. longa; gluma inferior lanceolata, acuminata, breviter acuteque biloba, marginibus inferne incurvis apice versus bicarinatis, carinis hispidulis exceptis glabra, 8-nervis, tenuiter cartilaginea; gluma superior lanceolata acuminata, 3-nervis, marginibus inflexis hyalina; lemma inferius hyalinum, lanceolatum, obtusum apice laceratum, 4.0-4.2 mm. longum; lemma superius lineare, bilobum, lobis filiformibus 0.5-0.7 mm. longis, hyalinum, 1-nerve, 5 mm. longum; arista valde geniculata 16-18 mm. longa, columna scabridula, 7 mm. longa; caryopsis oblongo-elliptica, 3.75 mm. longa. *Spiculae pedicellatae* dimorphae, quarum una mascula

vel neutra, una semper neutra, lanceolatae vel anguste lanceolatae, acutae, usque ad 4.2 mm. longae; pedicelli gracillimi, complanati, marginibus hispiduli, 3.0-3.5 mm. longi; gluma inferior tenuiter membranacea, 4-6-nervis, laevis, vel minuta; gluma superior hyalina, 3-nervis vel nulla; lemma inferius lineare, apice acute trilobum, hyalinum, enerve, usque ad 2.75 mm. longum vel nullum; lemma superius nullum; lodiculae lineares bilobae, vel nullum; antherae 1.3-1.6 mm. longae.

Burke District: Iffley Station, approx. 19° 25' S., 141° 1' E., on grassland (*Astrebla*, &c.) plain on heavy dark grey soil, 20-8-1936, *Blake* 12636; Rocklands Station, Camooweal, grassland plain on grey gravelly clay loam, 750 ft., 1-5-1935, *Blake* 8844A; Julia Creek, 3-1934, *Moodie*; comm. *Agric. Chemist* lab. 4747 (mixed with *I. vaginiflorum* Domin); Richmond, river flats and channels on heavy brown loam ca. 700 ft., 9-6-1936, *Blake* 11676; Hughenden, grassland downs on grey-brown clay loam ca. 1,100 ft., 19-5-1936, *Blake* 11545 (type). Mitchell District: Prairie, grassland plains on heavy dark soils, 1,400 ft., 22-5-1936, *Blake* 11616. Moreton District: Brisbane, cultivated on sandy soil from seed of type-collection, 11-4-1937, *Blake* 12924.

Easily recognised by its copiously branched habit, its extreme fragility, the hard and shining nearly terete floral sheaths with convolute margins, the spathes semicylindric and hardened in their lower part, and the absence of involueral spikelets, this distinctive and most interesting species exhibits the greatest amount of reduction in the genus. The involueral spikelets are constantly reduced to the merest rudiments of pedicels, one of the pedicellate spikelets appears to be constantly neuter and reduced, while one raceme was found bearing apparently perfect grain where *both* pedicellate spikelets were reduced to a more or less rudimentary glume.

In *I. vaginiflorum* Domin, which the species most resembles, the floral sheaths are rounded on the back with slightly convex sides and appressed margins and enclose two or more racemes of which the outermost has at least some of the involueral spikelets prominent though usually reduced to the lower glume. The others show increasing degrees of reduction and approach those of *I. fragile*. As in the other species, however, the spathe is acutely keeled.

In habit *I. fragile* resembles *I. macratherum*, but is a smaller and more slender plant. Because of the ease with which the plants break up, perfect herbarium specimens are difficult to prepare.

The species was fairly abundant in the neighbourhood of Hughenden where it appeared to be quite indifferent to variations in drainage conditions. Nothing is known as to its particular merits as a fodder grass.

KEY TO THE AUSTRALIAN SPECIES OF ISEILEMA AND THEIR HYBRIDS.

Racemes becoming laterally exserted and finally disarticulating from their peduncles; involueral spikelets abruptly contracted into their pedicels with a transverse furrow at junction, or if not, then the racemes bearded at base with hairs up to 5 mm. long; inflorescence not disarticulating at maturity, the floral leaf sheaths herbaceous, always sharply keeled.

Racemes either glabrous at base or bearded with hairs 1-3 mm. long, or if up to 5 mm. long, then involueral spikelets at least 5 mm. long on short pedicels; involueral spikelets abruptly contracted into their pedicels and transversely furrowed at junction.

Involueral spikelets 4-6.5 mm. long
on pedicels $\frac{1}{3}$ - $\frac{1}{4}$ their length.

Racemes glabrous, lower lemma
1-3- nerved 1. *I. calvum*

Racemes bearded at base, lower
lemma nerveless.

Leaf-blades with long tubercu-
late-based hairs; keels of
involueral spikelets long-
ciliate 2. *I. ciliatum*

Leaf-blades glabrous, keels of
involueral spikelets pubes-
cent or scabrous.

Floral leaf-sheaths glandular
on keel, involueral spike-
lets flattened on back,
densely pubescent.

Racemes bearded at base
with hairs 2-3 mm.
long 3. *I. Windersii*

Racemes bearded at base
with hairs 4-5 mm.
long 0. *I. trichopus*

Floral leaf-sheath eglandular,
lower glume of involu-
eral spikelets very con-
vex on back 4. *I. convexum*

Involueral spikelets 3-4 mm. long,
on pedicels $\frac{1}{3}$ - $\frac{1}{2}$ their length,
scabrous on back 5. *I. membranaceum*

Racemes densely bearded at base with hairs up to 5 mm. long,
involueral spikelets attenuate on to their pedicels which are $\frac{1}{3}$ - $\frac{1}{2}$
their length and not or but slightly furrowed at the junction.

Pedicels of involueral spikelets
bearded only at base; plants
eglandular except for scattered
glands on keels of spathes and
sometimes of involueral spikelets 6. *I. eremaum*

Pedicels of involueral spikelets
bearded throughout; upper
part of internodes and keels of
floral sheaths closely glandular 7. *I. dolichotrichum*

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Racemes either quite enclosed within the floral sheaths, or if more or less exserted, then glabrous or shortly bearded (hairs rarely up to 3 mm. long), the involucrel spikelets attenuate on their pedicels which are about $\frac{1}{3}$ their length, with no or only an indistinct transverse furrow, or the spikelets reduced or absent; inflorescence usually readily disarticulating at maturity, the racemes usually falling with their sheaths.

Floral leaf-sheaths herbaceous or somewhat indurated, keeled, racemes at length more or less exserted, sometimes disarticulating; involucrel spikelets more or less developed, rarely absent.

Awn 2-3 cm. long; plant rather regularly glandular on edge and keel of leaf and on keel of floral sheath 8. *I. macrathenum*

Awn rarely attaining 2 cm. long; plant eglandular or with few scattered glands.

Lower lemma 1-3-nerved .. 11. *I. vaginiflorum*
x *I. calvum*

Lower lemma nerveless.

Racemes bearded at base with hairs 2-3 mm. long .. 12. *I. vaginiflorum*
x *I. eremaeum*

Racemes glabrous or very shortly bearded.

Involucrel spikelets faintly furrowed at junction 13. *I. vaginiflorum*
x *I. membranaceum*

Involucrel spikelets not furrowed at junction .. 14. *I. vaginiflorum*
x *I. macrathenum*

Floral leaf-sheaths becoming indurated and cartilaginous, rounded on back downwards; racemes almost wholly enclosed and tightly embraced by the spathes and floral sheaths; involucrel spikelets usually reduced to a more or less hyaline lower glume or absent; plants entirely eglandular or with but few scattered glands on keel of sheath.

Each floral sheath with 2-3 spathes and racemes of which the lowest (outermost) at least has involucrel spikelets; floral sheaths with slightly convex sides and appressed margins; spathes acutely keeled 9. *I. vaginiflorum*

Each floral sheath with one raceme, subcylindric with convolute margins; involucrel spikelets constantly reduced to minute rudiments of pedicels 10. *I. fragile*

I. trichopus (No. 0 in the key) has not yet been found in Queensland.

In the following enumeration of species a vernacular name for popular usage has been suggested for each species. Two of these were

proposed by Everist in Queensl. Agric. Journ. n.s. xliii., 382, 1935, but it must be admitted that in our present state of our knowledge of the genus the names are unfortunately chosen.

Unless stated to the contrary, all the collections cited were made by myself.

1. *I. calvum* C.E.H., Coarse Flinders Grass (in allusion to its habit) is pre-eminently a species of the channels and the deeper, damper depressions where it usually forms small patches. It is the coarsest species in the genus, the culms are more regularly erect, and the old leaves are of a paler, less reddish tint than usual. The large glabrous raceme and the unique 1-3-nerved lower lemmas are very characteristic.

The type comes from Jardine Valley about 12 miles east of Hughenden, and Hubbard records it also from Hughenden and Nonda in the Burke District and from the Gilbert River in the Cook District. I found it common between Hughenden and Jardine Valley (No. 11626) where it occupied depressions as described above, and at the following new localities:—

Burke District: Iffley Station, about 130 miles south of Normanton, grassland (*Astrelba*, &c.) plains on heavy dark grey soil 20-8-1936, No. 12635; Oorindi, 40 miles east of Cloncurry, on grassland plain on light brown gravelly sandy loam, 428 ft., 18-5-1936, No. 11626. Gregory North District: Frensham Station, near Kynuna, in stream channels, ca. 700 ft., 13-5-1936, No. 11498; Tranby Station, about 60 miles south-west of Winton, in stream channels, 9-5-1936, No. 11427.

Also seen but not collected at various places between Hughenden and Winton in depressions in the grassland in May, 1936.

2. *I. ciliatum* C.E.H., Hairy-leaved Flinders Grass, was based on a solitary specimen collected by Domin in February, 1910, near Hughenden, in grassy places towards Mount Walker. The Hughenden district has been well searched since without the species being rediscovered. I visited the locality in 1934 and twice in 1935, but it was not until May, 1936, that a small patch was finally located near the foot of Mount Walker towards the northern end. The plants were growing with *I. convexum* near the head of a small gully in scattered Gidgea country. It is a very distinctive species, very strongly scented in the living state. One of its most outstanding characters was not described by Hubbard. Scattered along the margins of the leaves, particularly near the base, are rather long, slender, tuberculate-based hairs, a character unknown in any other species. The grain, also hitherto undescribed, is elliptic and 3.5 mm. long. The densely long-ciliate keels of the involucreal spikelets are a prominent character.

Burke District: Near Hughenden near Mount Walker, on yellowish brown gravelly sandy loam at head of small gullies in Gidgea (*Acacia Cambagei*) parkland, 1,250 ft., 24-5-1936, No. 11628. Moreton District: Brisbane, cultivated on sandy soil, 18-4-1937, No. 12932.

3. *I. Windersii* C.E.H., Scented Flinders Grass, occurs chiefly on open Mitchell grass plains and downs, not however in association with *Astrelba pectinata*. It is usually somewhat stouter and less spreading than the widespread *I. vaginiflorum*, while its strong sweetish smell is very pronounced in its native habitat, though less so on cultivated specimens. Hubbard records the species from near Camooweal, near Nonda and near Hughenden. Recent records are:—

Burke District: Normanton, in dried-out swampy *Eucalyptus microtheca* parkland on yellowish sandy loam—one dead plant 2 ft.

long—8-8-1936, No. 12493; near Camooweal on Rocklands Station, grassland plain on grey gravelly clay loam, 750 ft., 1-5-1935, No. 8843; Yelvertoft Station, between Mount Isa and Camooweal, on muddy edge of waterhole, 21-4-1935, No. 8624; Oorindi, 40 miles east of Cloncurry, grassland plain on light-brown gravelly sandy loam, 428 ft., 18-5-1936, No. 11538; Torver Valley Station ca. 30 miles north of Hughenden, on grassland tableland on grey-black clay ca. 1,300 ft., 24-8-1936, No. 12654. Gregory North District: Frensham Station, near Kynuna, in open *Astrelba* grassland on grey-brown clay silt, ca. 750 ft., 13-5-1936, No. 11495; Manuka Station, near Corfield, in channels, ca. 850 ft., 7-6-1936, No. 11666; Mitchell District: Prairie, grassland plain on dark-grey clay loam with fine gravel, 1,400 ft., 22-5-1936, No. 11612.

4. *I. convexum* C.E.H. Yellow Flinders Grass. In general habit this species closely resembles *I. Windersii*, but it is not or only very faintly scented. The bulging usually yellowish racemes serve to distinguish it. This grass has a tendency to restrict itself to depressions, forming a zone outside *I. calvum*, or else occupying the centre of depressions too shallow to support that species.

I. convexum was described chiefly from cultivated specimens, and the only natural habitats cited are in the neighbourhood of Hughenden. In May, 1936, I found it very common in the latter region (Nos. 11548, 11627, 11639), and also in the following localities:

Burke District: Iffley Station, 130 miles south of Normanton, in grassland (*Astrelba* &c.) on heavy dark grey soil, 20-8-1936, No. 12634; Richmond, on river flats and channels on heavy brown loam, ca. 700 ft., 9-6-1936, No. 11672; Tarbrax Station, about 30 miles south of Maxwellton, on open grassland downs, 28-7-1936, No. 12406. Gregory North District: Tranby Station, about 60 miles south-west of Winton, in channels, 9-5-1936, No. 11428.

5. *I. membranaceum* (Lindl.) Domin. This species was called "Small Flinders Grass" by Everist, but it grows as tall as most other species though it is frequently rather more slender. The statement that it dries off to a pale straw colour is incorrect. Normally it becomes reddish brown. The best distinguishing characters of this very widely spread species are the very small racemes very shortly bearded or nearly or quite glabrous at the base, and the scabrous involucreal spikelets. Though usually found on heavy soils it is occasionally to be found on sandy soils particularly on railway embankments, and an extreme and very interesting habitat cited below is the crest of a low desert sand-dune where it was behaving as a coloniser.

Among the very numerous localities from which this species was collected, the following are cited to indicate its geographical distribution or peculiarities in habitat. If a locality or a neighbouring locality has been cited by Hubbard, it is marked with an asterisk.

Burke District: Rocklands Station, *Camooweal, grassland plain on grey gravelly clay loam, 750 ft., 1-5-1935, No. 8845; Flinders River, lat. 19° 30' S., "common on Iffley on black soil," 20-8-1936, No. 12644; Oorindi, 40 miles east of Cloncurry, in grassland on light brown gravelly sandy loam, 428 ft., 18-5-1936, No. 11537; Richmond, on banks and dry beds of channels, ca. 700 ft., 17-6-1934, No. 6281; Hughenden, grassland downs on grey-brown clay loam, ca. 1,100 ft., 19-5-1936: Mitchell District: *Prairie, grassland plains on heavy grey soils, 1,400 ft., 22-5-1936, No. 11617; Dundonald and Rodney Downs Stations, between

*Longreach and Aramac, on open grassland downs on greenish grey clay, 3-5-1936, No. 11361. Gregory North District: Frensham Station, near Kynuna, in open *Astrelba* grassland on grey-brown clay silt, ca. 750 ft., 13-5-1936, No. 11496; Manuka Station, near Corfield, in open grassland, ca. 850 ft., 7-6-1936, No. 11665; Tranby Station, ca. 60 miles south-west of Winton, in channels, 9-5-1936, No. 11425; near Boulia on grassy plain, 24-7-1936, No. 12370; 35 miles south of Bedourie on Eyre's Creek flood, 21-7-1936, No. 12302. Gregory South District: Birdsville, on Diamantina flood, 19-7-1936, No. 12214; on low sandhill, No. 12244; Betoota, in channels, 17-7-1936, No. 12168; near Windorah on flood-plain of Cooper's Creek, 11-7-1936, No. 12077; Mount Howitt Station, ca. 100 miles west of Eromanga, in channels of Cooper's Creek, 6-7-1936, No. 12020; Nockatunga Station, approx. 27° 30' S., 143° 0' E., on silt beds, 28-6-1936, No. 11876; Warrabin Station, between Quilpie and Windorah, near pools (crab-holes) in mulga country, 24-4-1934, No. 5503. Warrego District: Chesterton Station, approx. 25° 20' S., 147° 20' E., in mixed grassland on dark grey clay silt, ca. 1,750 ft., 9-4-1936, No. 11168; *Charleville, depressions in lightly timbered country, ca. 950 ft., 19-4-1934, No. 5334; Cunnamulla, grassland plain on light brown silt clay, 600 ft., 12-4-1936, No. 11199; Thargomindah, on creek bank, 400 ft., 24-6-1936, No. 11774; Morven, on grassland on dark brown silt clay, ca. 1,400 ft., 1-5-1934, No. 5668; and also associated with myall (*Acacia pendula*), 2-4-1936, No. 10989. Maranoa District: Roma, in open grassy places on heavy soils, ca. 1,000 ft., 29-3-1936, No. 10885; *Noondoo Station, south-east of Dirranbandi, on grassland with *Eucalyptus coolabah* on dark brown silt clay, 28-2-1936, No. 10571. Leichhardt District: Minerva, north of Springsure, grassland on dark grey clay loam, 800-1,000 ft., 7-3-1935, No. 7932. Darling Downs District: Dulacca to Palardo, in railway enclosure (very common at Palardo), on sandy soil, 15-2-1935, No. 7581; *Jondaryan, grassland on dark grey clay, 1,250 ft., 22-2-1935, No. 7581. Moreton District: —Brisbane, spontaneous beside pathway, 26-4-1937.

Also recorded from North Kennedy District (Pentland) and from Port Curtis District (Biloela, and between Rockhampton and Westwood).

6. *I. eremaeum* S. T. Blake. Bunch Flinders Grass—in allusion to its dense compact habit. See above.

7. *I. dolichotrichum* C.E.H. Rough-stemmed Flinders Grass is suggested as a vernacular on account of the stems (culms) being roughened by small glands just below the nodes. This species was described by Hubbard from a solitary plant collected by himself at Duchess in February, 1931, during a very dry period. As the result of excellent rains earlier in the year it was very abundant near that town in May, 1936, near one of the rugged ridges so characteristic of the region. Most of the plants were growing near the foot among *Triodia*, *Enneapogon*, and *Neurachne*, but quite a number ascended the ridge, growing in the little pockets of soil between the boulders. The plants formed small tufts mostly 3-4 in. high, with a distinct resinous odour. The old leaves were less reddish and paler than usual in the genus. At the base of the plants were small masses of "seed" held together by the long hairs at the base of the racemes.

Gregory North District: Duchess, in valleys on stony brownish red loam associated with *Triodia* and scattered *Eucalyptus leucophylla* at 1,200 ft., 18-5-1936, No. 11519. Moreton District: Brisbane, cultivated on sandy soil from seed from above, 11-4-1937, No. 12920.

8. *I. macratherum* Domin, Bull Flinders Grass (name recorded in *C. T. White* 1478 as the local name on the Gilbert River)¹. This species is usually recognisable by its profusely branched habit and its faint but distinct odour similar to that of *I. Windersii*. It is however very closely allied to the following species and this relationship will be discussed below. Until recently known only from Chillagoe and the Gilbert River, its known range now extends into the region of greatest concentration of species. The new records are:—

Cook District: Koolatah Station, approx. 15° 50' S., 142° 15' E., on parkland to open grassland on yellowish silt clay, 16-8-1936, No. 12582. Burke District: Normanton, in dried-out swampy *Eucalyptus microtheca* parkland among tall grass on yellowish sandy loam, 8-8-1936, No. 12494; Magoura Station, west of Normanton, on river bank, 31-5-1935, No. 9191; between Normanton and Burketown on "black soil" plains, 31-5-1935, No. 9213; Burketown, in *Astrebla* grassland on yellow-brown clay loam, ca. 30 ft., 1-6-1935, No. 9250; Riversleigh Station, approx. 19° 0' S., 138° 45' E., old alluvial flats on grey-brown fine sand, 21-4-1935, No. 8702; Rocklands Station, near Camooweal, grassland plain on grey gravelly clay loam, 750 ft., 1-5-1935, No. 8844; Pymurra, 18 miles east of Cloncurry, on dark brown soil with scattered gidgea (*Acacia Cambagei*), 611 ft., 18-5-1936, No. 11534; Oorindi, 40 miles east of Cloncurry, in grassland on light brown gravelly sandy loam, 428 ft., 18-5-1936, No. 11535; Quarrel's Siding, near Julia Creek, in grassland on greenish grey fine silt, 496 ft., 18-5-1936, No. 11542; Hughenden, grassland downs on grey-brown clay loam, ca. 1,100 ft., 19-5-1936, No. 11543. Gregory North District: Manuka Station, Corfield, on grassland downs, 840 ft., 7-6-1936, No. 11664. Mitchell District: Morella, between Longreach and Winton, grassland on dark brown clay loam, 828 ft., 28-5-1936, No. 11640.

9. *I. vaginiflorum* Domin. Called Red Flinders Grass by Everist. When well grown this species has usually a loosely spreading habit, but small plants are more rigid and erect. Generally speaking, the culms and sheaths are of a rich purplish colour—often more highly coloured than in other species—but very rarely as in No. 11656 from near Longreach, these parts are very pale and not at all purplish. Such plants were very few and were growing with highly coloured plants. The species is further discussed below in dealing with hybridism. It is very widely distributed, and, as a rule, very common in any one locality, occurring under a variety of drainage conditions. Very rarely indeed is it found on light soils.

Distribution.—Burke District: Almost throughout the southern part as far north as Camooweal and Iffley (No. 12643). Mitchell District: Widely spread on the grasslands. North Kennedy District: Charters Towers (ex Hubbard). Gregory North District: near Boulia on grassy plain, 24-7-1936, No. 12369; Frensham Station, near Kynuna, in open *Astrebla* grassland on grey-brown clay silt, ca. 750 ft., 13-5-1936, No. 11497; Winton, grassland downs on stony light yellowish brown clay loam, 600 ft., 30-6-1934, No. 6536; Kalkadoon Station, approx. 22° 30' S., 142° 25' E., in channels of Diamantina River, 11-5-1936, No. 11463, tiny plants ca. 1 in. high; Tranby Station, ca. 60 miles south-west of Winton, in channels, 9-5-1936, No. 11426. Gregory South District: Birdsville, on fine drift sand on gibber slopes, 19-7-1936, No. 12212A;

¹ By some mistake Hubbard records this name as "Bull Mitchell Grass."

45 miles west of Windorah on stony hilly country in *Acacia* scrub, 14-7-1936, No. 12118; Warrabin Station, between Quilpie and Windorah, 24-4-1934; grassland plain on light grey silt loam, No. 5491; edge of pools (crab-holes) in mulga country, No. 5502; *Windorah, on flood plain of Cooper's Creek, 12-7-1936, No. 12080. Warrego District: West of Thargomindah on pale grey silt clay flats, ca. 400 ft., 25-6-1936, No. 11788; Cunnamulla, on sandy patch, 29-4-1934, No. 5629; on grassland plains on light brown silt clay, 12-4-1936, No. 11198. Leichhardt District: Minerva, north of Springsure, very common in mixed grassland on dark grey clay loam, ca. 800 ft., 6-3-1935, No. 7907; (cited by Hubbard from Emerald and Peak Downs). Port Curtis District: Rockhampton, a weed in sports ground on sandy soil, 2-3-1935, No. 7787.

10. *I. fragile* S.T. Blake. Brittle Flinders Grass. See above, p. 85.

All but two of the above species are very distinct and can be readily distinguished either in the herbarium or in the field. There is, however, a difficult series of forms apparently connecting *I. macratherum* and *I. vaginiflorum*, species which, when typically developed are readily distinguished as follows:—

I. macratherum.—Plant copiously branched, frequently sub-erect, distinctly scented when fresh; floral leaf-sheaths acutely keeled at least in upper half, herbaceous throughout or only slightly hardened near the base, glandular on the keel; margins and keel of the leaves also rather closely glandular, at least near the base; mature racemes partly exsert; involueral spikelets well developed with firm glumes and a lower lemma; awn 2-3 cm. long.

I. vaginiflorum.—Plant less branched, more slender, usually drooping or spreading, not scented; floral leaf-sheaths not keeled, becoming hardened and rounded on the back downwards at maturity, keel eglandular or with a very few scattered glands; leaves not glandular; racemes always almost completely enclosed; involueral spikelets usually reduced to a membranous lower glume or even still further reduced; awn rarely so long as 2 cm.

The other forms of the series vary in habit with more or less distinctly keeled and somewhat hardened floral sheaths and partially exsert racemes with shorter awns than in *I. macratherum*. Involueral spikelets are variable, even on the same specimen, but are usually better developed than in *I. vaginiflorum*. Glands are usually present, but few in number, and irregularly scattered. One or more frequently occurs on the keels of the lower glume of the involueral spikelets. It certainly seems probable that such forms are hybrids of which *I. vaginiflorum* is one of the parents. Such forms appear to be very rare; as a rule only isolated plants have been found, and then mostly in company with both suspected parents. In one case (No. 12 below) a hybrid swarm seems to have been detected, and it is in this collection alone that well-formed grain was found.

11. *I. vaginiflorum* x *I. calvum*.—This form is only known from the two specimens collected by Hubbard and Winders at Jardine Valley where it was found growing in company with its supposed parents. One of these specimens is now in the Queensland Herbarium. With the habit of *I. calvum* the racemes look rather like those of *I. vaginiflorum*, but are somewhat exsert, and the lower lemma is 1-3-nerved.

12. *I. vaginiflorum* x *I. eremaeum*.—Numerous specimens of this form were collected at Birdsville on fine drift sand overlying gibber

slopes in company with its supposed parents (19-7-1936, No. 12212). The three forms here occurred as small compact tufts, very similar to one another in appearance. The inflorescence disarticulates at the nodes as in the first species, but the racemes are subexsert and frequently fall before the inflorescence breaks up. The racemes approach those of *I. vaginiflorum* in general appearance, but the hairs at the base are up to 3 mm. long. The involueral spikelets are either male or neuter; when male they resemble those of *I. eremaeum*; when neuter, they are very similar to those of *I. vaginiflorum*.

13. *I. vaginiflorum* x *I. membranaceum*.—There are two distinct forms of this. In the original form described by Hubbard, the habit is that of *I. vaginiflorum*, but by reason of the thinner, more distinctly keeled floral sheaths, and the partly exsert racemes with better developed involueral spikelets, it resembles *I. macratherum* rather closely. But the awns are shorter, the involueral spikelets are furrowed at the junction with the pedicel, and glands are almost confined to a few scattered ones on the keels of the involueral spikelets. This form has only been found in the Leichhardt District. I have seen one of the three collections cited by Hubbard (*White* 3418 from Clermont) and my 8064 from Blair Athol on grassland, 16-3-1935, is the same form.

Another collection from Hughenden (on grassland downs on grey-brown clay loam, ca. 1,100 ft., 19-5-1936, No. 11547) appears also to be a hybrid between the same two species, but the habit is similar to that of *I. membranaceum*. Very few specimens were found though others were diligently sought for.

14. *I. vaginiflorum* x *I. macratherum*.—To this is referred a curious series of specimens from Prairie (grassland plains on heavy dark soils, 1,400 ft., 20-5-1936, No. 11614). In habit some specimens approach one species, some the other. Racemes are included to subexsert, the involueral spikelets mostly reduced to a thin lower glume, the floral sheaths hardened but strongly nerved, glands are numerous, few or absent, and leaves glandular or not. There is no degree of constancy, even on the same specimen.

EXPLANATION OF PLATES.*

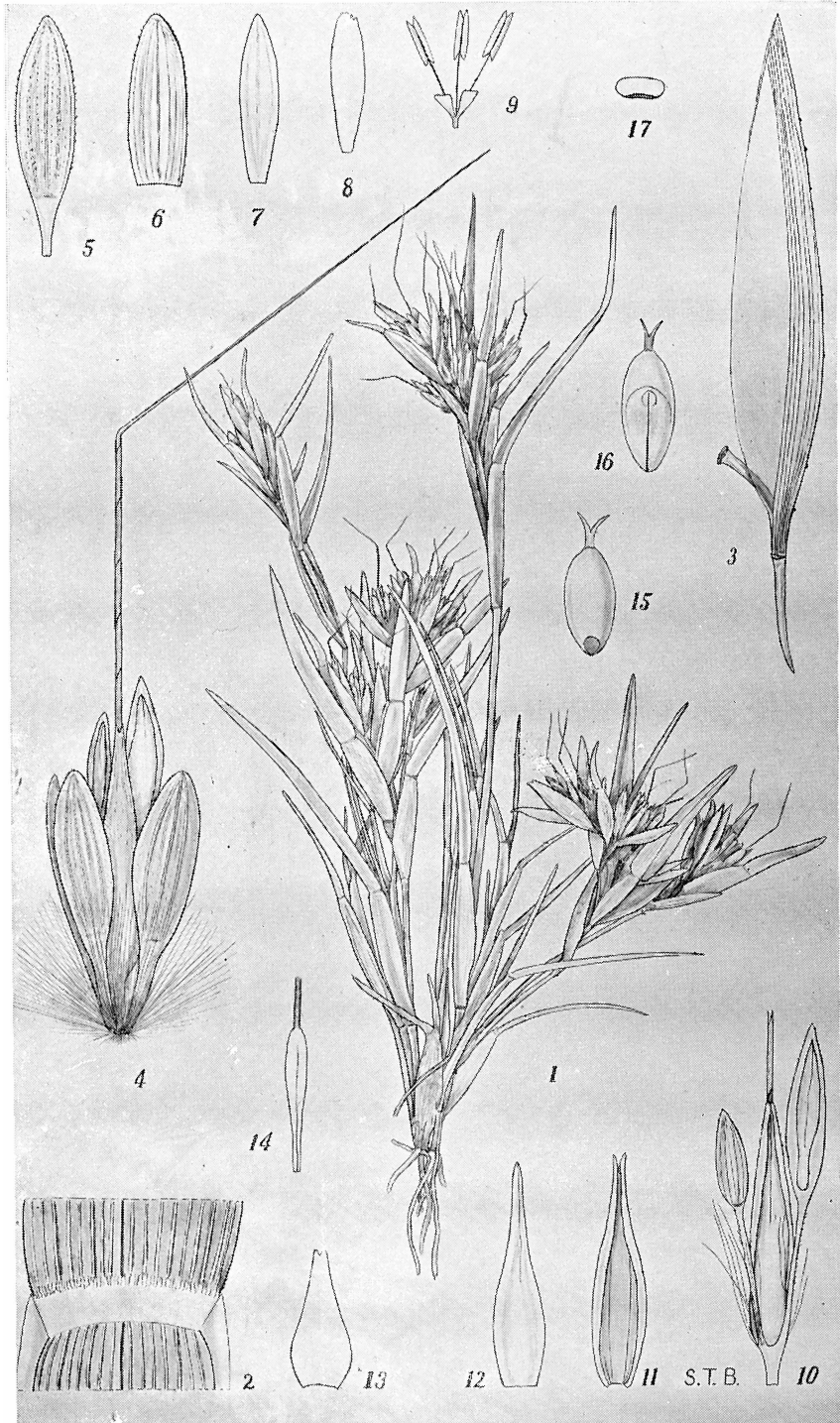
PLATE III.—*Iseilema eremaeum* S. T. Blake (from *Blake* 12213).

Fig. 1, plant, *natural size*; 2, ligule; 3, spathe; 4, raceme; 5, involueral spikelet; 6-9, details of involueral spikelet:—6, lower glume, from inside; 7, upper glume, from outside; 8, lower lemma; 9, male flower; 10, fertile and pedicellate spikelets; 11-17, details of fertile spikelet:—11, lower glume, from inside; 12, upper glume, from outside; 13, lower lemma; 14, upper lemma; 15 and 16, caryopsis; 17, transverse section of caryopsis. Figs. 2-17 x 6.

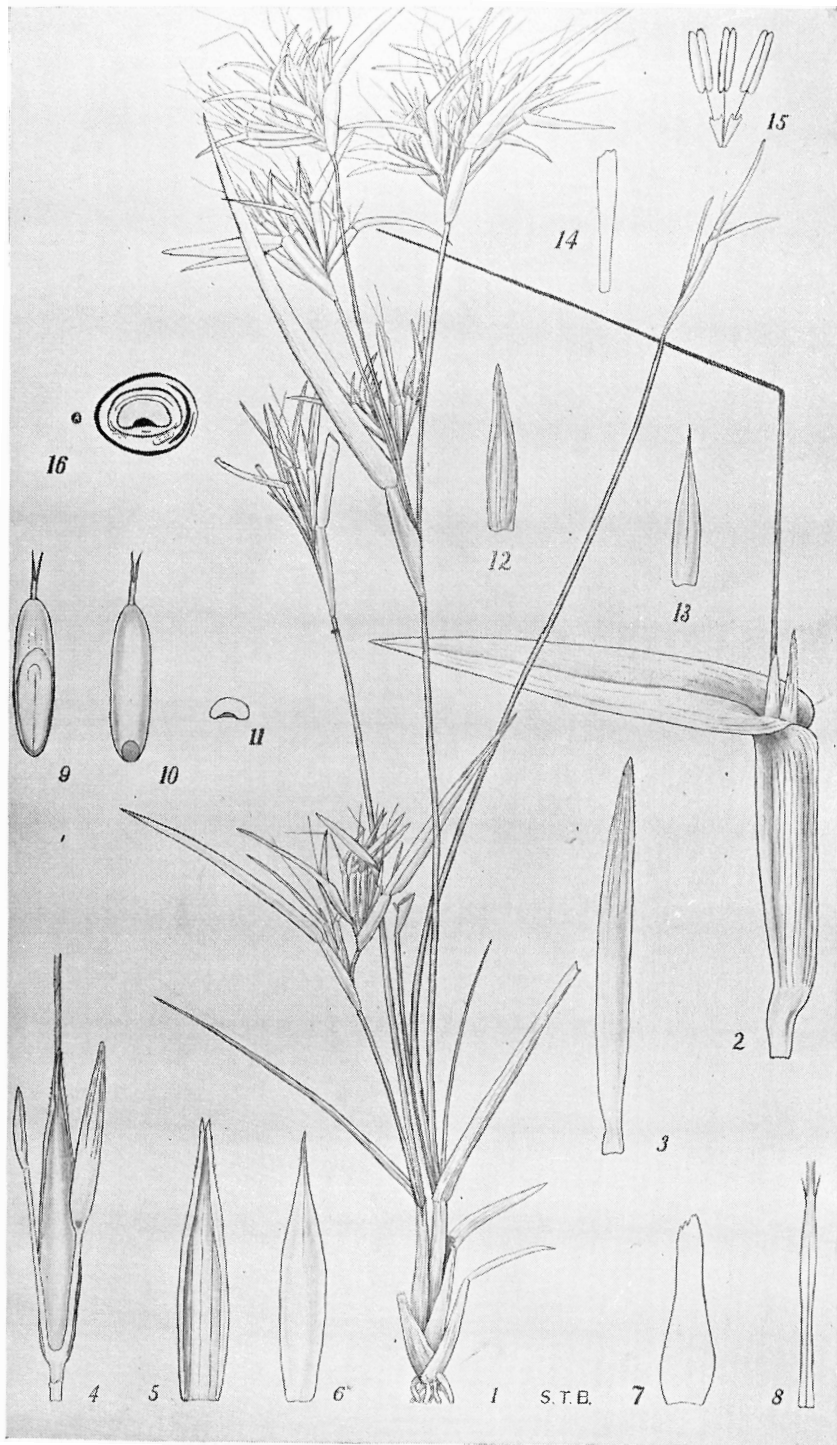
PLATE IV.—*Iseilema fragile* S. T. Blake (from *Blake* 11545).

Fig. 1, part of plant, *natural size*; 2, "seed"—disarticulated floral sheath with spathe and raceme enclosed; 3, spathe; 4, raceme; 5-11, details of fertile spikelet:—5, lower glume, from inside; 6, upper glume, from outside; 7, lower lemma; 8, upper lemma; 9 and 10, caryopsis; 11, transverse section of caryopsis; 12-15, details of male pedicellate spikelet:—12, lower glume, from inside; 13, upper glume, from outside; 14, lower lemma; 15, flower; 16, transverse section, partly diagrammatic, of "seed" (fig. 2). Figs. 2-15 x 6, fig. 16 x 9.

* Due to an error in the preparation of the plates, the magnification of the figures is slightly less than that stated in the Explanation.



Iseilema eremaeum S. T. Blake.



Iseilema fragile S. T. Blake.