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Abstract

The Government of Vietnam is promoting the development of a livestock industry in the highlands region of Central Vietnam. This booklet provides information and illustrations of grasses found in the region at altitudes over 250 m, as a guide to agronomists seeking to develop and improve native or naturalised grasslands and rangelands.

Brief descriptions are provided for 89 grass species collected in the area and 86 species are illustrated with line drawings. Information is included on occurrence in Central Vietnam, world distribution, habitat, value as feed for livestock, other uses and deleterious properties. A brief list of appropriate references in Vietnamese and the world literature is provided.

Keywords

tropical grasses, savannas, grasslands

Introduction

The present study was developed at the request of Tay Nguyen University (Buon Ma Thuot, Vietnam) for information on the grasses in grazing lands of the Central Highlands of Vietnam. This area has undergone considerable change since the 1950s, with extensive areas being deforested and resettled by people from over-populated areas of the north, and, where soils are more fertile, developed for coffee farming. On less fertile lands, particularly around M'Drak, there is a developing livestock industry. In this area, the AusAID-funded Forages for Smallholders Project is working with local farmers, promoting the sowing and utilization of adapted high-quality forages. In the four years of the Project (since 1995), a considerable number of smallholders have sown improved forages, and are benefiting from them. However, areas are small (mostly <0.2 ha), and there will be a continuing need to utilize 'natural' grazing lands. Some knowledge of the species which occur in these lands, and their known characteristics, will be of benefit in designing management systems to improve their production potential on a sustainable basis.

Methods

The region of interest covered the provinces of Đắc Lắc, Gia Lai and Lâm Đống. A total of 23 sites were visited over the period 4-16 November 1998; these included sites identified by the second author as being of particular interest. Grass species were collected and identified, and herbarium specimens lodged at the Rijksherbarium, Leiden, The Netherlands and Queensland Herbarium, Brisbane. At each site soil pH (top 5 cm) was measured colorimetrically (CSIRO Soil pH Kit, Inoculo Laboratories, Australia).

Species are described based on collected specimens and available texts, and ecological information from the same sources is summarized. Illustrations have mostly been taken from earlier publications by the senior author, or prepared from specimens collected in Vietnam during the present study. In presenting the information, we have not attempted to construct a key, as it is inevitable that many grass species that occur in the area would not have been collected. The reader is referred to Pham-Hoaìng Hä (1972, 1993) for a more complete coverage of grasses of Vietnam which also include some information on distribution.

Descriptions have been kept as simple as possible, but it is not possible adequately to describe a grass without using some technical terms. The various parts of a grass plant are illustrated in Figure 2, and Figure 3 provides illustrations of different forms of inflorescence. A glossary gives definitions of botanical terms used.

For ease of identification, species are presented in six groups, based on gross morphology:

Group 1 – Grasses with a leafy (spatheate) panicle, or with panicle concealed within leaf sheath
Group 2 – Robust grasses >2 m tall, with plumose panicles
Group 3 – Grasses with spike-like inflorescences
Group 4 – Grasses with open panicles; spikelets without awns, not crowded along panicle branches
Group 5 – Grasses with open panicles; spikelets awned or prominently hairy, not crowded along panicle branches
Group 6 – Grasses with racemose panicles; spikelets crowded along panicle branches; spikelets awnless or awn short and indistinct
Group 7 – Grasses with racemose panicles and/or with spikelets crowded along panicle branches; spikelets awned or with a bristle

Within each group, species are arranged alphabetically.

Ecology

The highlands area of Central Vietnam extends from c. 11° to 14° N and from c. 108° to 109° E. Altitude ranges up to 2442 m. Soils range from infertile to quite fertile, depending on the parent rock, with sandy and gravelly, infertile soils on granites and rhyolites, and generally more fertile loams and clay-loams on andesites, basalts and schistose argyllites. Soil pH ranges from 5.0 – 7.0, with more neutral soils developed on basalt.

Four different agro-ecological zones were recognized during the present survey:

Areas previously under rainforest but now extensively modified by human activity
This is a very diverse area and ranges from intensive agricultural production systems such as coffee, tea and other crops, mostly on more fertile soils east of Buôn Ma Thuôt and between Dà Lạt and Bảo Lộc, to areas of mixed grazing and shrubland. Grasses vary depending on altitude and soil fertility, with the exotic species *Pennisetum clandestinum*, *Brachiaria decumbens* and *Melinis minutiflora* being frequent at high altitudes. No collections were made in areas of intensive cultivation. Collecting sites in this category included sites 4, 5, 14 and 15.

Areas previously under rainforest but deforested during the 1950s and 1960s
These areas are characterised by an almost total absence of shrubs or trees. They are generally at medium altitude (c. 500 m) and are often dominated by robust grasses, such as *Miscanthus floridulus*, *Saccharum arundinaceum*, *Imperata cylindrica* and *Vetiveria festucoides*, which are unpalatable to livestock except when young. In many situations there are short-grass areas, between the robust grasses, dominated by more palatable grasses tolerant of heavy grazing, such as *Digitaria longiflora*, *Eremochloa ciliatifolia*, *Chrysopogon aciculatus* and *Axonopus compressus*. Collection sites included Sites 6-11, 16 and 17.

Dipterocarp woodlands
These occur at comparatively low altitudes (200-500 m). Within this altitude range, and within the catchment for the Mekong River, it is likely that much of the area now settled and extensively modified would have originally been dipterocarp woodland. Sites visited where dipterocarp woodlands were relatively undisturbed were Sites 1-3, 12 and 13. Sites 1-3 had an understorey dominated by *Heteropogon contortus*, whereas Site 13 had an understorey dominated by the dwarf bamboo *Vietnamosasa* sp. and was comparable with the 'pek' savannas of southern Laos (Hacker *et al.* 1996). Site 12 was more disturbed, with *H. contortus* and the exotic *Pennisetum polystachion* being abundant.

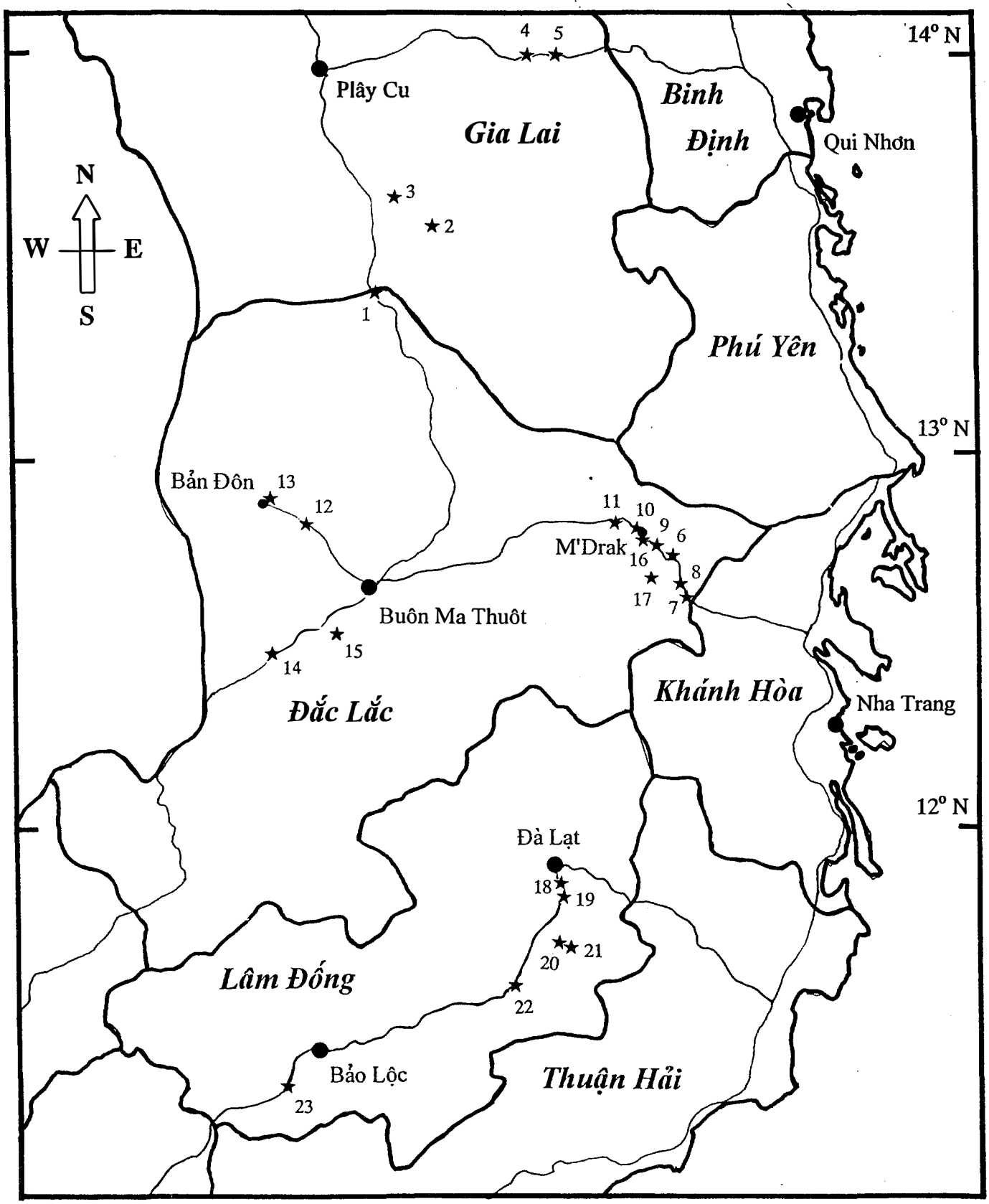


Figure 1. Central Vietnam, showing collection sites.

Pine tree woodlands
These occur on hillsides at higher altitudes (>850 m), Sites 18-23, and are similar to the pine tree woodlands of Xieng Khouang in northern Laos (Hacker *et al.* 1998). The understorey includes a wide diversity of grass species, including shade-tolerant species such as *Panicum notatum*, and some, such as *Eulalia* sp. and *Exotheca abyssinica*, not seen at lower altitudes.

Opportunities for sustainable development

The main target area in Central Vietnam for the development of a livestock industry is in the vicinity of M'Drak, Đắ Lắc Province. This area, once under forest but now mostly tall grassland, is dominated by a range of robust grasses which are only palatable when very young. It is likely that these have increased as a result of burning and grazing practices over the past 30 years. Continued high grazing pressures are only likely to increase the dominance of unpalatable species.

The successful development of a livestock industry is likely to depend initially on small areas of sown or planted forage in mixed crop/livestock systems. In the longer term, a procedure for the improvement of the naturalised grasslands will need to be developed. This is likely to involve introduction of a legume, such as *Stylosanthes guianensis* CIAT184, and harvesting or grazing the robust grasses while still young and palatable. For the steeper land in the district, forestry is a preferable alternative, and considerable areas are currently being planted to *Eucalyptus* and *Acacia* spp. However, we observed mature stands of Acacia left the soil bare and subject to erosion. Consideration should therefore be given to planting trees in 20-50 m wide bands along the contour, alternating with bands of forages to prevent development of erosion gullies.

The remaining areas of pine tree woodlands in Lâm Đống Province are on steeply sloping land and we believe that they should only be utilised as a sustainable forestry resource.

The dipterocarp woodlands are apparently rapidly being settled, but some areas visited appeared to be relatively undisturbed by human activity. There is little doubt that increasing grazing pressure in these areas would change the balance of grasses to less palatable species. *Heteropogon contortus*, which is dominant in many of these areas, is a palatable and productive species, and grazing pressure should be maintained at a low to moderate level to prevent it from disappearing.

Acknowledgments

We are grateful to Mr Phan Van Tân, Tay Nguyen University, for his contribution to the study during the field trip, and to Mr Phạm Chiên for the provision of a vehicle. We are also indebted to AusAID for funding the study through the Forages for Smallholders Project. Thanks are due to CIRAD for permission to copy and modify illustrations of *Mnesithea mollicoma* and *M. glandulosa* from Schmid (1958), published in *l'Agronomie Tropical*.

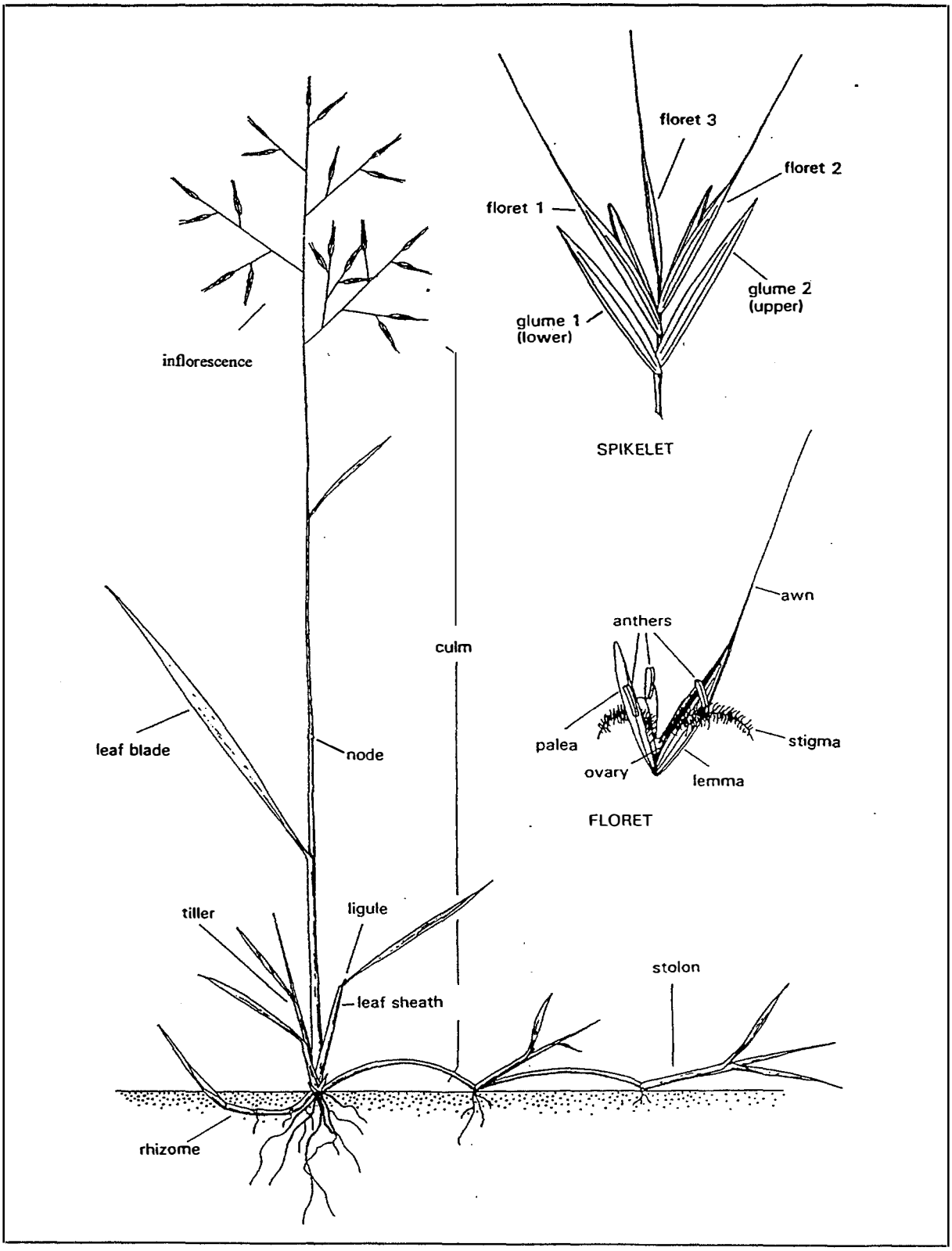


Figure 2. The parts of a grass plant (Tothill and Hacker 1983).

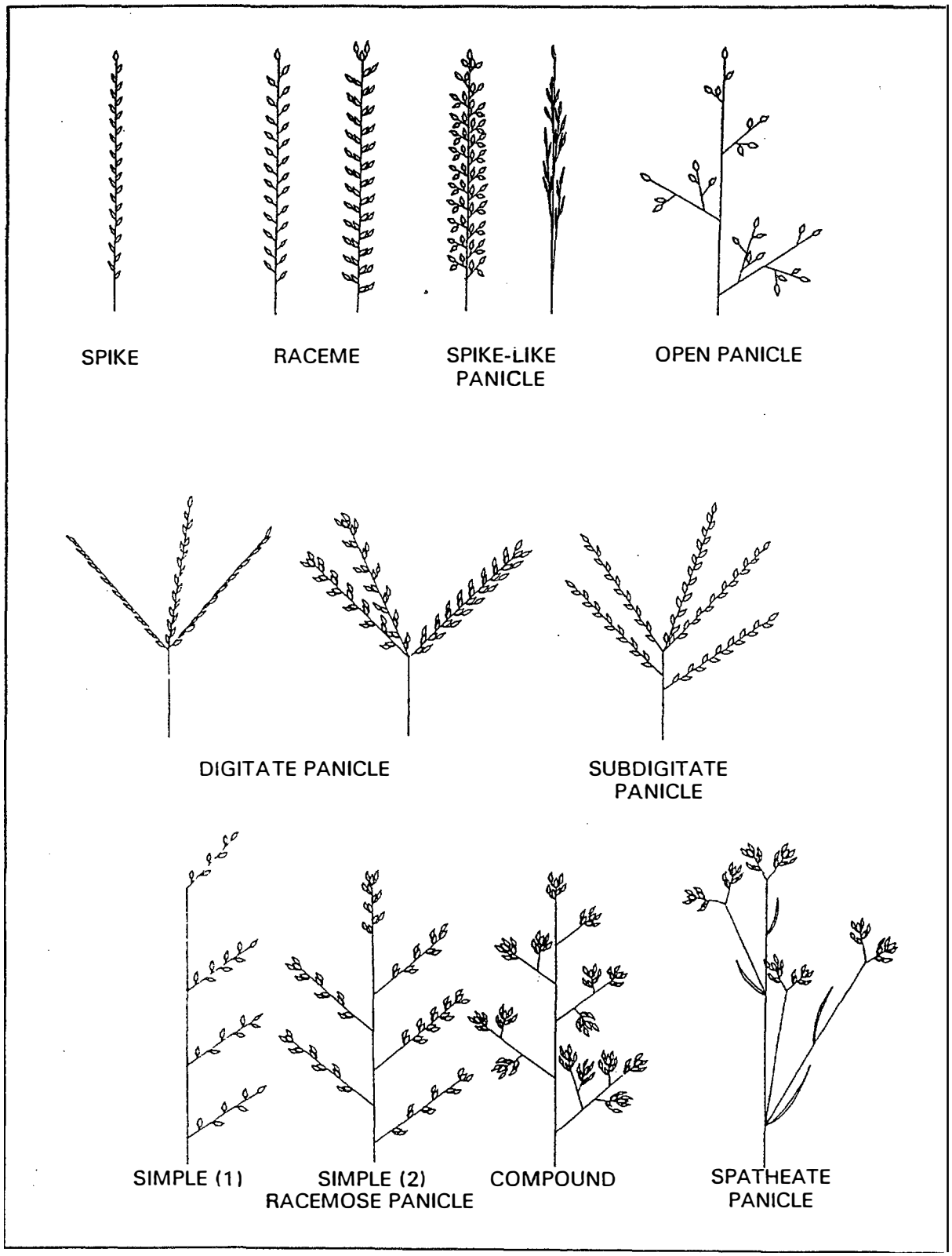


Figure 3. Stylised inflorescence forms of grasses (Tothill and Hacker 1983)

Group 1 – Grasses with a leafy (spatheate) panicle, or with panicle concealed within the leaf sheath

Apluda mutica (Figure 4A)
Vernacular names – rếp, trấu-thảo (Vietnam)

Description – a fine-stemmed, weak perennial, scrambling through surrounding vegetation to a height of 3 m. Nodes hairless. Leaf sheaths hairless, or with a few hairs close to the margins. Leaf blades 7.5-40 cm long, and 3-15 mm wide, tapering to the base, hairless. Ligule a 1 mm membrane, minutely hairy along the upper margin. Inflorescence a leafy panicle 3-40 cm long, composed of terminal and axillary racemes, each comprising 3 spikelets. Spikelets dissimilar, one sessile and fertile, 2 pedicellate and sterile. Sessile, spikelet 3.5-6 mm long, with 2 florets, only the upper fertile, the lemma pointed or with a delicate awn, the groups of 3 spikelets generally falling entire.

Habitat – occurs in a wide range of habitats including disturbed sites, clearings, roadsides, plantations, also in grasslands and savannas. Commonly found in lightly shaded, moist situations.

Uses for livestock – when young, grazed by cattle and buffalo.

Other uses – none.

Deleterious properties – none.

Distribution – throughout South-east and tropical Asia, Madagascar, Indonesia, northern Australia and New Caledonia. Quite common in Đắc Lắc Province in the vicinity of M'Drak at an altitude of c. 500 m, also occurring in dipterocarp woodlands in Gia Lai Province, as a minor component of the vegetation in situations protected from grazing.

References – Schmid 1958, as *A. varia* (p. 195); Bor 1960 (p. 93); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 680); Gilliland 1971 (p. 273); Pham-Hoàng Hộ 1972 (p.971); Lazarides 1980 (p. 19); Mannetje and Jones 1992 (p. 236); Pham-Hoàng Hộ 1993 (p. 785); Hacker *et al*. 1998 (p. 19).

Cymbopogon mekongensis (Figure 4B)
Description – tufted perennial with culms 0.8-1 m tall, the base with persistent sheaths. Nodes hairless. Leaf sheaths hairless. Leaf blades 10-20 cm long, 1.5-6 mm wide, hairless, more or less aromatic. Ligule 1.5-2 mm long. Inflorescence a narrow spatheate panicle, with slender, paired racemes 10-15 mm long, the peduncles much shorter than the spathes. Spikelets dissimilar, in pairs, the sessile spikelet fertile, the pedicellate spikelet sterile. Sessile spikelet 3.5-4 mm long, with 2 florets, only the upper one fertile and with a 8-14 mm long awn, falling entire with the adjacent internode and pedicel.

Habitat – occurs in open grasslands.

Uses for livestock – likely to be unpalatable to livestock, as are most species in this genus.

Other uses – none.

Deleterious properties – none.

Distribution – Indo-China. In Central Vietnam, found at an altitude of c. 1000 m in Lâm Đồng Province.

References – Soenarko 1977 (p. 388); Lazarides 1980 (p. 31); Pham-Hoàng Hộ 1993 (p. 893).

Diectomis fastigiata (Figure 4C)
Vernacular names – song-doạn (Vietnam)

Description – few-stemmed annual with culms up to 1.5 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades, 5-45 cm long, 1-4 mm wide, hairless. Ligule a membrane 10-15 mm long. Inflorescence a leafy panicle, the racemes solitary, often largely enclosed within the subtending sheath. Racemes c. 4 cm long, 4 mm wide, flattened. Spikelets in dissimilar pairs, laterally compressed, the sessile spikelet fertile, the pedicellate spikelet sterile. Sessile spikelet 4-5 mm long, with a deep dorsal groove, the upper glume with an awn 1-2 cm long, and with 2 florets, only the upper one fertile, Fertile floret with a 2.5-4 cm long awn. Pedicellate spikelet 5-9 mm long. The sessile spikelet falls entire with the adjacent internode and pedicellate spikelet.

Habitat – grassland and open forest or woodland. Not adapted to heavy shade. Occurs on infertile soils as well as skeletal soils.

Uses for livestock – a good fodder grass when young.

Other uses – none.

Deleterious properties – when the grass is mature, awns on the spikelets can be troublesome to grazing animals.

Distribution – occurs in the tropics of both hemispheres. Occurs in northern Đắc Lắc Province as a minor component of the herbaceous flora of dipterocarp woodlands.

References – Schmid 1958 (p. 202); Bor 1960 (p. 135); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 670); Pham-Hoàng Hộ 1972 (p. 973); Lazarides 1980 (p. 33, 34); Mannetje and Jones 1992 (p. 242); Pham-Hoàng Hộ 1993 (p. 896); Hacker *et al.* 1996 (p. 13).

Exotheca abyssinica (Figure 4D)
Description – perennial with culms 0.3-2 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades 5-50 cm long, 1-4 mm wide, hairless. Ligule with a 3-18 mm long membrane on each side. Inflorescence a spatheate panicle, with pairs of racemes borne on a long peduncle. Racemes with 2 pairs of male spikelets at the base and 2 fertile, sessile spikelets. Sessile spikelets 12-16 mm long, the fertile floret bearing a geniculate awn 6-10 cm long. Pedicelled spikelet 14-16 mm long, sometimes with a bristle up to 10 mm long,

Habitat – woodlands and open forests from 800 m to 1800 m altitude.

Uses for livestock – in East Africa it may be a significant component of natural grazed pastures.

Other Uses – none.

Deleterious properties – none.

Distribution – Only known from East and Central Africa and Vietnam, where it occurs in Lâm Đồng Province at altitudes above 1000 m.

References – Schmid 1958, as *E. chevalieri* (p. 229); Lazarides 1980 (p. 41); Pham-Hoàng Hộ 1993 (p. 898).

Hyparrhenia filipendula (Figure 5A)
Vernacular names – hạ-hùng thòng (Vietnam); tambookie grass (Australia)

Description – tufted perennial, not aromatic, with culms to 2 m tall. Nodes hairless. Leaf sheaths

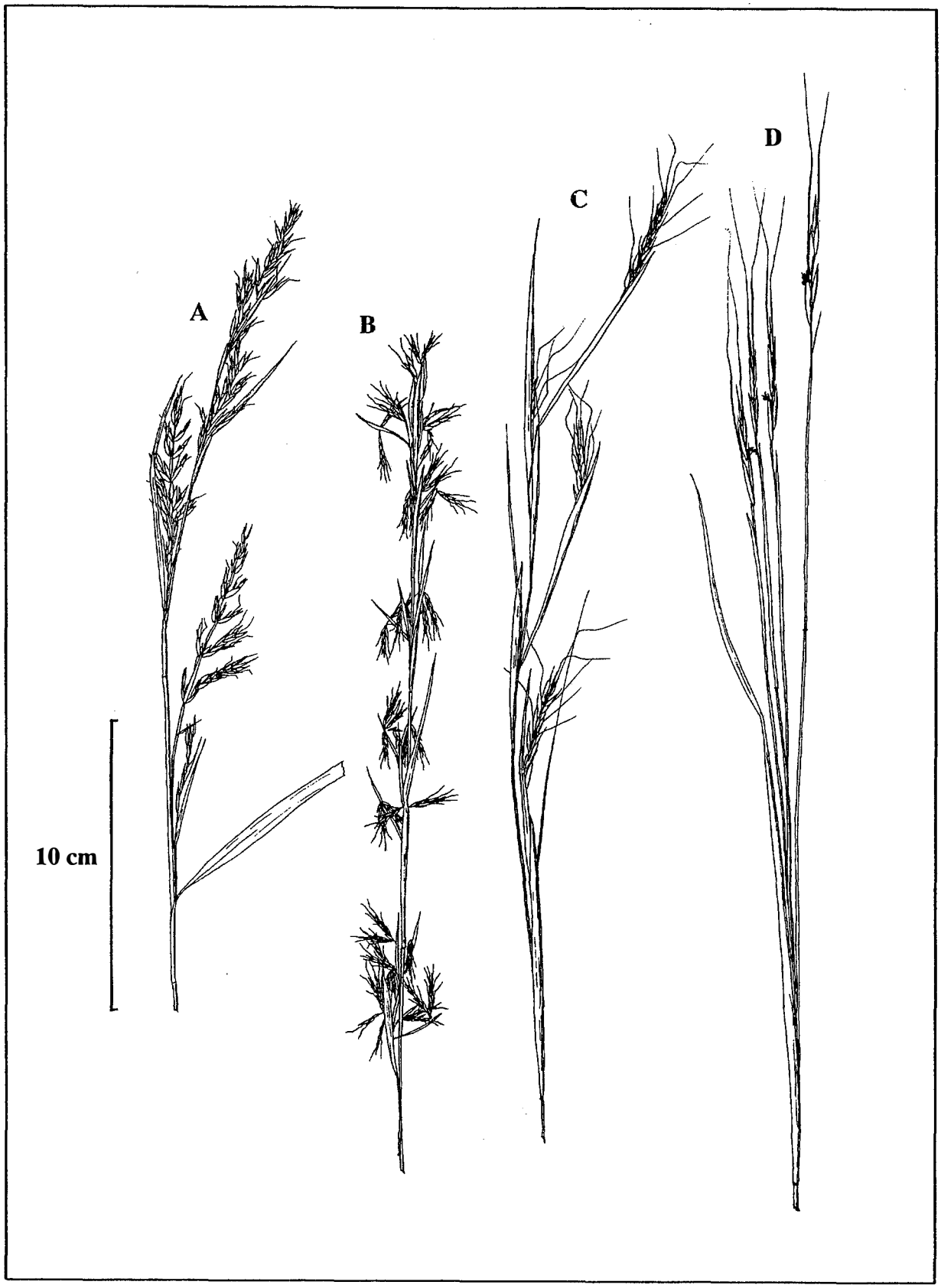


Figure 4. A – *Apluda mutica*; B – *Cymbopogon mekongensis*; C – *Diectomis fastigiata*; D – *Exotheca abyssinica*

hairless. Leaf blades up to 40 cm long, 6 mm wide, hairless except for a few hairs close to the ligule. Ligule a membrane 0.5-1 mm long, lacking hairs along the upper margin. Inflorescence a narrow spatheate panicle 30-80 cm long, with slender, paired racemes, each pair of racemes with 2-4 geniculate awns 3-6 cm long. Spikelets in the upper part of the raceme in dissimilar pairs, the sessile spikelet fertile, the pedicellate spikelet sterile. The sessile spikelet has 2 florets, only the upper one fertile, and is covered with white hairs. It is 4.5-8 mm long, and falls entire.

Habitat – occurs in open grasslands and woodlands, on soils derived from schists and granites.

Uses for livestock – moderately palatable to livestock, but only of minor significance. To a limited extent cultivated as a pasture species in tropical America.

Other uses – none.

Deleterious properties – none.

Distribution – South-east Asia, Philippines, Indonesia, Papua-New Guinea, Sri Lanka, Africa and eastern Australia. Occurs in Lâm Đồng Province at an altitude of c. 1000 m.

References – Schmid 1958, as *Cymbopogon filipendulus* (p. 229); Bor 1960 (p. 167); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960, as *Cymbopogon filipendulus* (p. 670); Pham-Hoaìng Hä 1972 (p.984); Lazarides 1980 (p. 47, 48); Tothill and Hacker 1983 (p. 275); Mannetje and Jones 1992 (p. 239); Pham-Hoàng Hộ 1993 (p. 897); Hacker *et al.* 1996 (p. 22).

Hyparrhenia rufa* var. *siamensis(Figure 5B)
Description – tufted perennial, not aromatic, with culms to 3 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades 30-60 cm long, 2-9, hairless. Ligule a 2 mm membrane with a tuft of hairs at each end. Inflorescence a spatheate panicle up to 1 m long, with paired racemes 15-25 mm long, the paired racemes with 6-7 geniculate awns. Spikelets in pairs, in the upper part of the raceme the spikelet pairs dissimilar, the sessile spikelet fertile, the pedicellate spikelet sterile. Sessile spikelet 4-5 mm long, with 2 florets, only the upper one fertile and with an awn 18-30 mm long, and usually covered with reddish-brown bristles, falling entire.

Habitat – grasslands, disturbed areas.

Uses for livestock – although the species has been grown as a forage, it is generally considered only to be palatable when young.

Other uses – none.

Deleterious properties – none.

Distribution – the species is native to tropical and southern Africa, but now widely naturalised in tropical America and Australia. The specimen collected in Vietnam was var. *siamensis*, of South-east Asian distribution. Occurs in Đắc Lắc province to the south-west of Buôn Ma Thuột at an altitude of c. 500 m, where it is locally common in disturbed areas.

References – Bor 1960 (p. 167); Lazarides 1980 (p. 47, 48); Clayton and Renvoize 1982 (p. 794); Tothill and Hacker 1983 (p. 276).

Kerriochloa siamensis (Figure 5C)
Vernacular names – kiết-thảo (Vietnam)

Description – slender perennial with culms 20-70 cm tall, branching extensively in the lower part of the plant and with leaves crowded on the culms. Nodes hairless. Leaf sheaths hairy. Leaf blades 1.5-5 cm

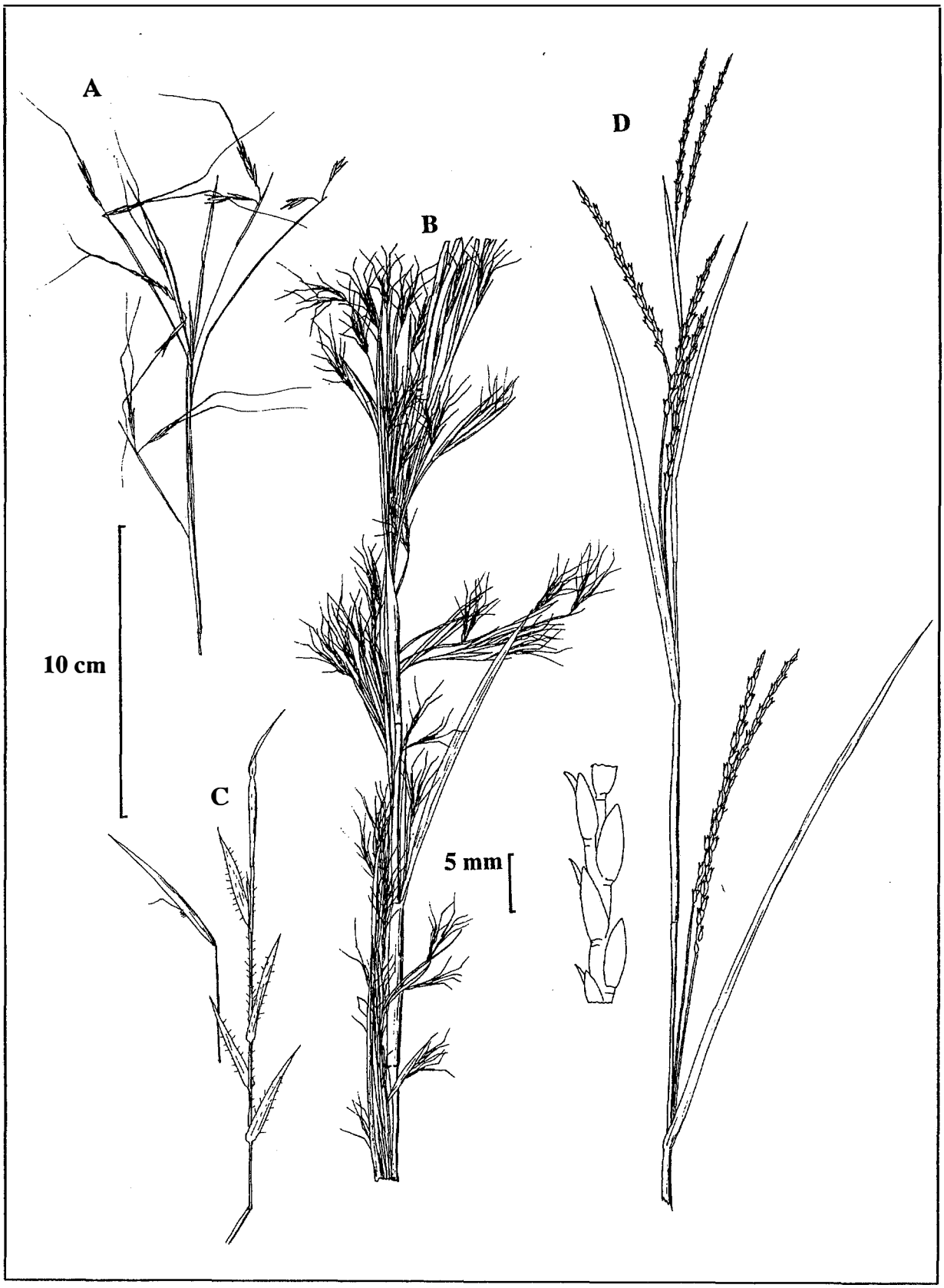


Figure 5. A – *Hyparrhenia filipendula*; B – *H. rufa* var. *siamensis*; C – *Kerriochloa siamensis*; D – *Mnesithea glandulosa*

long, 2.5-4 mm wide, hairy. Ligule a membrane 1 mm long, lacking hairs along the upper margin. Inflorescence a solitary raceme 2.5-3.5 cm long almost totally enclosed within a slightly curved modified leaf sheath, only 1-2 awns and ends of spikelets emerging. Spikelets in pairs, laterally compressed, the sessile spikelet fertile and bearing a geniculate awn c. 16 mm long, the pedicellate spikelet sterile. Sessile spikelet 5-6 mm long, with 2 florets, only the upper one fertile, falling entire with the adjacent rhachis internode and the pedicellate spikelet.

Habitat – occurs as a minor component of open grasslands, on degraded sandy granitic soils and lateritised red earths. Also reported as occurring on open rocky ground and along roadsides. A lowland form occurs in a wide range of situations in Cambodia.

Uses for livestock – tolerant of heavy grazing, but not a productive species.

Other uses – none.

Deleterious properties – none.

Distribution – Thailand, Vietnam, Cambodia. Occurs in Lâm Đồng Province in pine tree woodlands at altitude of c. 1000 m and sometimes in open grasslands cleared of pine trees where it can become locally dominant.

References – Schmid 1958 (p. 180-183); Pham-Hoàng Hộ 1972 (p. 967); Lazarides 1980 (p. 55); Pham-Hoàng Hộ 1993 (p. 886); Hacker *et al*. 1998 (p. 23).

Mnesithea glandulosa (Figure 5D)
Vernacular name – Xoang-trục sóng (Vietnam)

Description – erect grass sometimes to 2.5 m tall and with prop-roots at the base. Nodes Leaf sheaths. Leaf blades up to 60 cm long, 35 mm wide, hairless except for a few hairs towards the junction with the leaf sheath. Ligule a membrane 1 mm long. Inflorescence a leafy panicle, with clusters of racemes terminally and/or in upper leaf axils, the racemes fully emerged from the leaf sheath at maturity. Racemes 8-15 cm long, jointed, with spikelet pairs alternating on either side, breaking up at maturity. Spikelets in pairs, one sessile and fertile, the other pedicellate and sterile, its pedicel fused to the rhachis. Sessile spikelet 4-5 mm long, the lower glume hairy on the back, with 2 florets, only the upper one fertile. Pedicellate spikelet 1-2 mm long, shortly winged at the tip.

Habitat – grasslands, woodlands and disturbed forests up to an altitude of 1,000 m.

Uses for livestock – a leafy grass, but leaves are hard and of low nutritive value.

Other Uses – none.

Deleterious properties – none.

Distribution – Thailand, Vietnam, Malaysia, Indonesia, Papua New Guinea. In Central Vietnam found in disturbed area where there is some protection from heavy grazing.

References – Schmid 1958, as *Rottboellia glandulosa* (p. 191, 194); Bor 1960, as *Coelorhachis glandulosa* (p. 120); Gilliland 1971, as *Coelorhachis glandulosa* (p. 270); Pham-Hoàng Hộ 1972, as *Coelorhachis glandulosa* (p. 970); Mannetje and Jones 1992 (p. 240); Pham-Hoàng Hộ 1993 (p. 904).

Mnesithea laevis* var. *cochinchinensis (Figure 6A)
Vernacular name – ký-vĩ láng (Vietnam)

Description – erect perennial with culms to 2 m tall. Nodes hairless or minutely hairy. Leaf sheaths with

short, coarse hairs along the margins, otherwise hairless. Leaf blades up to 45 cm or more long, 2-5 mm wide, with coarse hairs along the margins, otherwise hairless. Ligule a membrane 1 mm long. Inflorescence a leafy panicle, with one to several racemes clustered terminally and/or in upper leaf axils, each raceme on a short peduncle, or sometimes reduced to a single raceme. Racemes up to 15 cm long, 2.5 mm thick, cylindrical, with the spikelets embedded in the rhachis and alternating on either side, breaking up at maturity. Spikelets single (the pedicellate spikelet reduced to a small scale), sessile, dorsoventrally compressed, hairless, 2.5-4 mm long, each with 2 florets, the upper one fertile, falling entire with the adjacent rhachis internode.

Habitat – grows in patches in grassland, savanna and open forest on sandy soils up to an altitude of 600 m., or heavy soils with disturbance.

Uses for livestock – a forage grass of minor importance.

Other Uses – none.

Deleterious properties – none.

Distribution – Thailand to south China, Philippines. Common in southern Indo-China, including Central Vietnam, where it occurs at altitudes up to and exceeding 1000 m. Generally occurs in moist areas as a minor component of grasslands and dipterocarp woodlands.

References – Schmid 1958, as *Rottboellia laevis* (p. 193, 194); Bor 1960 (p. 197); Pham-Hoàng Hộ 1972 (p. 971); Lazarides 1980 (p. 59); Mannetje and Jones 1992 (p. 240); Pham-Hoàng Hộ 1993 (p. 907); Hacker *et al*. 1996 (p. 21).

Mnesithea mollicoma (Figure 6B)
Vernacular name – ký-vĩ (Vietnam)

Description – erect perennial with culms 0.6-1.8 m tall. Nodes silky-hairy Leaf sheaths covered with soft hairs. Leaf blades mostly 23-38 cm long, 2-27 mm wide. Ligule a short membrane backed by dense hairs. Inflorescence a leafy panicle, with racemes borne terminally and/or axillary in upper leaf axils, each raceme on a long peduncle or sometimes with a single terminal raceme. Racemes up to 8 cm long, 2.5 mm thick, cylindrical, breaking up at maturity. Spikelets in 3s in the lower part of the raceme, 2 sessile and fertile, one pedicellate, reduced to 2 glumes, sterile. In the upper part of the raceme, spikelets in pairs, one sessile and one pedicellate. Sessile spikelets are sunk into hollows in the raceme axis. Sessile spikelets hairy, 3.5-5 mm long, with 2 florets, the upper one fertile.

Habitat – occurs at altitudes up to 1300 m in open scrub, rubber plantations and dipterocarp woodlands where it may be the dominant grass species.

Uses for livestock – a nutritive species, well grazed when young, but not high yielding. Classed as a minor forage.

Other Uses – none.

Deleterious properties – none.

Distribution – Thailand to southern China, Malaysia, Indonesia, Philippines. In Central Vietnam occurs Gia Lai province in moist areas in dipterocarp woodland at an altitude of c. 500 m.

References – Schmid 1958, as *Rottboellia mollicoma* (p. 193, 194); Gilliland 1971, (p. 268); Pham-Hoàng Hộ 1972 (p. 970); Lazarides 1980 (p.59); Mannetje and Jones 1992 (p. 240); Pham-Hoàng Hộ 1993 (p. 907).

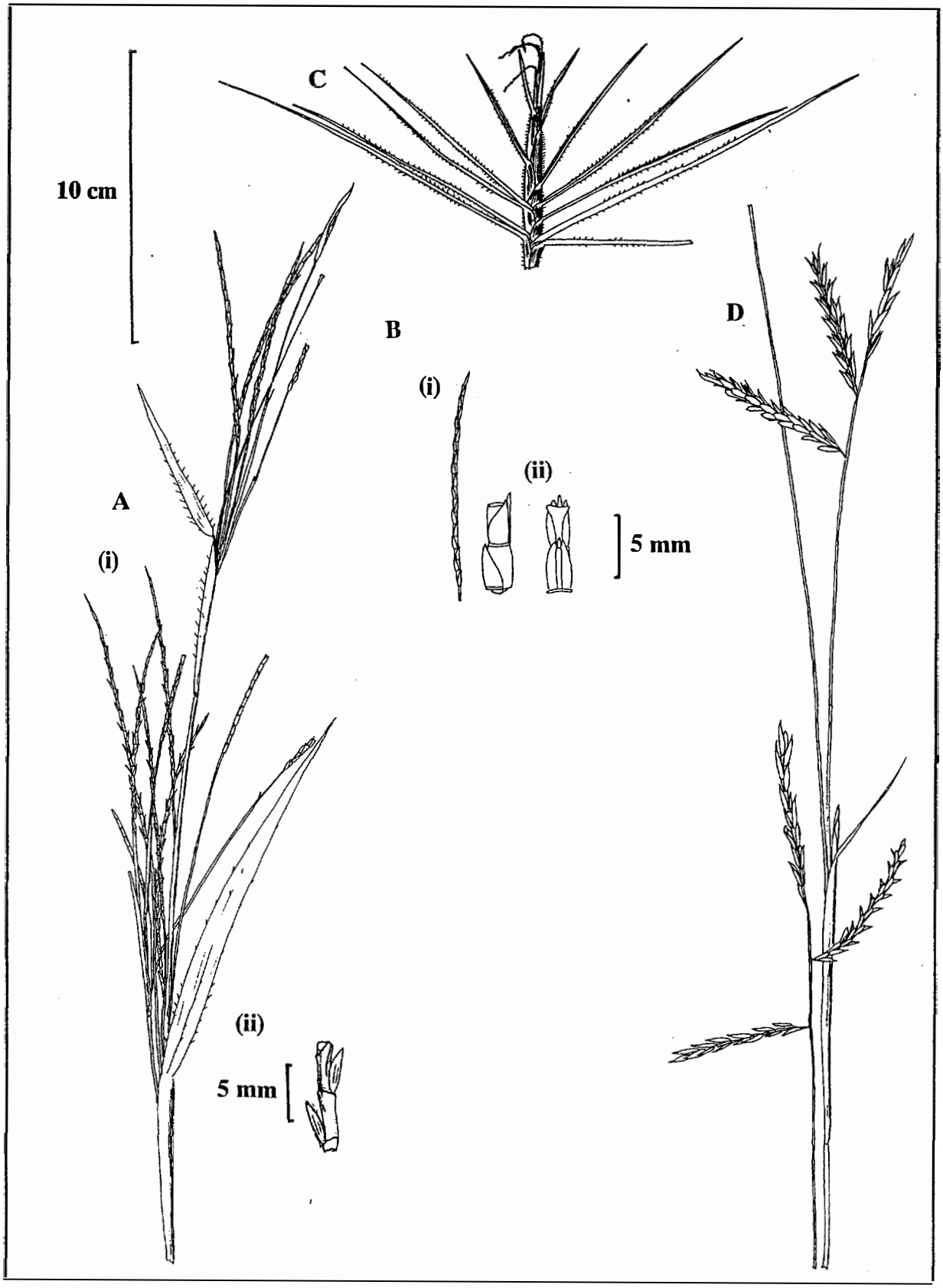


Figure 6. A – *Mnesithea laevis* var. *cochinchinensis* (i) inflorescence, (ii) spikelets; – *M. mollicoma* (i) inflorescence, (ii) spikelets; C – *Pennisetum clandestinum*; D – *Polytoca digitata*

Pennisetum clandestinum (Figure 6C)
Vernacular names – Kikuyu grass (Australia)

Description – a strongly stoloniferous and rhizomatous perennial forming a dense, low sward. Leaf sheaths densely hairy. Leaf blades 1-15 cm long, 1-5 mm wide, with a hairy midrib. Ligule a rim of

short hairs. The inflorescence comprises 2-4 spikelets which are concealed within the uppermost leaf sheath. Spikelets solitary, similar, 10-20 mm long, surrounded by a few short bristles, with 2 florets, only the upper one fertile. Anthers are exserted briefly on long filaments.

Habitat – moderately fertile to fertile soils and cool-tropical or warm-temperate climates, with rainfall >1000 mm. Tolerant of low pH and high aluminium and manganese levels in the soil.

Uses for livestock – an excellent grazing grass.

Other uses – also used as a lawn grass and for erosion control.

Deleterious properties – a potential weed of arable land.

Distribution – a native of East Africa. Widely sown and naturalised in the higher altitude Old World tropics, and subtropics. In Vietnam occurs along roadsides and in farm pastures in the vicinity of Da Lat, at close to or above 1000 m altitude.

References – Schmid 1958 (p. 656); Bor 1960 (p. 344); Lazarides 1980 (p. 134); Gilliland 1971 (p. 162); Tothill and Hacker 1983 (p. 337); Mannetje and Jones 1992 (p. 187); Pham-Hoàng Hộ 1993 (p. 853).

Polytoca digitata (Figure 6D)
Description – perennial with culms 0.75-2.5 m tall, often with prop-roots. Nodes densely covered with appressed hairs. Leaf sheaths hairless. Leaf blades 30-90 cm long, 12-38 mm wide, hairless, rough along the margins. Ligule membranous. Inflorescence a. number of spikelike racemes, often with a group of 3 at the top of the culm and also racemes from upper leaf axils. Lateral racemes are entirely male, whereas the central one is male towards the tip and near the base, female in between. Spikelets are 9-10 mm long, not awned.

Habitat – occurs in dipterocarp and pine tree woodlands, and grasslands, from sea level to 1500 m altitude and on a wide range of soil types. Often associated with *Imperata cylindrica*.

Uses for livestock – has been cultivated for fodder, but now considered to be a forage of minor significance.

Other Uses – none.

Deleterious properties – none.

Distribution – India to Vietnam, Indonesia, Philippines. Occurs in Lâm Đồng, Đắc Lắc and Gia Lai Provinces at altitudes up to 850 m, in open grassland situations.

References – Schmid 1958, as *P. heteroclita* (p. 145); Bor 1960 (p. 267); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960, as *P. heteroclita* (p. 654); Pham-Hoàng Hộ 1972 (p. 990); Lazarides 1980 (p. 97); Mannetje and Jones 1992, as *P. bracteata* (p. 242); Pham-Hoàng Hộ 1993 (p. 908).

Rottboellia cochinchinensis (Figure 7A)
Vernacular names – cỏ-mia (Vietnam)

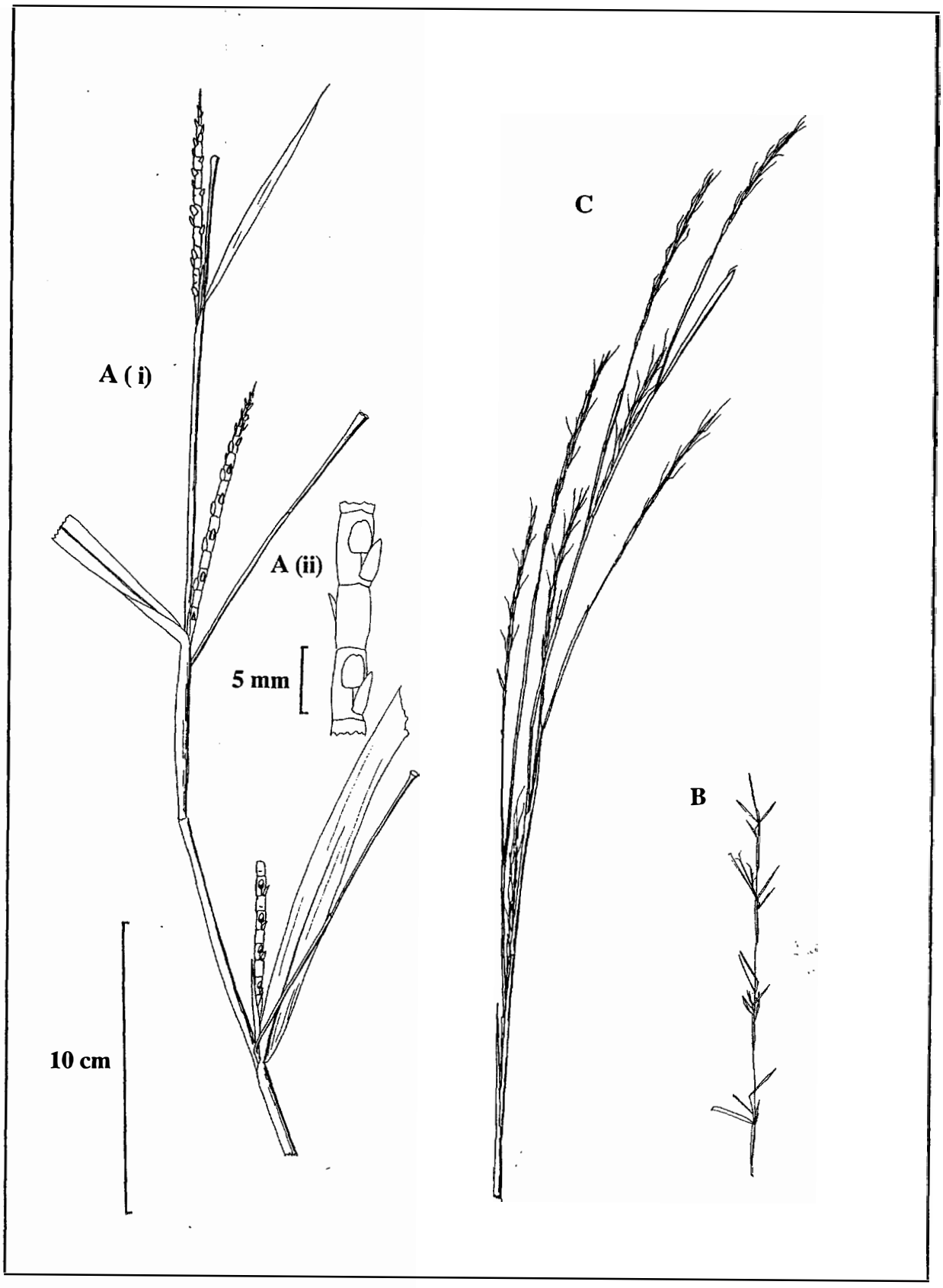


Figure 7. A – *Rottboellia cochinchinensis* (i) inflorescence, (ii) spikelets; B – *Schizachyrium brevifolium*; C – *S. sanguineum*

Description – an annual with prominent prop roots and culms from 0.8-3 m tall. Nodes hairless. Leaf sheaths often with prominent long and stiff hairs. Leaf blades up to 60 cm long, 10-25 mm wide, hairless. Inflorescence a leafy panicle, with single racemes 8-15 cm long, lacking awns, breaking up at maturity. Spikelets in dissimilar pairs, one sessile, the other pedicellate. Spikelets with two florets, the lower male, the upper bisexual, or, in pedicellate spikelets, male, awnless. Sessile spikelet c. 5 mm long, falling entire with the adjacent rhachis internode and the pedicel, the pedicellate spikelet falling separately. Pedicel of pedicellate spikelet fused with the joint.

Adaptation – a common species in disturbed sites including cultivation, plantations and stream banks but also in deciduous and secondary forests. It also occurs on quite fertile soils with high pH, including soils derived from limestone.

Uses for livestock – considered to be a moderately good forage and has also been made into hay or silage. In a pasture situation it forms coarse clumps, which tend to be less palatable to livestock than other grasses. Generally more palatable to water buffaloes than cattle.

Other uses – none.

Deleterious properties – can be a serious problem in rice fields.

Distribution – native to tropical and subtropical regions of South-east Asia, Africa and Australia; introduced to the West Indies and America. In Central Vietnam occurs in disturbed sites in Đắc Lắc and Gia Lai Provinces at altitudes of 250-600 m, often around cultivation.

References – Schmid 1958, (p. 193); Bor 1960 (p. 206); Pham-Hoàng Hộ 1972 (p. 969); Lazarides 1980 (p. 66); Tothill and Hacker 1983 (p. 365) all as *R. exaltata*; Pham-Hoàng Hộ 1993 (p. 906); Hacker *et al.* 1996 (p. 13).

Schizachyrium brevifolium (Figure 7B)
Vernacular names – tiết-phưởng lá-ngắn (Vietnam)

Description – a very delicate erect, ascending or trailing annual with culms 25-60 cm tall. Nodes hairless. Leaf sheaths hairless. Leaf blades flat, 1-5 cm long, 2-4 mm wide, blunt-ended, hairless. Ligule a membrane, lacking hairs along the upper margin. Inflorescence a narrow, leafy panicle, with very delicate terminal and axillary racemes 10-25 mm long, breaking up at maturity. Spikelets in dissimilar pairs, dorsoventrally flattened, the sessile spikelet fertile, the pedicellate spikelet sterile. Sessile spikelet 2-3.5 mm long, with 2 florets, only the upper one fertile, and a geniculate awn up to 16 mm long, falling entire with the adjacent rhachis internode and the pedicellate spikelet.

Habitat – a widespread and common species, indicative of low soil fertility. Occurs in degraded savannas, along tracks and roadsides, and in open sandy or rocky sites in dry forests or grasslands, but generally as a minor component of the vegetation.

Uses for livestock – an unproductive species of little significance as a forage.

Other uses – none.

Deleterious properties – none.

Distribution – South-east Asia, tropical Asia, Africa and America. In Central Vietnam occurs in Đắc Lắc and Gia Lai Provinces from low altitudes to altitudes >1000m.

References – Schmid 1958 (p. 200); Bor 1960 (p. 215); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 662); Gilliland 1971 (p. 291); Pham-Hoàng Hộ 1972 (p. 972); Lazarides 1980 (p. 69,700; Mannetje and Jones 1992 (p. 242); Pham-Hoàng Hộ 1993 (p. 895); Hacker *et al.* 1996 (p. 14); 1998 (p. 25).

Schizachyrium sanguineum (Figure 7C)
Vernacular names – tiết-phưởng máu (Vietnam)

Description – perennial with culms 0.6-1.5 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades 15-30 cm long, long and narrow, 2-6 mm wide, hairless. Ligule membranous. Inflorescence a leafy panicle, with slender single racemes 4-12 cm long, c. 2 mm wide, partly included in the spathe. Spikelets in pairs, dorsoventrally compressed, the sessile spikelet fertile, the pedicellate spikelet sterile. Sessile spikelet 7-8 mm long, with 2 florets, only the upper one fertile, with an awn 12-16 mm long, falling entire with the adjacent rhachis internode and the pedicellate spikelet.

Habitat – occurs in open sites in dry deciduous forest and grassy savannas, commonly on skeletal soils.

Uses for livestock – relished by stock at all times.

Other uses – none.

Deleterious properties – none.

Distribution – throughout South-east Asia and pan-tropical. Occurs in dipterocarp woodland in Đắc Lắc Province at an altitude of c. 500 m.

References – Schmid 1958, as *S. semiberbe* (p. 200); Bor 1960 (p. 216); Gilliland 1971 (p. 289); Pham-Hoàng Hộ 1972 (p.973); Lazarides 1980 (p. 70); Mannetje and Jones 1992 (p. 242); Pham-Hoàng Hộ 1993 (p. 895); Hacker *et al.* 1996 (p. 14).

Themeda arguens (Figure 8A)
Vernacular names – lô nhọn (Vietnam)

Description – annual with stiffly erect culms 1-3 m tall, the leaves densely tufted at the base. Leaf sheaths hairless except for a few hairs close to the leaf blade. Leaf blades 10-40 cm long, 1-8 mm wide, hairless except for a few hairs close to the ligule. Ligule a membrane 1 mm long. Inflorescence a spatheate panicle, with spikelets in clusters, each with a single sessile, fertile spikelet surrounded by 4 pedicellate, sterile spikelets. Sessile spikelet densely covered with brown hairs, 3 mm long, with 2 florets, only the upper one fertile, with a hairy awn 6 – 9 cm long. Pedicellate spikelets 8-10 mm long, hairless.

Habitat – grasslands and woodlands up to 1200 m altitude, particularly on disturbed ground.

Uses for livestock – a minor forage species, palatable only when young, soon becoming woody.

Other uses – none.

Deleterious properties – the 'seeds' are sharply pointed and can work their way into the mouths of grazing livestock, forming abscesses. Considered to be a weed in the Caribbean region.

Distribution – throughout South-east Asia, extending to Australia and introduced to the West Indies. Occasional in grasslands in Đắc Lắc Province in the vicinity of M'Drak, at an altitude of c. 500 m.

References – Schmid 1958 (p. 230); Bor 1960 (p. 250); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 669); Gilliland 1971 (p. 300); Pham-Hoàng Hộ 1972 (p. 988); Lazarides 1980 (p. 77); Mannetje and Jones 1992 (p. 243); Pham-Hoàng Hộ 1993 (p. 899).

Themeda arundinacea (Figure 8B)
Vernacular names – lô sậy, cỏ-dê (Vietnam)

Figure 8. A – *Themeda arguens*; B – *T. arundinacea*

overlapping sheaths. Nodes hairless. Leaf sheaths hairless to sparsely hairy. Leaf blades 40-100 cm long, 5-25 mm wide, hairless. Ligule a membrane with minute hairs along the upper margin. Inflorescence a leafy panicle, 30-60 cm long, with many clusters of bracts and spikelets. Spikelets in groups, with 1 sessile fertile spikelet surrounded by sessile and pedicellate sterile spikelets 12-16 mm long and covered with brown to golden brown hairs. The sessile spikelet is c. 10 mm long, bears a geniculate, hairy awn 30-50 mm long, and has 2 florets, only the upper one fertile, falling entire.

Habitat – a common and widespread species in grasslands and savannas of Indo-China, occurring on a variety of soil types, including infertile soils.

Uses for livestock – young growth is grazed, but plants soon become woody and unattractive to livestock.

Other uses – culms are used for building walls of houses and the leaves are used for pulp for paper-making.

Deleterious properties – the "seeds" are sharply pointed at the base and readily work their way into clothing and skin.

Distribution – India and throughout South-east Asia. Occurs in Đắc Lắc Province in the vicinity of M'Drak.

References – Schmid 1958 (p. 233); Bor 1960 (p. 250); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 669); Gilliland 1971 (p. 301); Pham-Hoàng Hộ 1972 (p. 987); Lazarides 1980 (p. 76); Pham-Hoàng Hộ 1993 (p. 899); Hacker *et al.* 1996 (p. 15); 1998 (p. 27).

Themeda caudata
Vernacular names – lô duôi, cỏ-phao (Vietnam)

Description – Robust perennial with culms 2.5-6 m tall, from a strongly flattened base. Leaf blades 40-100 cm long, 5-25 mm wide, hairy on the under side and with a white midrib. Ligule membranous. Inflorescence a spatheate panicle up to c. 1.5 m long, the spikelets in clusters with 2-3 fertile, sessile spikelets surrounded by sparsely hairy male spikelets 8-15 mm long. Sessile spikelet with a geniculate, hairy awn 40-80 mm long.

Habitat – woodlands.

Uses for livestock – a coarse grass, but likely to be palatable to livestock when young.

Other uses – none.

Deleterious properties – none.

Distribution – India to Vietnam, Indonesia. In Central Vietnam occurs in Lâm Đống Province in areas cleared from pine tree woodlands at an altitude of 850 m.

References – Schmid 1958 (p. 233); Bor 1960 (p. 250); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 669); Pham-Hoàng Hộ 1972 (p. 987); Lazarides 1980 (p. 77); Pham-Hoàng Hộ 1993 (p. 900).

Themeda intermedia (Figure 9A)
Description – a robust perennial with culms to 2-5 m tall, the tillers strongly flattened at the base (up to c. 10 cm wide). Nodes hairless. Leaf sheaths hairless. Leaf blades up to 100 cm long, 15 mm wide, sparsely hairy on the under surface only. Ligule a membrane 1 mm long, lacking hairs along the upper margin. Inflorescence a spatheate panicle, up to c. 1 m long, with arching branches. Spikelets in clusters with 2-3 sessile fertile spikelets surrounded by sterile spikelets. Fertile spikelets 7 – 9 mm long, dark

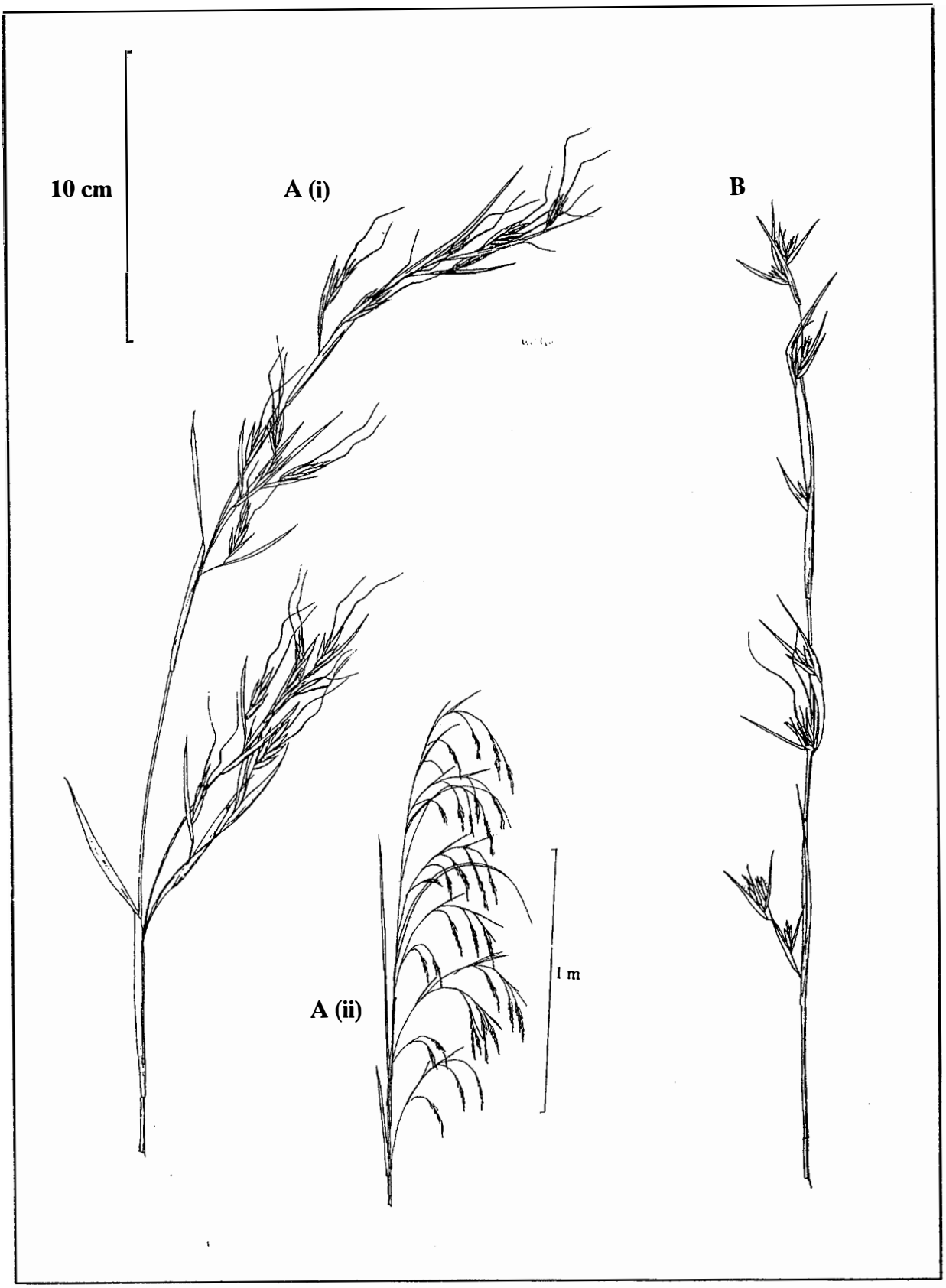


Figure 9. A – *Themeda intermedia* (i) part of inflorescence, (ii) entire inflorescence; B – *T. triandra*

brown and densely hairy, each awnless or bearing a geniculate or almost straight awn 10 – 30 mm long. Sterile spikelets 10-15 mm long, densely covered with golden to brown hairs.

Habitat – grasslands and woodlands

Uses for livestock – likely to be palatable to livestock when young.

Other Uses – none.

Deleterious properties – none.

Distribution – occurs from India to Vietnam, Indonesia, Philippines and Papua New-Guinea. In the highlands of Lâm Đồng Province, Vietnam, frequent in pine tree woodlands at altitudes of c. 1000 m.

References – Bor 1960 (p. 251); Hacker et al. 1998 (p. 29).

Themeda triandra (Figure 9B)
Vernacular names – lô tam-húng (Vietnam); kangaroo grass (Australia)

Description – perennial, forming tussocks and with culms 0.3-2 m tall. Nodes hairless. Leaf sheaths hairless below, but often hairy above. Leaf blades 8-65 cm long, 2-10 mm wide, hairless. Ligule a membrane with minute hairs along the upper margin. Inflorescence a leafy panicle 10-30 cm long, with several clusters of leafy bracts and spikelets with 2-3 awns to 8 cm long from each cluster, the awns thick and dark at the base, geniculate. Spikelets in groups, with a single sessile fertile spikelet surrounded by 2 pairs of sessile and 1 pair of pedicellate male or sterile spikelets. Sessile spikelet 6-11 mm long, with a 30-60 mm long geniculate, hairy awn. Sterile spikelets 7-14 mm long, usually hairless.

Habitat – occurs in savannas and grasslands, generally on lighter soils. Tolerant of some shade, but generally not adapted to the most degraded or very dry soils.

Uses for livestock – a palatable and nutritious grass, especially when young, but may die out if grazed or burnt too frequently.

Other uses – none.

Deleterious properties – none.

Distribution – widely distributed in savannas, woodlands and grasslands in South-east Asia and wetter areas of African and Australian tropics and subtropics, where the species also extends into temperate latitudes. Occurs in Lâm Đồng Province at altitudes of c. 1000 m.

References – Schmid 1958 (p. 230-232); Bor 1960 (p. 254); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 669); Pham-Hoàng Hộ 1972 (p. 986); Lazarides 1980 (p. 76); Tothill and Hacker, as *T. australis* 1983 (p. 403); Pham-Hoàng Hộ 1993 (p. 901); Hacker *et al.* 1996 (p. 15); 1998 (p. 28).

Themeda villosa
Vernacular names – lô mía (Vietnam)

Description – robust perennial with culms to 4 m tall, flattened at the base. Nodes hairless. Leaf sheaths hairless. Leaf blades up to 150 cm long, 20 mm wide, hairless, with rough margins. Ligule a minute rim fringed with short hairs. Inflorescence a dense, spatheate, drooping panicle up to 1 m long. Spikelets in clusters, with 2-3 fertile spikelets surrounded by male spikelets up to 10 mm long. Fertile spikelets covered with brown hairs, awnless or with a geniculate, hairy awn up to 42 mm long.

Habitat – occurs in open woodlands or grasslands up to an altitude of 1500 m, in moist, often disturbed situations.

Uses for livestock – very palatable when young, but soon becomes coarse.

Other Uses – used for making pulp for paper, which is of good quality, but the pulp is difficult to bleach.

Deleterious properties – none.

Distribution – India and throughout South-east Asia. In the Lám Âäúng Province, occurs in pine tree woodlands at altitudes of up to 1500 m. The specimens collected of this species near Âaì Laût were atypically low-growing, with weak, prostrate stems and inflorescences.

References – Schmid 1958 (p. 232, 233); Bor 1960 (p. 254); Pham-Hoàng Hộ and Nguyến-Van-Dương 1960 (p. 669); Gilliland 1971 (p. 301); Pham-Hoàng Hộ 1972 (p. 987); Lazarides 1980 (p. 76, 78); Pham-Hoàng Hộ 1993 (p. 901).

Group 2 – Robust grasses >2 m tall, with plumose panicles

Miscanthus floridulus (Figure 10)
Vernacular names – lò (Vietnam)

Description – robust perennial to 4 m tall, with solid culms, forming large tussocks. Leaf sheaths hairy along the margins. Leaf blades to 1.2 m long, 12-45 mm wide, with a prominent white mid-vein and rough margins. Ligule a membrane 1-3 mm long, minutely hairy along the upper margin. Inflorescence a large white, pinkish or greyish panicle up to or exceeding 45 cm long, 30 cm across with unbranched racemes from a short axis. Spikelets paired, similar, dorsoventrally compressed, 3.5-5 mm long, awned, with 2 florets, only the upper one fertile, falling entire from the persistent branches.

Habitat – open situations, forest margins and cleared land once under forest.

Uses for livestock – a robust grass which rapidly becomes unpalatable to livestock; of no significance as fodder.

Other uses – culms are used for arrow-shafts in Papua New Guinea and for racks for vegetables and tobacco in the Philippines. The Hmong people in Laos use it symbolically in clan gatherings to exorcise bad luck.

Deleterious properties – none.

Distribution – widespread in the Malay Peninsular and South-East Asia, Indonesia, Taiwan, Japan, Papua-New Guinea and the Philippines. Common and widespread on induced grasslands in the M'Drak area of Đắc Lắc Province.

References – Gilliland 1971 (p. 217); Pham-Hoàng Hộ 1972 (p. 956); Lazarides 1980 (p. 58); Pham-Hoàng Hộ 1993 (p. 859); Hacker *et al.* 1998 (p. 31).

Neyraudia arundinacea (Figure 11)
Vernacular names – Sậy unở (Vietnam)

Description – reed-like perennial with stout, solid culms 1.5-3.5 m tall. Nodes hairless. Leaves mostly on the culms, on short internodes, the blades disarticulating from the sheaths. Leaf sheaths hairless. Leaf blades 30-80 cm long, c. 25 mm wide, hairless, lacking a white midrib. Ligule a fringe of long hairs. Inflorescence an open panicle up to c. 60 cm long, with numerous fine branches in whorls and extensive secondary branching. Spikelets solitary, all similar, laterally compressed, 6-9 mm long, narrow, awnless, with a hairy rhachilla and 3-8 fertile florets, each with a 1-2 mm awn, the glumes shorter than the adjacent florets.

Habitat – occurs in grasslands and open woodlands up to an altitude of 2000 m, often along roadsides and other disturbed sites.

Uses for livestock – grazed when young, but rapidly becomes cause and low in quality.

Other Uses – in parts of Lao PDR young shoots are cooked as a vegetable. Inflorescences are used for making mattresses and the culms are used for support for thatch for houses.

Deleterious properties – none.

Distribution – India, Thailand, Lao PDR, Vietnam, tropical Africa. In Đắc Lắc and Lâm Đồng Provinces, a common species at altitudes of 400-1300 m, particularly east of M'Drak, Đắc Lắc Province.

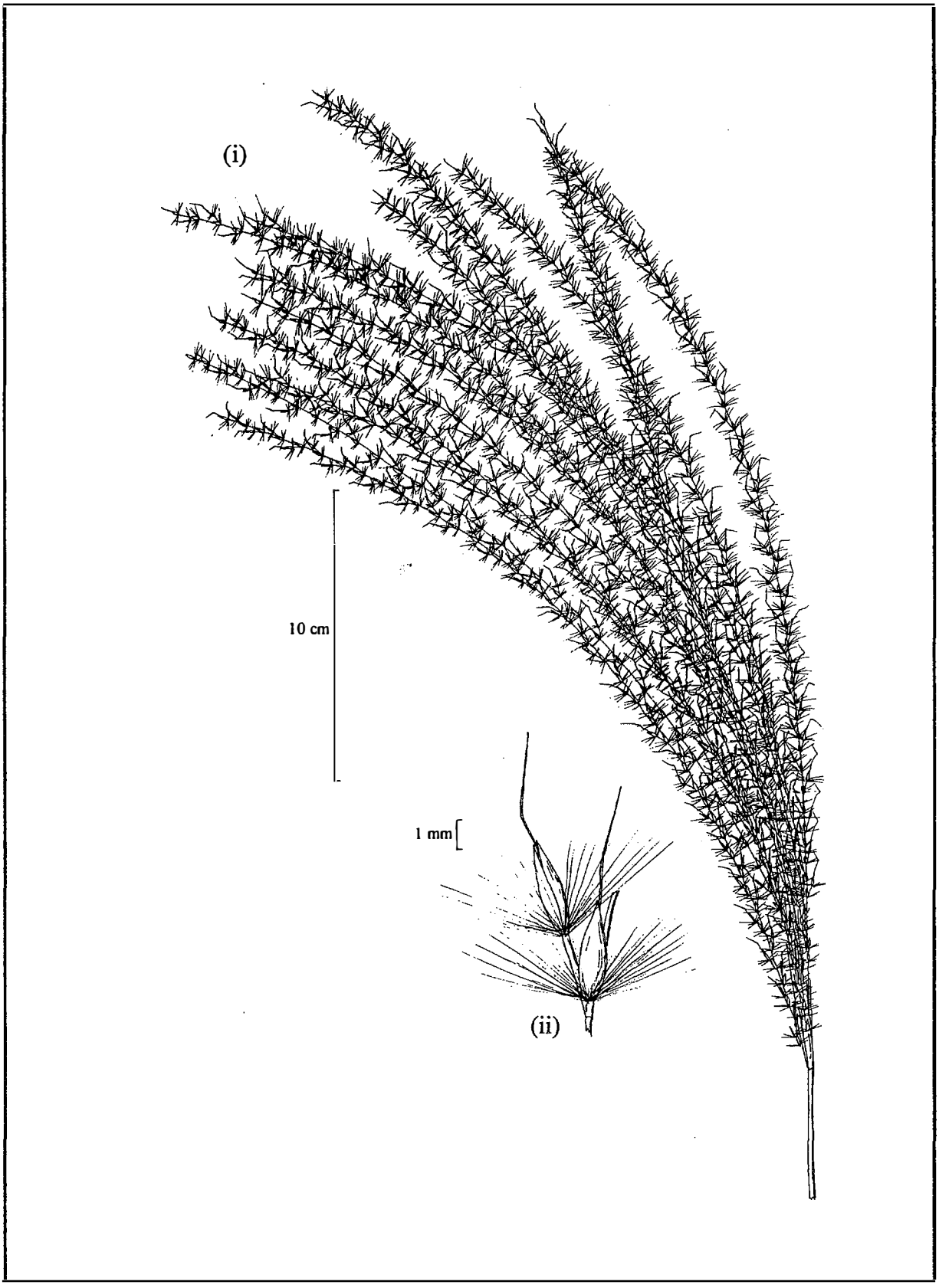


Figure 10. *Miscanthus floridulus* (i) inflorescence, (ii) pair of spikelets

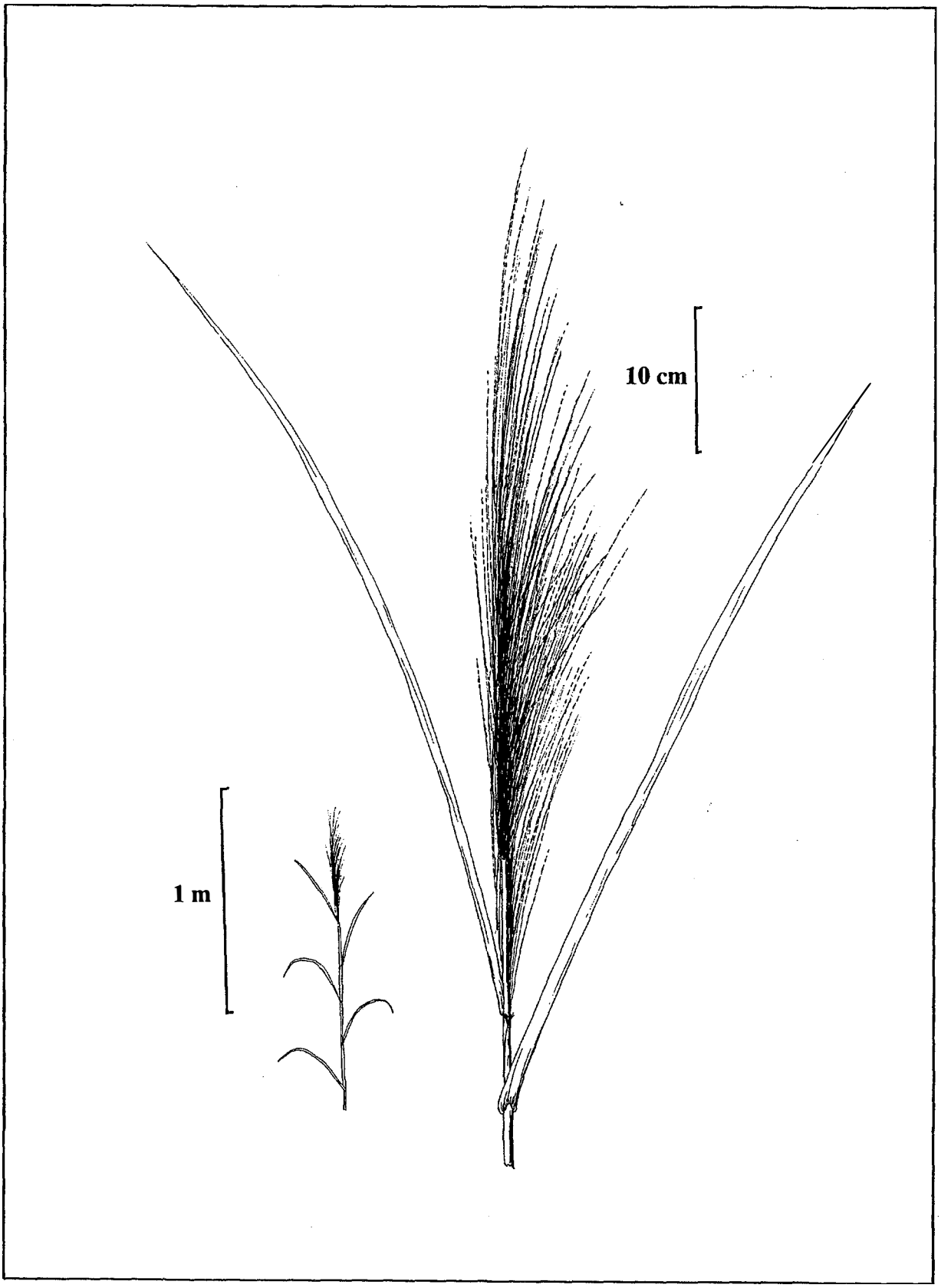


Figure 11. *Neyraudia arundinacea* (i) emerging inflorescence, (ii) culm

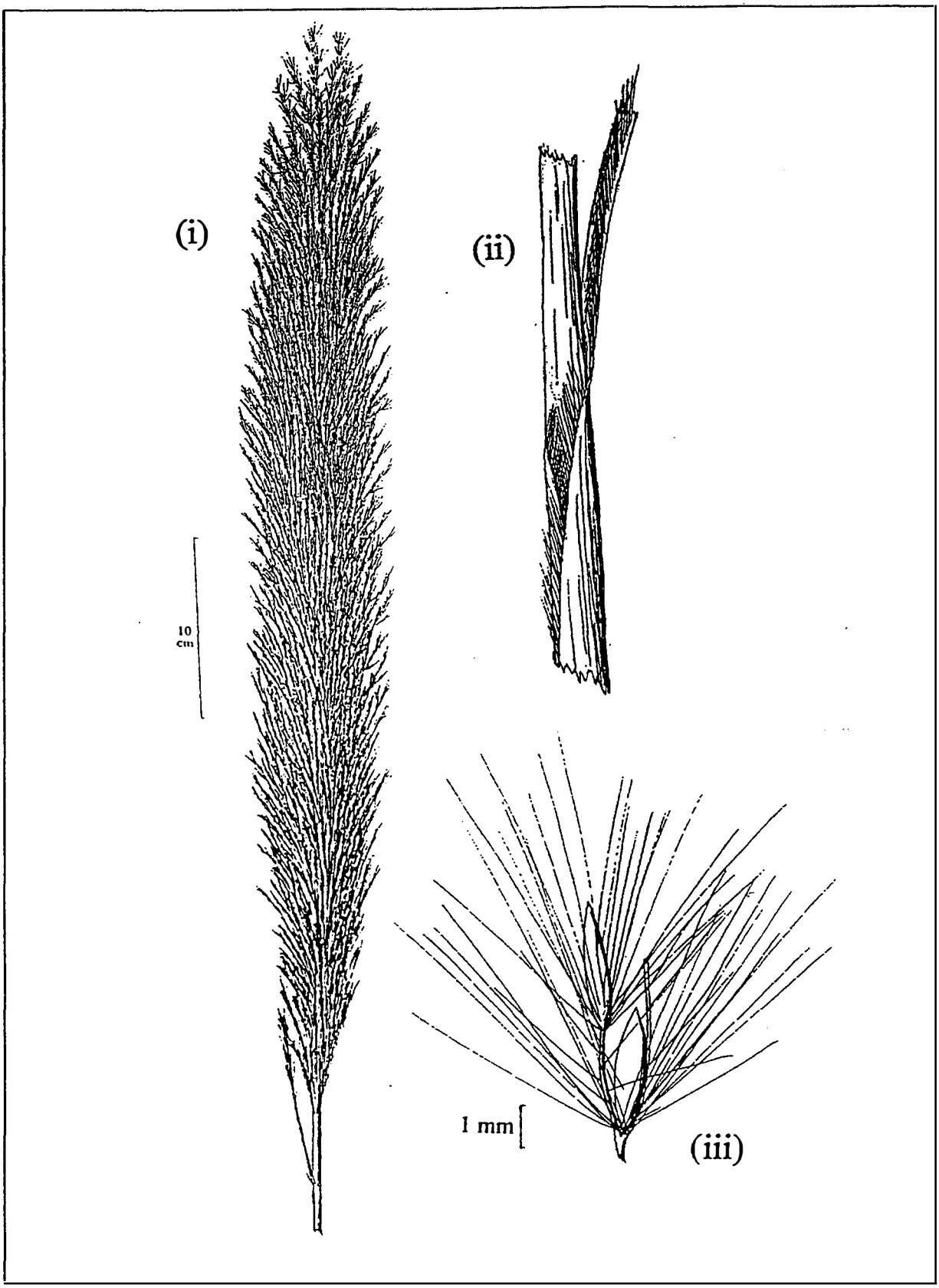


Figure 12. *Saccharum arundinaceum* (i) inflorescence, (ii) junction of leaf blade and sheath, (iii) pair of spikelets

References – Schmid 1958, as *Arundo madagascariensis* (p. 490); Bor 1960 (p. 518); Pham-Hoàng Hộ 1972 (p. 879); Lazarides 1980 (p. 178); Pham-Hoàng Hộ 1993 (p. 787); Hacker *et al.* 1998 (p. 31).

Saccharum arundinaceum (Figure 12)
Vernacular names – lách (Vietnam).

Description – robust perennial with rhizomes and forming large tussocks, with culms 2.5-7 m or more tall. Lower nodes 2 cm or more thick. Lower leaf sheaths densely covered with spreading, white hairs, the upper sheaths hairless except for a fringe of long hairs along the margins close to the junction with the leaf sheath. Leaf blades up to 2.5 m long, 7.5 cm wide, hairless, but sharp along the margins, and with a distinct white mid-vein. Ligule a short rim, bordered by dense, stiff hairs. Inflorescence a bushy panicle 30-100 cm long, with extensive secondary branching, the main axis densely hairy. Spikelets paired, similar, 2.5-4 mm long, each with 2 florets, only the upper one fertile, falling entire.

Habitat – Generally a species of lower altitudes, favouring riverbanks and moist areas.

Uses for livestock – palatable to livestock when young, but needs to be cut at frequent intervals to provide leafy forage.

Other uses – the thick culms are commonly used for making frames for huts.

Deleterious properties – as it is unpalatable when it matures, it may become increasingly dominant in overgrazed grasslands.

Distribution – India- Vietnam, Sri Lanka. In Central Vietnam, abundant in open grasslands in Đắc Lắc Province at altitudes up to 600 m, where it occurs on infertile soils in association with *Imperata cylindrica.*

References – Schmid 1958 (p. 156, 160); Bor 1960 (p. 211); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 664); Gilliland 1971 (p. 226); Pham-Hoàng Hộ 1972 (p. 957); Lazarides 1980 (p. 68); Pham-Hoàng Hộ 1993 (p. 862); Hacker *et al.* 1998, as *Saccharum* sp. No 1476 (p. 38).

Group 3 – Grasses with spike-like inflorescences

Eremochloa ciliatifolia (Figure 13A)
Description – perennial with culms to 20-60 cm tall. Nodes usually shortly hairy. Leaf sheaths hairless. Leaf blades flat, 4-15 cm long, 5-10 mm wide, with a blunt tip and conspicuous long hairs along the margins. Ligule a short membrane. Inflorescence a characteristically curved, 1-sided raceme 4-7 cm long, borne on a long peduncle. Spikelets solitary (the pedicellate spikelet reduced to a pedicel bearing a 2.5 mm bristle), similar, dorsoventrally compressed, 4-5 mm long, awnless, with long bristles up to 3 mm long along the margins, and with 2 florets, only the upper one fertile, falling with the adjacent rhachis intemode and pedicel.

Habitat – occurs in open dipterocarp forests and grasslands on sandy soils, sometimes forming small, locally dominant communities.

Uses for livestock – a species apparently grazed and tolerant of heavy grazing.

Other uses – none.

Deleterious properties – none.

Distribution – Burma – Vietnam, Malaysia. In Central Vietnam, locally common in Đắc Lắc Province in short-grass areas with *Chrysopogon aciculatus* at medium altitudes c. 500 m.

References – Bor 1960 (p. 146); Lazarides 1980 (p. 38); Hacker *et al.* 1996 (p. 17).

Heteropogon contortus (Figure 13B)
Vernacular names – dị-thảo vặn (Vietnam); speargrass, black speargrass (Australia).

Description – a perennial species to 1 m tall (rarely to 1.5 m), well-tillered and leafy early in the season, but becoming stemmy at flowering. Nodes hairless. Leaf sheaths compressed, sometimes with a few hairs near the ligule. Leaf blades up to 30 cm long, 2-8 mm wide, almost hairless, folded towards the base, and with the tip blunt, canoe-shaped. Inflorescence a 3-8 cm raceme with a long peduncle – several may arise from a single culm, from upper leaf sheaths. Spikelets paired, dissimilar, the lower fertile and sessile, the upper sterile. Sessile spikelet 5-7 mm long, with 2 florets, only the upper one, which bears a long, black, geniculate awn, fertile, the spikelets falling entire, often with joints and pedicels.

Habitat – adapted to light and medium-textured soils. Apparently less shade-tolerant than the related *H. triticeus.*

Uses for livestock – in Australia it is regarded as a valuable grazing grass in native subtropical and tropical rangelands. In Australia, overgrazing can result in it being replaced by unpalatable species such as *Aristida*.

Other uses – none.

Deleterious properties – the sharp seed-bases can penetrate the hides of sheep, and, in the most severe cases, can cause death. Cattle are much less likely to suffer injury.

Distribution – south and South-east Asia and the tropics and subtropics of Australia, Africa and the Americas. In Central Vietnam often the dominant grass species in dipterocaip woodland (e.g. south of Plây Cu).

References – Schmid 1958 (p. 221); Bor 1960 (p. 163); Gilliland 1971 (p. 292); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 650); Pham-Hoàng Hộ 1972 (p. 981); Lazarides 1980 (p. 46); Tothill

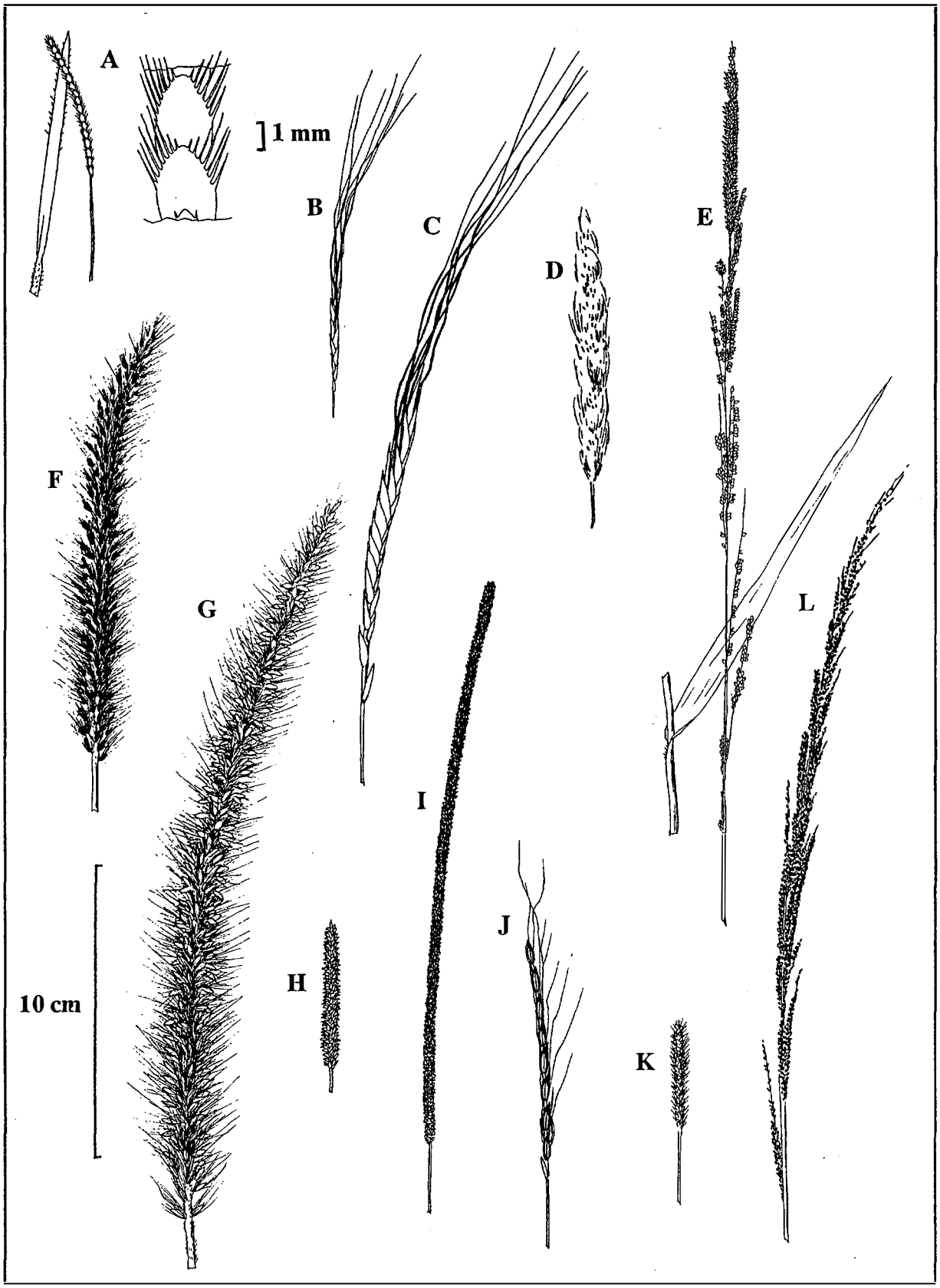


Figure 13 . A – *Eremochloa ciliatifolia*; B – *Heteropogon contortus*; C – *H. triticeus*; D – *Imperata cylindrica*; E – *Panicum auritum*; F – *Pennisetum polystachion*; G - *P. purpureum*; H – *Sacciolepis indica*; I – *S. myuros*; J – *Sehima nervosum*; K – *Setaria parviflora*; L – *Sporobolus indicus* var. *major*

and Hacker 1983 (p. 279); Mannetje and Jones 1992 (p. 137); Pham-Hoàng Hộ 1993 (p. 898); Hacker *et al.* 1996 (p. 19).

Heteropogon triticeus (Figure 13C)
Vernacular names – dị-thảo to (Vietnam); giant speargrass (Australia)

Description – a robust annual or short-lived perennial species, sometimes with prop roots, and with culms from 1.3 to 3 m tall from a strongly flattened, leafy base. Nodes hairless. Leaf blades up to 60 cm or more long, narrow, hairless. Inflorescence a raceme 10-20 cm long, with one to several borne separately on long peduncles in upper leaf axils. These are similar to those of *H. contortus*, but much larger, 12-20 cm long. Spikelets paired, dissimilar, the lower fertile and sessile, the upper sterile, borne on a peduncle. Sessile spikelet 12-20 mm long, with 2 florets, only the upper one, which bears a black, geniculate awn 10-15 cm long, fertile, the spikelets falling entire, often with joints and pedicels.

Habitat – grows in a range of situations, from dry hillsides to near streams and paddy fields. In central Vietnam frequently encountered in open dipterocarp and pine tree woodlands

Uses for livestock – reputed to be palatable to livestock.

Other uses – none.

Deleterious properties – none.

Distribution – south and South-east Asia and tropical Australia. Although *H. triticeus* generally has a more tropical adaptation than *H. contortus*, in Vietnam it occurs in Lâm Đồng Province at altitudes of up to 1300 m.

References – Schmid 1958 (p. 221); Bor 1960 (p. 165); Pham-Hoàng Hộ 1972 (p. 982); Lazarides 1980 (p. 46); Tothill and Hacker 1983 (p. 260); Mannetje and Jones 1992 (p. 239); Pham-Hoàng Hộ 1993 (p. 899); Hacker *et al.* 1996 (p. 20).

Imperata cylindrica (Figure 13D)
Vernacular names – tranh (Vietnam); blady grass (Australia).

Description – strongly rhizomatous perennial to 1.8 m tall. Nodes usually with a ring of silky hairs. Leaf sheaths with hairy margins. Leaf blades basal, commonly erect, up to 180 cm long, 5-25 mm wide, with a prominent midrib and very rough margins. Ligule a 0.5 mm membrane with minute hairs along the upper margin. Inflorescence a narrow spike-like panicle 3-30 cm long. Spikelets in pairs, similar, 3-6 mm long covered with silky, white hairs up to 25 mm long, with 2 florets, only the upper one fertile, falling entire. In contrast to other grasses discussed in this booklet, which flower towards the end of the monsoon, *I. cylindrica* is reported to flower and seed in April-May.

Habitat – adapted to a wide range of soil types, but generally favours lighter soils. In Indo-China occurs up to an altitude of 2,000 m, in moderately to very humid districts. Characteristically a species of full sunlight, frequently dominating hillsides that have been cleared from primary or secondary forest. Tolerant of fire and cultivation.

Uses for livestock – grazed when young, but becomes unpalatable as it matures. In many parts of South-east Asia, burning is practised to maintain palatable herbage, and this increases the dominance of *I. cylindrica*.

Other uses – a good species for thatching and can be made into paper. Reputed in the Philippines to have medicinal properties. In parts of Laos roots rhizomes are used in the treatment of kidney pains.

Deleterious properties – seeds are widely dispersed by wind and colonise bare areas and cultivation. Rhizomes are difficult to kill, making this a well-known weed throughout the region.

Distribution – south and South-east Asia, east and southern Africa, tropical and subtropical Australia. Widespread throughout the Central Highlands of Vietnam.

References – Schmid 1958 (p. 153,154); Bor 1960 (p. 169); Gilliland 1971 (p. 220); Pham-Hoàng Hộ 1972 (p. 956); Lazarides 1980 (p. 49,50); Tothill and Hacker 1983 (p. 279); Mannetje and Jones 1992 (p. 140); Pham-Hoàng Hộ 1993 (p. 858); Hacker *et al.* 1996 (p. 20); 1998 (p. 41).

Microchloa indica (Figure 14A)
Description – very small, tussock-forming annual often forming mats and with culms to 40 cm tall. Nodes hairless. Leaf sheaths hairless. Leaf blades rolled, up to 3 cm log, 0.5 mm wide, hairless except for a few hairs close to the junction with the leaf sheath. Ligule a membrane, with a row of minute hairs along the upper margin. Inflorescence a slightly curved spike 4-8 cm long, with a row of overlapping, dorsoventrally compressed spikelets on one side. Spikelets solitary, all similar, usually 2-2.5 mm long, with a single floret, disarticulating above the glumes.

Habitat – a pioneer plant, often growing on cleared soil where there is little competition.

Uses for livestock – an unproductive species, of no significance for livestock.

Other Uses – none.

Deleterious properties – none.

Distribution – India, Malaysia, Vietnam, China, tropical Africa, South America. In Đắc Lắc province it occurs west of M'Drak in areas of exposed granite pavements.

References – Schmid 1958 (p. 510); Bor 1960 (p. 473); Pham-Hoàng Hộ 1972 (p.897); Lazarides 1980 (p. 162); Mannetje and Jones 1992 (p. 240); Pham-Hoàng Hộ 1993 (p. 803).

Mnesithea laevis (Figure 6A)

See page 12.

Mnesithea mollicoma (Figure 6B)

See page 13.

Panicum auritum (Figure 13E)
Description – rhizomatous perennial with culms 0.5-2 m (rarely to 4 m) tall. Nodes hairless. Leaf sheaths hairy along the upper margins, otherwise hairless. Leaf blades 10-60 cm long, 4-35 mm wide, blunt at the base, and tapering to the tip, hairless, but with rough margins. Ligule a minute rim c. 0.3 mm long, lacking hairs along the upper margin, but with a few hairs in the throat. Inflorescence a. narrow spikelike panicle up to 9-45 cm long and 2-15 cm wide, the spikelets borne in clusters along short secondary branches. Spikelets in pairs, all similar, dorsoventrally compressed, 2-3 mm long, with 2 florets, only the upper one fertile, the glumes very unequal, shedding entire.

Habitat – to 1200 m. Occur in wet sites in grasslands and woodlands, including standing water. Commonly occurs in disturbed land.

Uses for livestock – a good fodder grass.

Other Uses – none.

Deleterious properties – a minor weed of plantations.

Distribution – India, South-east Asia, southern China. In Đắc Lắc province it occurs in swampy areas near M'Drak.

References – Bor 1960 (p. 324); Gilliland 1971 (p. 137); Lazarides 1980 (p. 126, 129); Mannetje and Jones 1992 (p. 239); Pham-Hoàng Hộ 1993 (p. 827).

Pennisetum polystachion (Figure 13F)
Vernacular names – đuôi-voi nhỏ (Vietnam); feather pennisetum (Australia)

Description – a robust annual, or sometimes perennial with culms 1-3 m tall. Nodes hairless. leaf sheaths densely hairy towards the junction with the leaf blade. Leaf blades 5-50 cm long, 4-18 mm wide, hairless or hairy. Ligule a collar 1-3.5 mm long, with a row of short hairs along the upper margin. Inflorescence a dense spike-like panicle 5-25 cm long, 13-26 mm wide, purplish in colour. Spikelets solitary, similar, 3-5 mm long, surrounded by spreading bristles up to 30 mm long, 2-flowered, only the upper one fertile, falling entire and free from the bristles.

Habitat – occurs on clay soils as well as sandy soils, but mostly on disturbed ground, where it can occur in monospecific communities. It is tolerant of some shade and increases with regular burning.

Uses for livestock – has been described as a useful fodder and can be made into hay.

Other uses – useful for controlling soil erosion. Can be made into paper pulp.

Deleterious properties – generally considered a weedy species.

Distribution – native to tropical Africa and India, but now pan-tropical. In South-east Asia generally restricted to lower altitudes (<200 m). Abundant in the vicinity of Buôn Ma Thuôt, where it forms monospecific stands on disturbed land.

References – Bor 1960 (p. 346); Pham-Hoàng Hộ 1972 (p. 930); Lazarides 1980 (p. 134); Mannetje and Jones 1992 (p. 189); Pham-Hoàng Hộ 1993 (p. 853, 854).

Pennisetum purpureum (Figure 13G)
Vernacular names – cỏ đuôi-voi (Vietnam); elephant grass, Napier grass (Australia)

Description – an erect perennial with culms 1-4 m (sometimes to 6 m) tall, forming large clumps and sometimes developing stolons and rhizomes. Leaf sheaths hairless or with bristles. Leaf blades up to 150 cm long, 50 mm wide, hairless or with hairs at the base and with rough margins. Ligule a minute rim, bearing a row of hairs 2-3 mm long along the upper margin. Inflorescence a spikelike panicle up to 30 cm long, the spikelets in groups of 1-4 surrounded by bristles which are usually16-25 mm long. Spikelets similar, solitary but in clusters, 5-7 mm long, each with 2 florets, only the upper one fertile, falling entire.

Habitat – adapted to fertile soils and humid climates.

Uses for livestock – used for cut-and-carry and for grazing. A good quality forage when young, but rapidly becomes stemmy and loses quality. Although it will grow on less fertile and shallow soils, it is not so productive in these situations and other species are preferred. Vegetatively propagated.

Other uses – culms can be used for fencing and making walls of huts.

Deleterious properties – can be a troublesome weed in forests and plantations, but rarely spreads by seed.

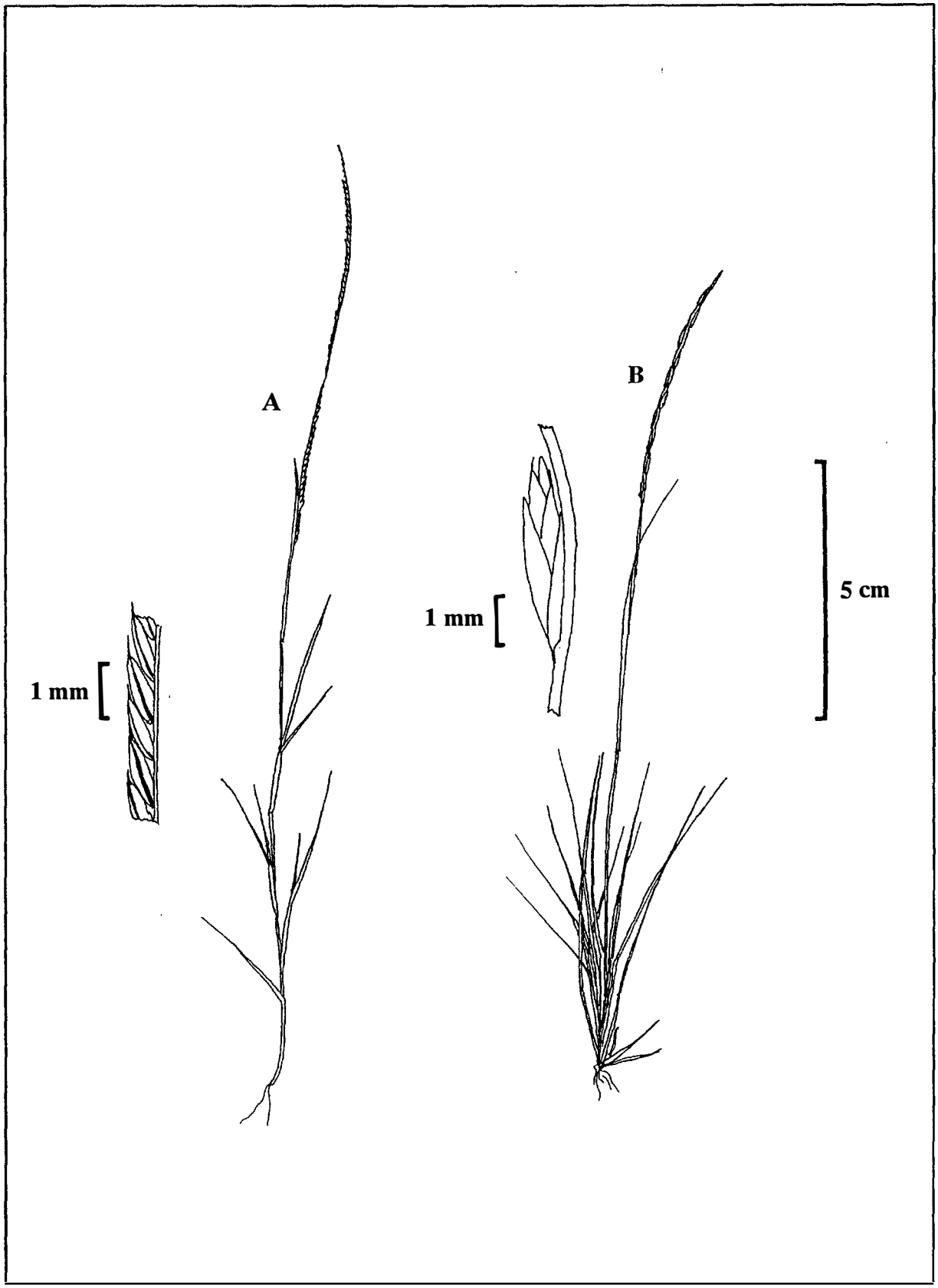


Figure 14 . A – *Microchloa indica*; B – *Tripogon aff. chinensis*

Distribution – native to tropical Africa, but now pan-tropical. In the Central Highlands of Vietnam occurs along water courses in the M'Drak area.

References – Schmid 1958 (p. 357, 656); Bor 1960 (p. 348); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 652); Gilliland 1971 (p. 162); Pham-Hoàng Hộ 1972 (p. 931); Lazarides 1980 (p. 134); Mannetje and Jones 1992 (p. 191); Pham-Hoàng Hộ 1993 (p. 908).

Sacciolepis indica (Figure 13H)
Vernacular names – bấc nhỏ (Vietnam); Indian cupscale grass (Australia).

Description – a very variable annual with culms to 60 cm or more tall. Nodes hairless. Leaf sheaths hairless or sometimes shortly hairy. Leaf blades 8-12 cm long, rarely to 25 cm long, 2-5 mm wide, hairless or slightly hairy. Ligule a membrane 0.5 mm long. Inflorescence a dense spike-like panicle 1-15 cm long. Spikelets solitary, similar, 2-3 mm long, with 2 florets, the glumes about equalling the spikelet in length, only the upper one fertile, falling entire. The species is quite similar to *Setaria parviflora*, but the inflorescence does not have the prominent bristles that are characteristic of *Setaria* spp.

Habitat – adapted to a wide range of habitats, from rice fields and garden cultivation to grassland, savanna and marshes, but more commonly found on moderately infertile soils.

Uses for livestock – considered to be a good forage plant, but generally not a very productive species. In some regions of Indo-China, reported to grow as a low and dense grassland.

Other uses – none.

Deleterious properties – none.

Distribution – south and South-east Asia, Polynesia, northern Australia; introduced to Africa and America. Frequently found as a minor component of grasslands of the Central Highlands of Vietnam at altitudes up to and exceeding 1000 m.

References – Schmid 1958 (p. 350); Bor 1960 (p. 357); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 674); Gilliland 1971 (p. 152); Pham-Hoàng Hộ 1972 (p. 926); Lazarides 1980 (p. 139,140); Tothill and Hacker 1983 (p. 367); Mannetje and Jones 1992 (p. 242); Pham-Hoàng Hộ 1993 (p. 827); Hacker *et al.* 1996 (p. 21); 1998 (p. 41).

Sacciolepis myosuroides (Figure 13I)
Vernacular names – bấc duôi-chuột (Vietnam)

Description – erect annual or perennial with culms 0.5-1.1 m tall. Leaf sheaths hairless. Leaf blades to 5-25 cm long, 2-5 mm wide, hairless. Ligule a 1 mm membrane. Inflorescence a very narrow, spikelike panicle 5-25 cm long and 3-4 mm wide. Spikelets solitary, similar, laterally compressed, 1.5-2 mm long, with 2 florets, only the upper one fertile, falling entire.

Habitat – grows on infertile sandy soils and in moist and swampy situations.

Uses for livestock – grazed to some extent, but of no significance as a pasture species.

Other uses – none.

Deleterious properties – none.

Distribution – south and South-east Asia, and in tropical Australia. In the Central Highlands of Vietnam, occurs in dipterocarp woodlands, but not common.

References – Schmid 1958 (p. 348); Bor 1960 (p. 358); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 674); Gilliland 1971 (p. 152); Pham-Hoàng Hộ 1972 (p. 926); Lazarides 1980 (p. 139); Tothill and Hacker 1983 (p. 367); Mannetje and Jones 1992 (p. 242); Pham-Hoàng Hộ 1993 (p. 828); Hacker *et al.* 1996 (p. 22).

Sehima nervosum (Figure 13J)
Vernacular names – rat's tail grass (Australia).

Description – a tufted, erect perennial with culms 0.6-1.5 m tall, not leafy. Nodes hairless or slightly hairy. Leaf sheaths hairless or slightly hairy. Leaf blades up to 30 cm long, c. 3 mm wide, hairless. Ligule a line of hairs. Inflorescence a spike-like 1-sided raceme 6-18 cm long. Spikelets dissimilar, in pairs, one sessile and one pedicellate, only the sessile spikelet fertile, all partially embedded in the joints of the rhachis. Sessile spikelet 6-11 mm long, the glumes more or less equal, the upper glume awned, Florets 2, the lower male, the upper bisexual, with a geniculate awn 35-45 mm long, falling entire with the adjacent rhachis internode and pedicel. Pedicelled spikelet flat, 9-11 mm long, often purple.

Readily distinguished from *Heteropogon contortus* by the prominent nerves on the spikelets and shorter awns.

Habitat – a major component of grasslands and savannas, occurring on infertile sandy or skeletal soils.

Uses for livestock – in Australia considered to be a grass of poor quality (Tothill and Hacker 1983), although Bor (1960) and Lazarides (1980) state that it is an excellent fodder grass.

Other uses – none.

Deleterious properties – none.

Distribution – widespread in South-east Asia, East Africa and northern Australia. Quite common in dipterocarp woodlands in Đắc Lắc Province.

References – Schmid 1958 (p. 172); Bor 1960 (p. 218); Pham-Hoàng Hộ 1972 (p. 962); Lazarides 1980 (p. 71); Tothill and Hacker 1983 (p. 373); Pham-Hoàng Hộ 1993 (p. 885); Hacker *et al.* 1996 (p. 22).

Setaria parviflora (Figure 13K)
Vernacular names – đuôi-chồn (Vietnam); Queensland pigeon grass (Australia); knotroot bristlegrass; foxtail.

Description – annual or perennial with culms 5-100 cm tall, with tillers flattened at the base. Nodes hairless. Leaf sheaths hairless. Leaf blades 3.5-65 cm long, 2.5-8 mm wide, hairless. Ligule a fringe of hairs 0.5-1 mm long. Inflorescence a spike-like panicle up to 1-12 cm long. Spikelets in clusters of 2-3, all similar, almost obscured by spreading brownish or purplish bristles up to 10 mm long, which remain attached to the inflorescence after the spikelets have fallen, 2-2.5 mm long, with 2 florets, only the upper one fertile, falling entire.

Habitat – widespread as a constituent of grasslands and savannas, generally in well lit situations. Frequently found where the soil has been disturbed (*e.g.* roadsides).

Uses for livestock – generally not a productive species, although where it occurs as a significant component of the pasture, reported to be a good pasture species when young.

Other uses – none.

Deleterious properties – a significant weed in cultivation.

Distribution – pan-tropical. In Đắc Lắc and Lâm Đống Provinces, frequent at altitudes up to and exceeding 1000 m.

References – Bor 1960, as *S. pallide-fusca* (p. 363); Gilliland 1971, as *S. pallide-fusca* (p. 159); Pham-Hoàng Hộ 1972, as *S. pallide-fusca* (p. 929); Lazarides 1980 as *S. pallide-fusca* (p. 141,142); Tothill and Hacker, as *S. pallidefusca* 1983 (p. 376); Pham-Hoàng Hộ 1993 (p. 830); Hacker *et al.* 1996 (p. 23); 1998 (p. 42).

Sporobolus indicus* var. *major (Figure 13L)
Vernacular names – xạ-tử ấn (Vietnam)

Description – annual with culms to 1.2 m tall, forming dense tussocks. Nodes hairless. Leaf sheaths hairless. Leaf blades 6-50 cm long, 2-7 mm wide, hairless. Ligule a fringe of hairs. Inflorescence a narrow panicle 11-60 cm long with appressed branches. Spikelets solitary, all similar, 1.8-1.9 mm long, with a single fertile floret. Fruits are often infected by a black smut; they are expelled when ripe.

Habitat – Adapted to fertile, and stony, infertile soils. Frequently found in over-grazed short grassland.

Uses for livestock – not palatable to livestock.

Other uses – reported to have some use for fibre.

Deleterious properties – unpalatable and tends to become a major component of overgrazed pastures.

Distribution – South-east Asia, Malay Peninsular, Indonesia, India, Burma, Sri Lanka, China, Japan, Australia. In Vietnam occurs in heavily grazed pastures and along tracks in Đắc Lắc and Lâm Đống Provinces up to more than 1000 m altitude.

References – Schmid 1958 (p.486,488); Bor 1960 (p. 630); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 686); Gilliland 1971, as *S. fertilis* (p. 106); Pham-Hoàng Hộ 1972 (p. 892); Lazarides 1980, as *S. fertilis* (p. 190,191); Tothill and Hacker 1983 (p. 389); Baaijens and Veldkamp 1991 (p. 437); Mannetje and Jones 1992 (p. 253); Pham-Hoàng Hộ 1993 (p. 800); Hacker *et al.* 1998 (p. 42).

Tripogon aff. chinensis (Figure 14B)
Description – very small tussock-forming annual with culms 10-20 cm tall and mainly basal leaves. Nodes hairless. Leaf sheaths hairless. Leaf blades stiffly erect, rolled, sparsely covered with long hairs, 3-5 cm long and 0.5-1 mm wide. Ligule a minute rim with short hairs along the upper margin. Inflorescence a slender spike c. 6 cm long, with appressed spikelets alternating on either side of and partially embedded in the axis. Spikelets solitary, all similar, c. 4 mm long, laterally compressed, with c. 5 normally awnless florets (the specimens collected in Vietnam had florets with an awn <0.5 mm long, and may be an undescribed species).

Habitat – grows in depressions in rocky pavements, where there is little competition.

Uses for livestock – an unproductive species, of no significance for livestock.

Other Uses – none.

Deleterious properties – none.

Distribution – Philippines, China, Vietnam. Occurs in Đắc Lắc Province, west of Buôn Ma Thuôt, at an altitude of c. 200 m, associated with exposed basalt pavements.

Group 4 – Grasses with open panicles; spikelets without awns, not crowded along panicle branches

Cyrtococcum accrescens (Figure 15A)
Vernacular names – Cầu-dĩnh mọc (Vietnam)

Description – perennial with culms scrambling and rooting at the nodes for 1 m or more and rising to 0.3-1 m tall. Nodes hairless. Leaf sheaths hairy all over. Leaf blades 3-18 cm rarely to 25 cm long, 5-15 mm, rarely to 22 mm wide, hairy when young. Ligule a membrane 2 mm long, with a few hairs in the mouth. Inflorescence a large and open panicle 20-50 cm long, the pedicels 4-17 mm long, much longer than the spikelets. Spikelets paired, similar, laterally compressed, asymmetrical, c. 1.5 mm long, the lower glume shorter than the spikelet and the upper glume nearly equal to the spikelet, and with 2 florets, only the upper one fertile, shedding entire.

Habitat – shaded and moist situations in forests and woodlands and disturbed sites up to an altitude of 1500 m.

Uses for livestock – of some value as a fodder.

Other Uses – none.

Deleterious properties – a minor weed along margins of rice fields and in plantations.

Distribution – throughout South-east Asia, China, Japan, India, Sri Lanka. Occurs in western Đắc Lắc Province at an altitude of c. 500 m.

References – Bor 1960 (p. 291); Gilliland 1971 (p. 149); Pham-Hoàng Hộ 1972 (p. 922); Lazarides 1980 (p. 111, 112); Mannetje and Jones 1992 (p. 248); Pham-Hoàng Hộ 1993 (p. 808).

Cyrtococcum oxyphyllum (Figure 15B)
Vernacular names – Cầu-dĩnh lá nhọn (Vietnam)

Description – perennial with culms 10-50 cm tall, sometimes rooting at lower nodes. Nodes hairless. Leaf sheaths with hairy margins. Leaf blades 6.5-29 cm long, 5-16 mm wide, with 7-12 main nerves, hairless except for a few long hairs towards the base. Ligule a membranous rim. Inflorescence a rather dense panicle up to 12 cm long, with secondary branching, the branches hairy, and spikelets clustered towards the ends of branches, the pedicels shorter than the spikelets. Spikelets paired, similar, laterally compressed, asymmetrical, c. 2 mm long, the lower glume shorter than the spikelet and the upper glume nearly equal to the spikelet, and with 2 florets, only the upper one fertile, shedding entire.

Habitat – shaded and moist situations in forests and woodlands and disturbed areas up to an altitude of 1850 m, also in plantations.

Uses for livestock – a fairly good fodder.

Other Uses – none.

Deleterious properties – sometimes a weed of old gardens.

Distribution – India, Sri Lanka, Burma, South-east Asia, China, northern Australia. Occurs in Lâm Đồng Province along stream banks at altitudes over 1000 m.

References – Schmid 1958, as *C. pilipes* (p. 341); Bor 1960 (p. 291); Gilliland 1971 (p. 148); Pham-Hoàng Hộ 1972 (p. 922); Lazarides 1980 (p. 111, 112); Mannetje and Jones 1992 (p. 248); Pham-Hoàng Hộ 1993 (p. 808).

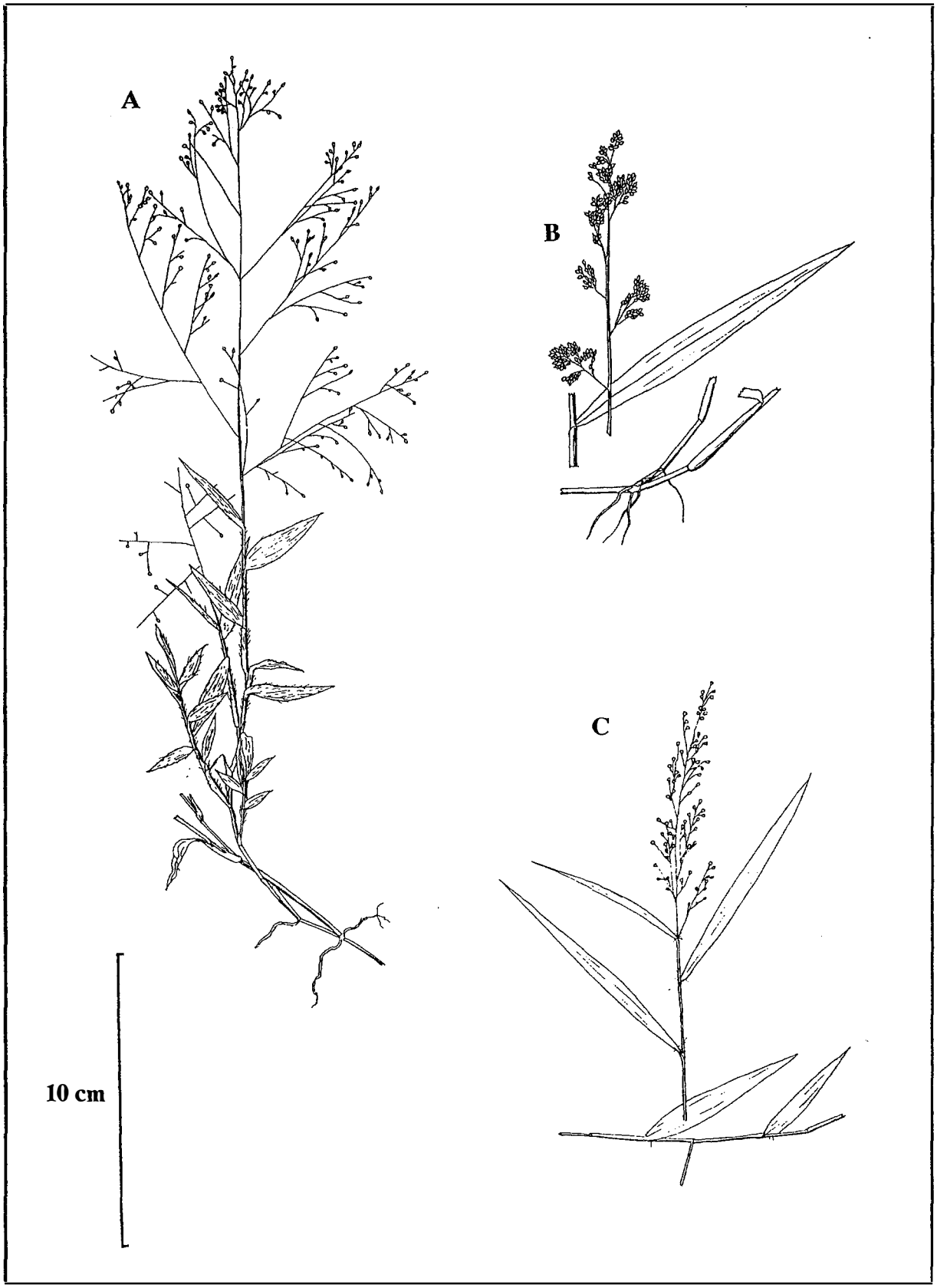


Figure 15. A – *Cyrtococcum accrescens*; B – *C. oxyphyllum*; C – *C. patens*

Cyrtococcum patens (Figure 15C)
Vernacular names – Cầu-dĩnh bò (Vietnam)

Description – weak-stemmed stoloniferous perennial with culms 12-30 cm, sometimes to 50 cm tall. Nodes hairless or hairy on one side. Leaf sheaths minutely hairy along the margins. Leaf blades 1-13 cm long, 3-8, occasionally to 14 mm wide, minutely hairy on the lower surface and sometimes with long hairs on the margins close to the junction with the sheath. Ligule a hairless membrane 0.5 mm long. Inflorescence a small and delicate open panicle 3-18 cm long, the primary branches borne singly on the main axis and the pedicels longer than the spikelets. Spikelets in pairs, laterally compressed, asymmetrical, all similar, 1.5-2 mm long, the lower glume shorter than the spikelet and the upper glume almost equalling the spikelet, and with 2 florets, the lower floret neuter and the upper fertile, shedding entire.

Habitat – shaded areas.

Uses for livestock – said to make an excellent fodder.

Other Uses – none.

Deleterious properties – none.

Distribution – widespread in South-east Asia, also India, Burma, China, Japan, Polynesia. In Vietnam it occurs in Gia Lai Province at an altitude of c. 700 m.

References – Schmid 1958 (p.341); Bor 1960 (p. 292); Gilliland 1971 (p. 148); Pham-Hoàng Hộ 1972, as *C. trigonum* (p. 922); Lazarides 1980 (p. 112); Pham-Hoàng Hộ 1993 (p. 808).

Eragrostis atrovirens (Figure 16A)
Description – blue-green perennial, with culms 0.6-1.4 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades inrolled when dry, 10-30 cm long, 1-5 mm wide, hairless except for a few long hairs close to the junction with the leaf sheath. Ligule a minute rim with a tuft of hairs at each end. Inflorescence a large, open panicle, 11-30 cm long, 6-15 cm wide, with secondary branching, but the lowermost longest panicle branch naked for the lower 35%-40% of its length. Spikelets solitary, all similar, laterally compressed, 5-12 mm long, 1.5-2.5 mm wide, with 6-15 florets, the lemmas and paleas falling together from below up at maturity.

Habitat – grassland, and in moist situations such as roadside ditches,

Uses for livestock – considered to be a minor forage species, although in parts of India it can contribute a significant part of the available forage.

Other Uses – none.

Deleterious properties – none.

Distribution – India–Vietnam, Africa, Taiwan, Japan, Malaysia, Indonesia, Papua-New Guinea, Philippines. Occurs in Đắc Lắc Province at low to medium altitudes, in moist situations in dipterocarp woodland and open grassland.

References – Bor 1960 (p. 503); Gilliland 1971 (p. 68); Pham-Hoàng Hộ 1972 (p. 887); Lazarides 1980 (p. 173); Mannetje and Jones 1992 (p. 238); Pham-Hoàng Hộ 1993 (p. 791); Hacker *et al.* 1998 (p. 47).

Eragrostis brownii (Figure 16B)
Vernacular names – (Vietnam); Brown's lovegrass (Australia)

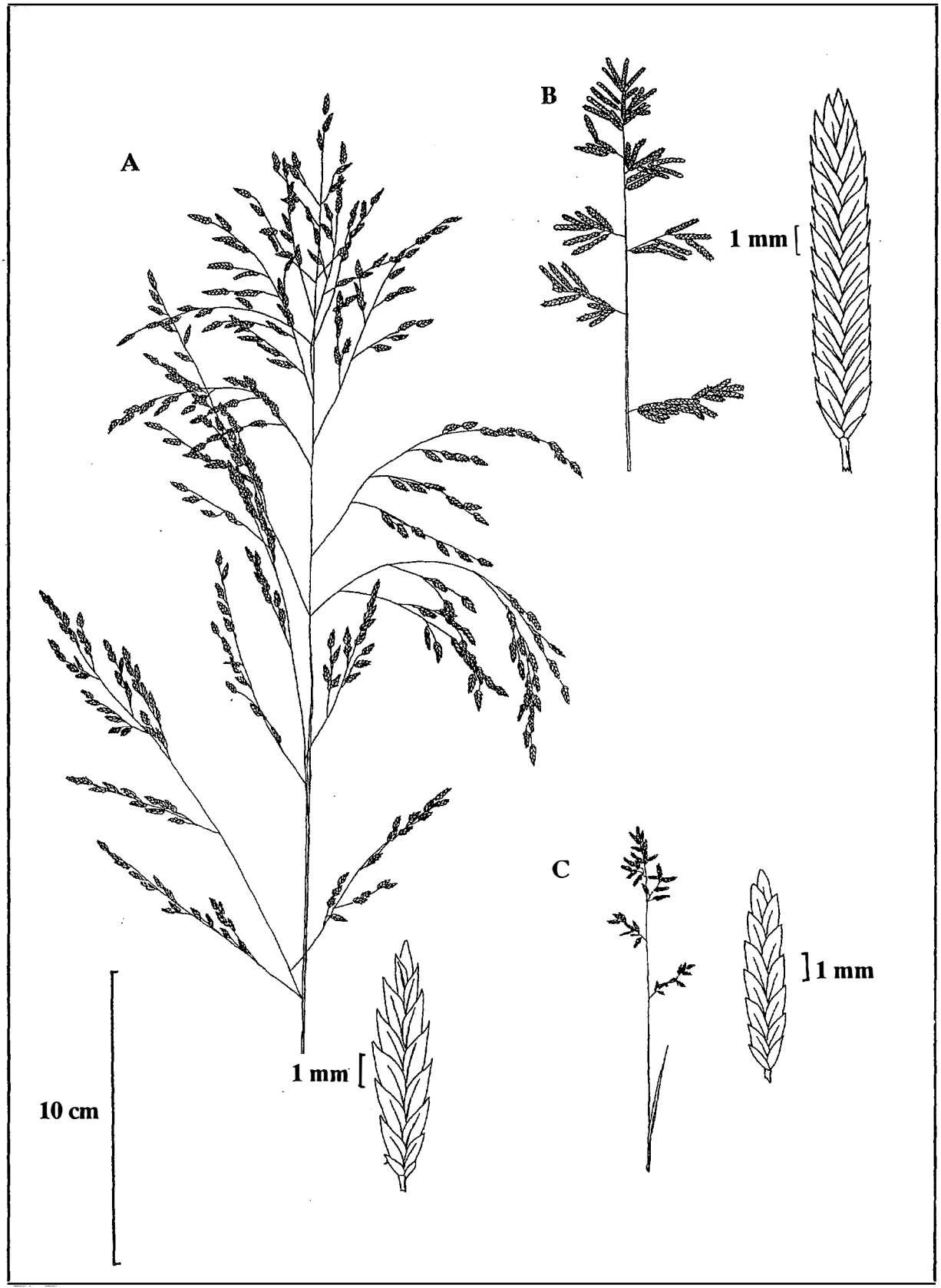


Figure 16. A – *Eragrostis atrovirens,* (i) inflorescence, (ii) spikelet; B – *E. brownii,* (i) inflorescence, (ii) spikelet; C – *E. cumingii,* (i) inflorescence, (ii) spikelet

Description – perennial with culms 0.1-1.1 m tall, moderately leafy at the base. Nodes hairless. Leaf sheaths with a few hairs along the upper margins. Leaf blades 3.5-25 cm long, 0.5-3 mm wide, hairless. Ligule a rim bearing a fringe of hairs. Inflorescence a more or less open panicle 3.5-20 cm long, 1.5-9 cm wide, the lowermost longest panicle branch naked in the lower 10-25% of its length, with shortly stalked spikelets often densely clustered along the primary branches. Spikelets solitary, all similar, laterally compressed, 4-15 mm (sometimes up to 40 mm) long and with up to 25 or more florets, all except the terminal ones fertile, breaking up from below upwards, the paleas persisting for a long time.

Habitat – a widely adapted species, but only a minor component of herbaceous vegetation in grasslands and savannas.

Uses for livestock – of no grazing significance.

Other uses – none.

Deleterious properties – none.

Distribution – Indo-China, Thailand, Indonesia, Papua-New Guinea, Australia. In Central Vietnam occurs in Đắc Lắc Province in bare soil areas in grasslands and woodlands.

References – Lazarides 1980 (p. 173); Tothill and Hacker 1982 (p.232); Hacker *et al.* (p. 25); Mannetje and Jones 1992 (p. 238); Hacker *et al.* 1996 (p. 25); 1998 (p. 47).

Eragrostis cumingii (Figure 16C)
Vernacular names – Xuân-thảo tich-lanh (Vietnam)

Description – erect annual, with culms 0.1-0.9 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades 4-19 cm long, hairless, usually inrolled, 0.5-2 mm wide. Ligule a short membrane with minute hairs along the upper margin. Inflorescence an open panicle 5-26 cm long, 2-8 cm wide, the lowermost longest panicle branch naked in the lower 10%-40% of its length. Spikelets similar, borne on short pedicels, laterally compressed, 4.5-20 mm long and 1.2-3 mm wide, and with up to 15 or more florets, the lemmas with 1 or 2 lines of glands along the lateral nerves, disarticulating from the base upwards and with the paleas persisting on the rhachilla after the lemmas shed.

Habitat – grassland.

Uses for livestock – of no significance as a forage.

Other Uses – none.

Deleterious properties – none.

Distribution – throughout South-east Asia, Burma , Indonesia and northern Australia. Occurs in Đắc Lắc Province in the M'Drak area, as an occasional plant where the soil is bare.

References – Bor 1960 (p. 507); Gilliland 1971 (p. 65);); Pham-Hoàng Hộ 1972 (p. 887); Hộ 1972, as *E. zeylanica* (p. 884); Lazarides 1980 (p. 174); Pham-Hoàng Hô, as *E. zeylanica* 1993 (p. 797).

Eragrostis japonica (Figure 17A)
Vernacular names – xuân thảo nhật (Vietnam)

Description – annual or possibly sometimes perennial with culms 0.2-1.5 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades 9-32 cm long, 2-9 mm wide, hairless. Ligule a membrane 0.2 mm high, with hairs along the upper margin. Inflorescence a narrow but open panicle 10-70 cm long, 2-4 cm wide, the primary branches short, in dense whorls and the lowermost longest panicle branch naked in

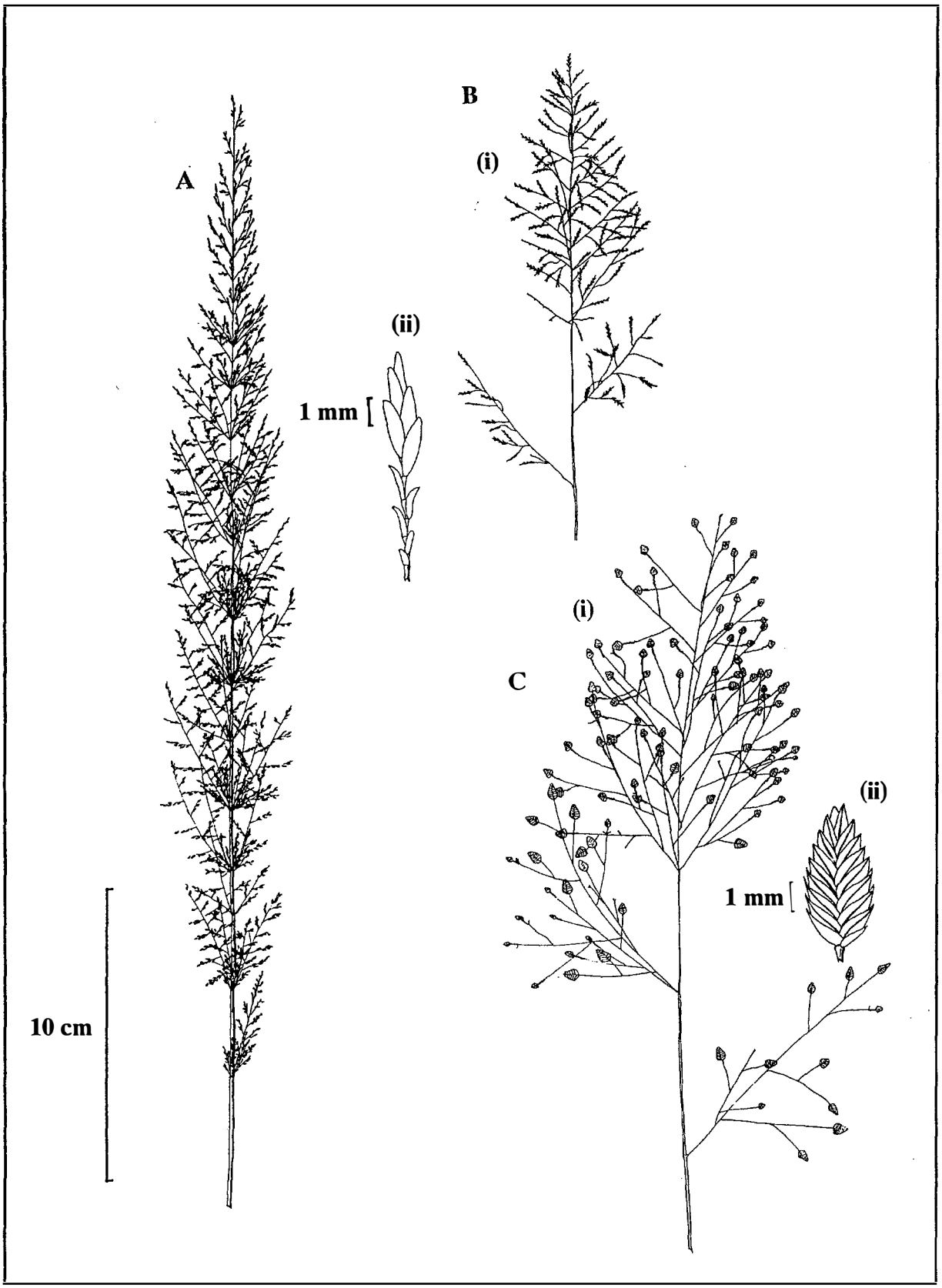


Figure 17. A – *Eragrostis japonica*; B – *E. ?tenuifolia,* (i) inflorescence, (ii) spikelet; C – *E. unioloides,* (i) inflorescence, (ii) spikelet

the lower 10%-35% of its length. Spikelets solitary, all similar, laterally compressed, c. 2 mm long, with 6-8 florets, the rhachilla breaking up at maturity, usually from the top downwards, the paleas long-persistent.

Habitat – disturbed ground.

Uses for livestock – a minor forage of little significance.

Other Uses – none.

Deleterious properties – none.

Distribution – tropical Asia, South-east Asia. Occurs in western parts of Đắc Lắc Province at altitudes of c. 200 m.

References – Bor 1960 (p. 509); Gilliland 1971 (p. 70); Pham-Hoàng Hộ 1972 (p. 883); Lazarides 1980 (p. 174); Mannetje and Jones 1992 (p. 238); Pham-Hoàng Hộ 1993 (p. 794).

Eragrostis ? tenuifolia (Figure 17B)
Vernacular names – elastic grass (Australia)

Description – an erect, tufted annual or short-lived perennial with erect culms up to 80 cm tall and mostly basal leaves. Nodes hairless. Leaf sheaths hairless or sparsely hairy. Ligule a row of short hairs with a dense tuft of long hairs at each end. Leaf blades up to 6-30 cm long, 0.5-4 mm wide, hairless, rolling inwards in older leaves. Inflorescence a stiff, open, pyramid-shaped panicle 10-20 cm long, 4.5-9 cm wide with secondary branching, the lowermost longest panicle branch naked in the lower 25%-30% of its length, the pedicels longer than the spikelets. Spikelets solitary, all similar, greyish, laterally compressed, 6-12 mm long, with 7-12 florets which break up progressively from the lowest upwards, leaving the rhachis and attached paleas.

Habitat – disturbed ground.

Uses for livestock – of no significance as a forage.

Other Uses – none.

Deleterious properties – a minor weed of cultivation and mown turf.

Distribution – India, tropical Africa, Papua-New Guinea, Australia, South America. Occurs in Lâm Đồng Province at altitudes of c. 1000 m.

References – Bor 1960 (p. 514); Lazarides 1980 (p. 176); Tothill and Hacker 1983 (p. 229).

Eragrostis unioloides (Figure 17C)
Vernacular names – xuân-thảo dỏ (Vietnam)

Description – perennial, sometimes with stolons, and with numerous culms 10-60 cm tall. Nodes hairless. Leaf sheaths hairless. Leaf blades usually 3-12 cm long, 2-8 mm wide, hairless. Ligule a rim with a fringe of hairs along the upper margin. Inflorescence an open panicle 5-17 cm long, 2-6.5 cm wide, the lowermost longest panicle branch naked in the lower 5%-14% of its length. Spikelets solitary, similar, strongly laterally compressed, pink, oval, 2-8 mm long, rarely to 16 mm long, and 1.2-4 mm wide, with 8-60 florets which shed progressively from the base of the spikelet as they mature, the paleas dropping early, all except the terminal florets fertile.

Habitat – occurs in a wide range of situations, from roadsides and old cultivation to marshy areas and over-grazed savanna, and from low to high altitudes. Often an indicator of impoverished or degraded soils.

Uses for livestock – in Thailand, whole plants are pulled up and fed to cattle. Where it occurs in abundance in paddy fields, it is grazed, although it does not withstand repeated grazing. Of little significance as a forage for livestock.

Other uses – in Malaysia, considered to be useful as a natural green manure in paddy fields.

Deleterious properties – none.

Distribution – probably originally from South-East Asia, now pan-tropical. Occurs in Đắc Lắc Province in dipterocarp woodlands and likely to be widespread in Central Vietnam in disturbed situations.

References – Schmid 1958 (p.497, 502); Bor 1960 (p. 515); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 676); Gilliland 1971 (p. 66); Pham-Hoàng Hộ 1972 (p. 886); Lazarides 1980 (p. 176); Tothill and Hacker 1983 (p. 231); Mannetje and Jones 1992 (p. 128); Pham-Hoàng Hộ 1993 (p. 792); Hacker *et al.* 1996 (p. 26); 1998 (p. 47).

Leersia hexandra (Figure 18A)
Vernacular names – bac (Vietnam); cut grass, rice grass (English).

Description – aquatic grass to 1.5 m tall, nodes on lower stems freely rooting in mud. Nodes minutely hairy. Leaf sheaths hairless. Leaf blades up to 25 cm long, 15 mm wide, hairless. Ligule a blunt membrane 1-2 mm long, hairless along the upper margin. Inflorescence a narrow panicle 5-15 cm long, c. 2.5 cm wide. Spikelets solitary, similar, laterally compressed, 3.5-4.5 mm long, with a single floret, which is fertile, falling entire.

Habitat – grows in standing water and swampy areas at all altitudes in Indo-China. Often grows in single-species stands.

Uses for livestock – very palatable to livestock, especially horses. Harvested for cut-and-carry forage during the dry season. In some countries, *L. hexandra* is cultivated in ricefields for hay, but may escape to become a troublesome weed. Sometimes toxic to livestock when fed fresh.

Other uses – none.

Deleterious properties – can be a weed of fallow or abandoned ricefields.

Distribution – throughout South-east Asia; native to the tropics of the New and Old Worlds. In Central Vietnam found at altitudes of c. 500 m, and likely also to occur at higher altitudes.

References – Schmid 1958 (p. 472); Bor 1960 (p. 599); Gilliland 1971 (p. 97); Pham-Hoàng Hộ 1972 (p. 872); Lazarides 1980 (p. 182,183); Tothill and Hacker 1983 (p. 295); Mannetje and Jones 1992 (p. 240) ; Pham-Hoàng Hộ 1993 (p. 776); Hacker *et al.* 1998 (p. 51).

Ottochloa nodosa (Figure 18B)
Vernacular names – slender panic grass (English)

Description – stoloniferous perennial with stolons 1 m or more long, often scambling over other plants, and with culms to 1 m tall. Nodes hairless. Leaf sheaths hairless or covered with short, spreading hairs, and with hairs along the margins. Leaf blades up to 4.5-15 cm long, 8-16 mm wide, disarticulating from the sheaths, and with sparse, long hairs along the veins on both surfaces. Ligule a 0.5 mm membrane. Inflorescence a very open panicle 8-50 cm long, with stiffly spreading primary branches. Spikelets all

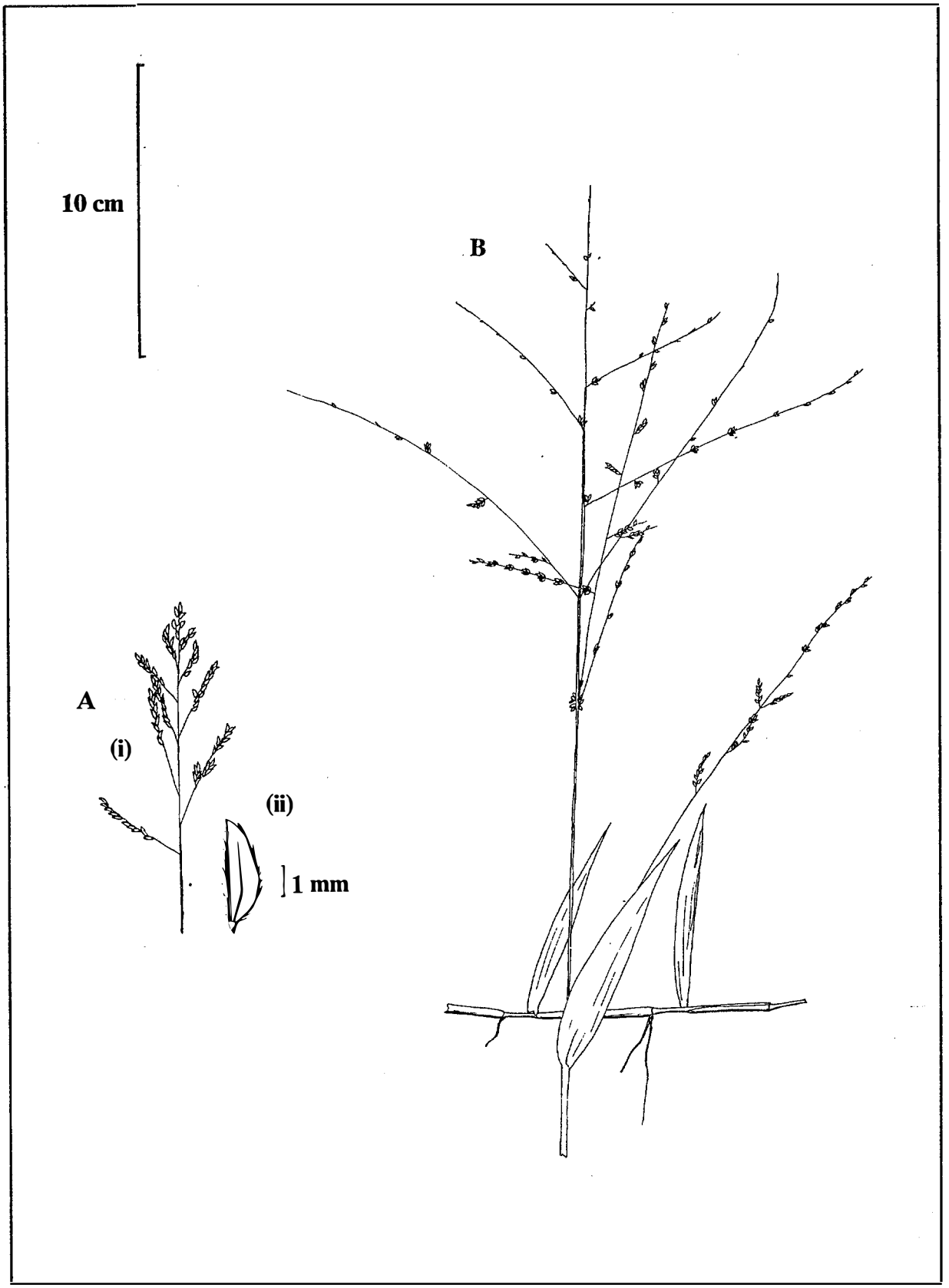


Figure 18. A – *Leersia hexandra,* (i) inflorescence, (ii) spikelet; B – *Ottochloa nodosa*

similar, solitary but in clusters of 3-7 on very short secondary panicle branches, dorsoventrally compressed, 3-3.5 mm long, narrow, shedding entire, the glumes almost equal, c. half as long as the spikelet, and with 2 florets, only the upper one fertile.

Habitat – forests, forest margins and woodlands up to an altitude of 1250 m, often in moist situations and disturbed ground.

Uses for livestock – of moderate value as a fodder.

Other Uses – none.

Deleterious properties – an important weed of rubber plantations, sago swamps and fallow rice fields.

Distribution – India, South-east Asia, Philippines, Australia, Africa. Occurs in western Đắc Lắc Province as an understorey plant in open *Imperata* grassland at altitudes of c. 500 m.

References – Schmid 1958, as *Hemigymnia multinodis* (p. 341, 343); Bor 1960 (p. 318); Gilliland 1971 (p. 143); Lazarides 1980 (p. 125, 126); Tothill and Hacker 1983 (p. 319); Mannetje and Jones 1992 (p. 171); Pham-Hoàng Hộ 1993 (p. 833).

Panicum humile (Figure 20A)
Vernacular names – kê Nam-Á (Vietnam).

Description – tussocky and densely-tillered annual with culms 8-60 cm tall, flowering prolifically. Leaf blades 6-16 cm long, 1-3 mm wide, the blades, sheaths and nodes hairless. Ligule a membrane, with hairs along the upper margin. Inflorescence a panicle up to 11.5 cm long, 6 cm wide. Spikelets in pairs, similar, dorso-ventrally compressed, 1.6-1.9 mm long, often purplish-coloured, with 2 florets, only the upper one fertile, falling entire.

Habitat – grows in open, waste land, moist grazing land and areas disturbed by cultivation or habitation, mostly on light soils and with some shade.

Uses for livestock – may produce useful grazing, but not a very productive species.

Other uses – none.

Deleterious properties – none.

Distribution –.South-east Asia, Malaysia, Indonesia, Philippines, China, India and north tropical Africa. In central Vietnam occurs in moist areas in open dipterocarp woodland.

References – Schmid 1958 (p. 334, 336); Bor 1960, as *P. austroasiaticum* (p. 324); Gilliland 1971, as *P. walense* (p. 68); Pham-Hoàng Hộ 1972, as *P. austroasiaticum* (p. 915); Lazarides 1980, as *P. walense* (p. 128, 130); Mannetje and Jones 1992, as *P. walense* (p. 241); Pham-Hoàng Hộ 1993 (p. 826).

Panicum maximum (Figure 19)
Vernacular names – kê duyên (Vietnam); Guinea grass (English).

Description – erect perennial with culms to 3 m tall. Leaf sheaths hairless. Leaf blades up to 60 cm long, 20 mm wide, usually hairless. Ligule a membrane 4-6 mm long. Inflorescence a large open panicle up to 40 cm long, 25 cm wide, with the lower branches arranged in a whorl. Spikelets solitary, similar, 3-4.5 mm long, with 2 florets, only the upper one fertile, falling entire.

Habitat – best adapted to more fertile soils and annual rainfall exceeding 1000 mm. Tolerant of some shade.

Figure 19. – *Panicum maximum*

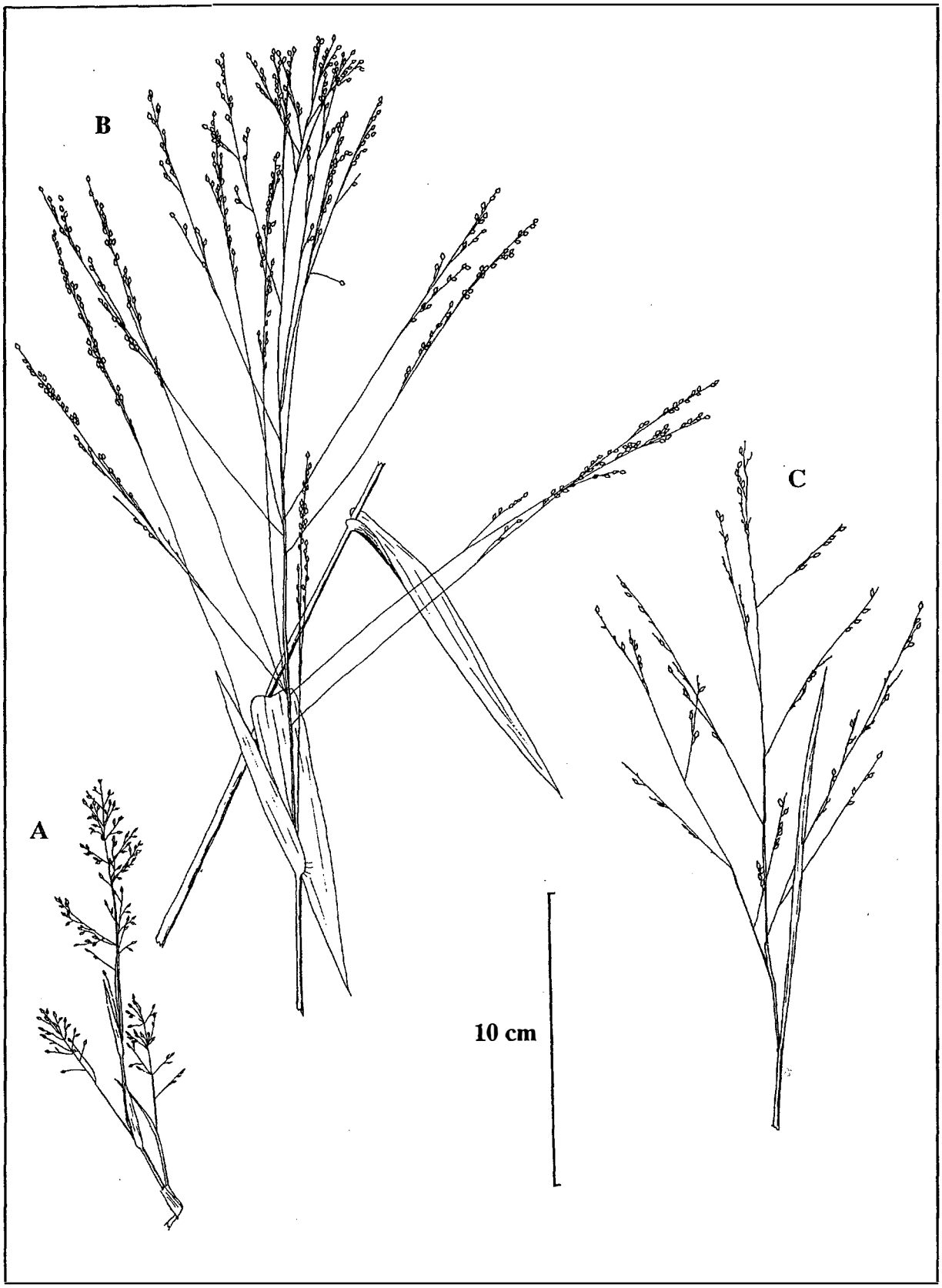


Figure 20. – A – *Panicum humile*; B – *P. notatum*; C – *P. repens*

Uses for livestock – an excellent grazing grass in regions to which it is adapted, and also used for cut-and-carry. May also be conserved as hay or silage. There is a wide range of commercially available cultivars in various countries in the tropics.

Other uses – none.

Deleterious properties – can be a troublesome weed in forestry nurseries and plantations.

Distribution – native to tropical Africa, now pan-tropical. In the Central Highlands of Vietnam occasionally found as an escape from cultivation where plants have been protected from heavy grazing.

References – Schmid 1958 (p. 338, 654); Bor 1960 (p. 327); Gilliland 1971 (p. 132); Pham-Hoàng Hộ 1972 (p. 917); Lazarides 1980 (p. 127, 129); Tothill and Hacker 1983 (p. 322); Mannetje and Jones 1992 (p. 172); Pham-Hoàng Hộ 1993 (p. 824).

Panicum notatum (Figure 20B)
Vernacular names – San dấu (Vietnam)

Description – perennial with sparse culms erect and up to 2 m tall, or scrambling, with a length of up to 10 m. Nodes covered with minute appressed hairs. Leaf sheaths hairy along the margins. Leaf blades 4.5-18 cm long, 7-32 mm wide, with a broad base and stiff, short hairs along the margins in the lower part. Ligule minute. Inflorescence a large and very open panicle 13-40 cm long, up to 25 cm or more wide, with stiffly spreading branches which do not bare spikelets in the lower half. Spikelets in pairs, all similar, dorsoventrally compressed, c. 2.5 mm long, the glumes very unequal, with 2 florets, only the upper floret fertile, the 'seeds' smooth and shiny.

Habitat – woodlands and open forests up to an altitude of 1600 m.

Uses for livestock – of little value as a fodder.

Other Uses – none.

Deleterious properties – none.

Distribution – Most parts of South-east Asia, India, Burma. A common species throughout Central Vietnam in dipterocarp and pine tree woodlands from medium altitudes up to and exceeding 1000 m, readily distinguished by its characteristically shaped leaf blades.

References – Schmid 1958, as *P. montanum* (p. 333, 336); Bor 1960 (p. 701); Gilliland 1971 (p. 142); Pham-Hoàng Hộ 1972 (p. 913); Lazarides 1980 (p. 127, 130); Mannetje and Jones 1992 (p. 241); Pham-Hoàng Hộ 1993 (p. 825); Hacker *et al*. 1998 p. 54).

Panicum repens (Figure 20C)
Vernacular names – Cỏ ựa-gà, cỏ ống (Vietnam); torpedo grass (Australia)

Description – a strongly rhizomatous perennial, the rhizomes up to 7 m long and sharply pointed, sometimes also with stolons. Culms 0.3-0.8 m tall. Nodes glabrous. Sheaths glabrous except for hairs along the upper margins. Leaf blades 5-25 cm long, 2-12 mm wide, with scattered hairs on the upper surface. Ligule a 0.5 mm membrane fringed with hairs. Inflorescence a panicle 13-22 cm long, with ascending branches and secondary and tertiary branching. Spikelets similar, in pairs, dorsoventrally compressed, 2.5-3 mm long, the glumes very unequal, and with 2 florets, the lower one male and the upper one fertile, shedding entire.

Habitat – grasslands, woodlands, paddy fields, along roadsides and canals up to 2000 m altitude, particularly on sandy soils. Tolerant of acid soils. Sometimes grows in standing water, but not tolerant of permanently flooded conditions.

Uses for livestock – a high-yielding species which is very palatable to livestock and tolerant of heavy grazing.

Other Uses – bank stabilisation and erosion control.

Deleterious properties – a weed of cultivation which is difficult to eradicate.

Distribution – pan-tropical. Occurs in Đắ Lắc Province, in seasonally flooded situations near M'Drak, Đắc Lắc Province.

References – Schmid 1958 (p. 336, 338); Bor 1960 (p. 330); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 666); Gilliland 1971 (p. 135); Pham-Hoàng Hộ 1972 (p. 918); Lazarides 1980 (p. 127, 130); Tothill and Hacker 1983 (p. 322); Mannetje and Jones 1992 (p. 176); Pham-Hoàng Hộ 1993 (p. 820).

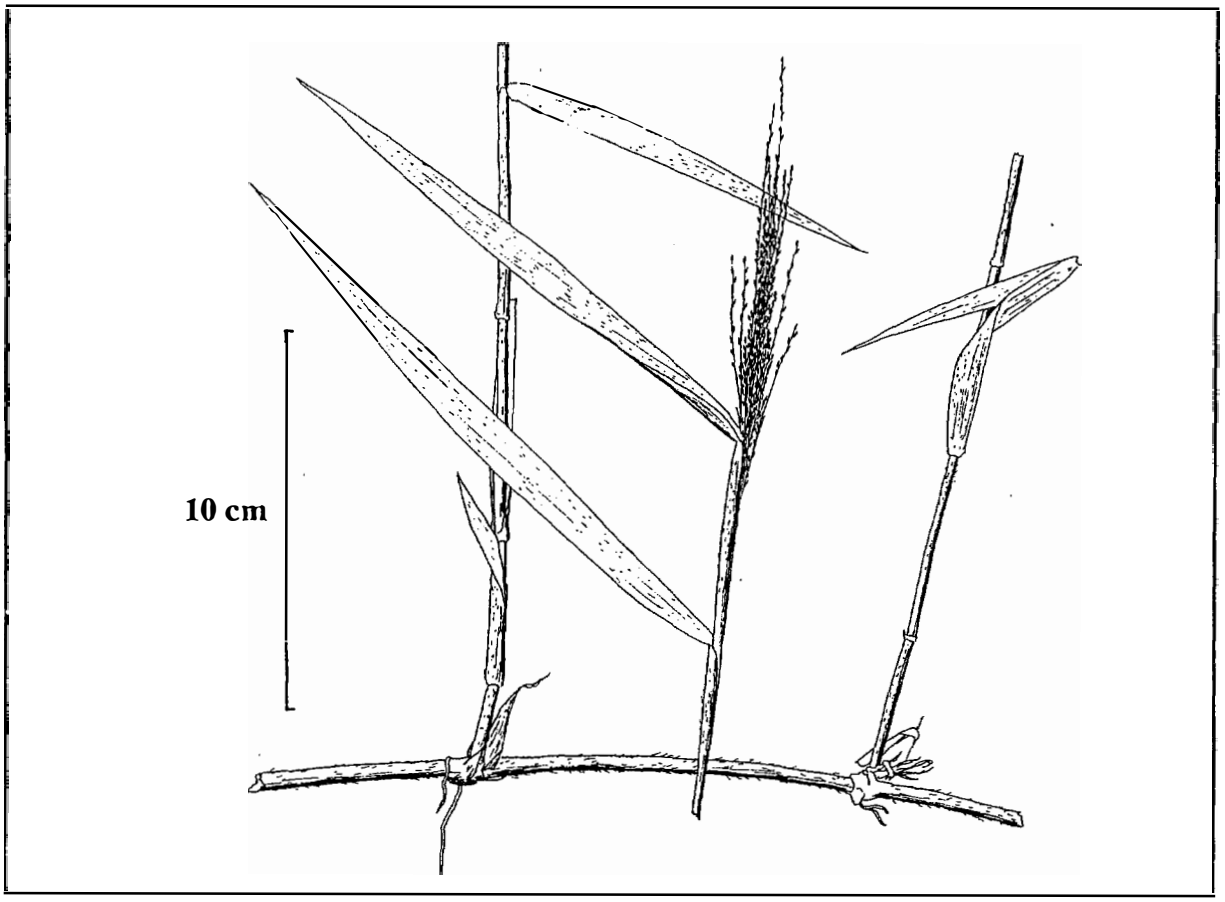


Figure 21. *Panicum sarmentosum* – young inflorescences produced from old, creeping culms

Panicum sarmentosum (Figure 21)
Vernacular names – kê trườn, cỏ voi (Vietnam)

Description – perennial with branched or unbranched solid culms to 10 m long, which often scramble through and over other plants, rooting at the nodes. Leaf blades up to 40 cm long, 15-20 mm wide, the blades more or less hairy on both surfaces, the sheaths on the creeping stems densely hairy. Nodes hairless. Ligule a fringe of hairs. Inflorescence a moderately dense, but open panicle up to c. 11 cm long. Spikelets solitary, similar, 2-2.5 mm long and distinctively shiny, with 2 florets, only the upper one fertile, falling entire.

Habitat – occurs in clearings and along margins of primary and secondary forest, often in dense, tangled masses, but reported not to occur in open forest or savanna.

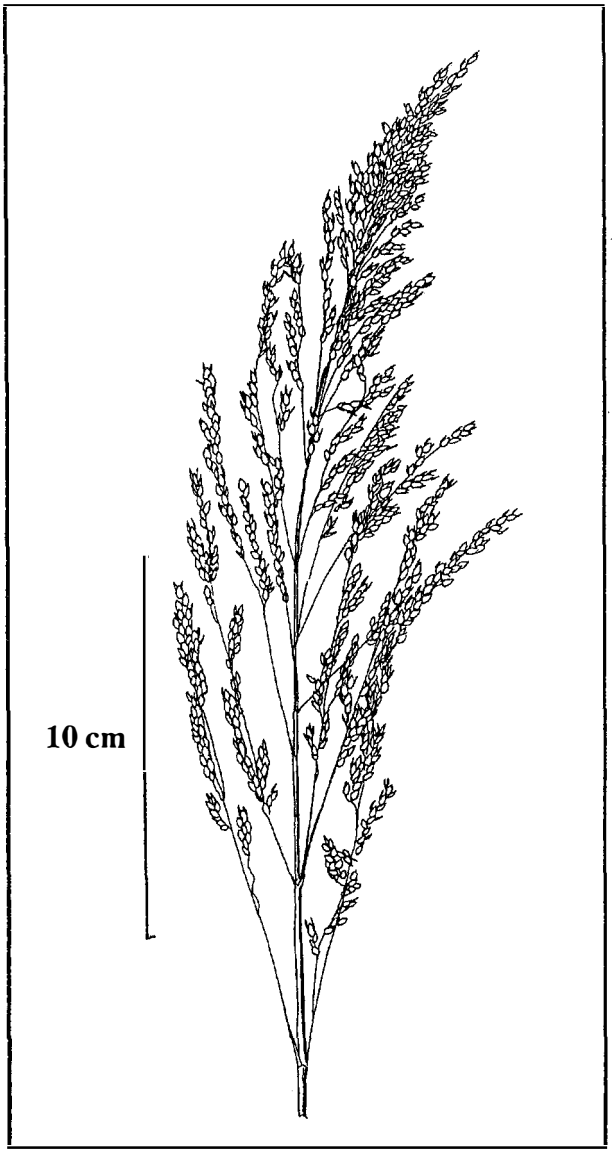
Uses for livestock – of minor value as a forage; the young growth is moderately palatable.

Other Uses – none.

Deleterious properties – may occur as a serious weed in gardens, old cultivations and rice fields.

Distribution – South-east Asia, India, Burma, southern China, Malaysia, Indonesia, Philippines, Papua-New Guinea, northern Australia. Occurs in Đắc Lắc Province, south of Buôn Ma Thuột, where its long, prostrate culms were colonising bare ground.

References – Schmid 1958 (p. 333, 336); Bor 1960 (p. 330); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 666, 668); Gilliland 1971 (p. 139); Pham-Hoàng Hộ 1972 (p. 918); Lazarides 1980 (p. 128, 130); Mannetje and Jones 1992 (p. 241); Pham-Hoàng Hộ 1993; Veldkamp 1996 (p. 203); Hacker *et al.* 1998 (p. 54).



Sorghum propinquum (Figure 22)
Vernacular names – Mía miên (Vietnam)

Description – perennial with long rhizomes and culms 0.9-3 m tall. Nodes densely covered with minute appressed hairs (visible under a lens). Leaf sheaths hairless. Leaf blades flat, 15-80 cm long, 12-60 mm wide, hairless, the margins rough. Ligule a membrane 1 mm long, densely hairy along the upper margin. Inflorescence an open panicle 20-60 cm long, the lower branches in whorls, the secondary branches terminating in racemes of 2-10 spikelet pairs (the terminal one a triplet). Spikelets in dissimilar pairs (or triplets), light brown to purplish, dorsoventrally compressed, not awned, the sessile spikelet fertile, awnless, 4-5 mm long, becoming brown, dark red or black with maturity.

Habitat – river and stream banks, grassland and open areas in forest up to 1000 m altitude.

Uses for livestock – of little value as a forage.

Other Uses – none.

Deleterious properties – none.

Distribution – India to China. Occurs in Đắc Lắc Province near M'Drak, along stream banks in areas protected from grazing.

References – Schmid 1958, as *S. affine* (p. 212, 214); Bor 1960 (p. 223); Gilliland 1971 (p. 229); Pham-Hoàng Hộ 1972 (p. 980); Lazarides 1980 (p. 72, 73); Pham-Hoàng Hộ 1993 (p. 878).

Figure 22. *Sorghum propinquum*

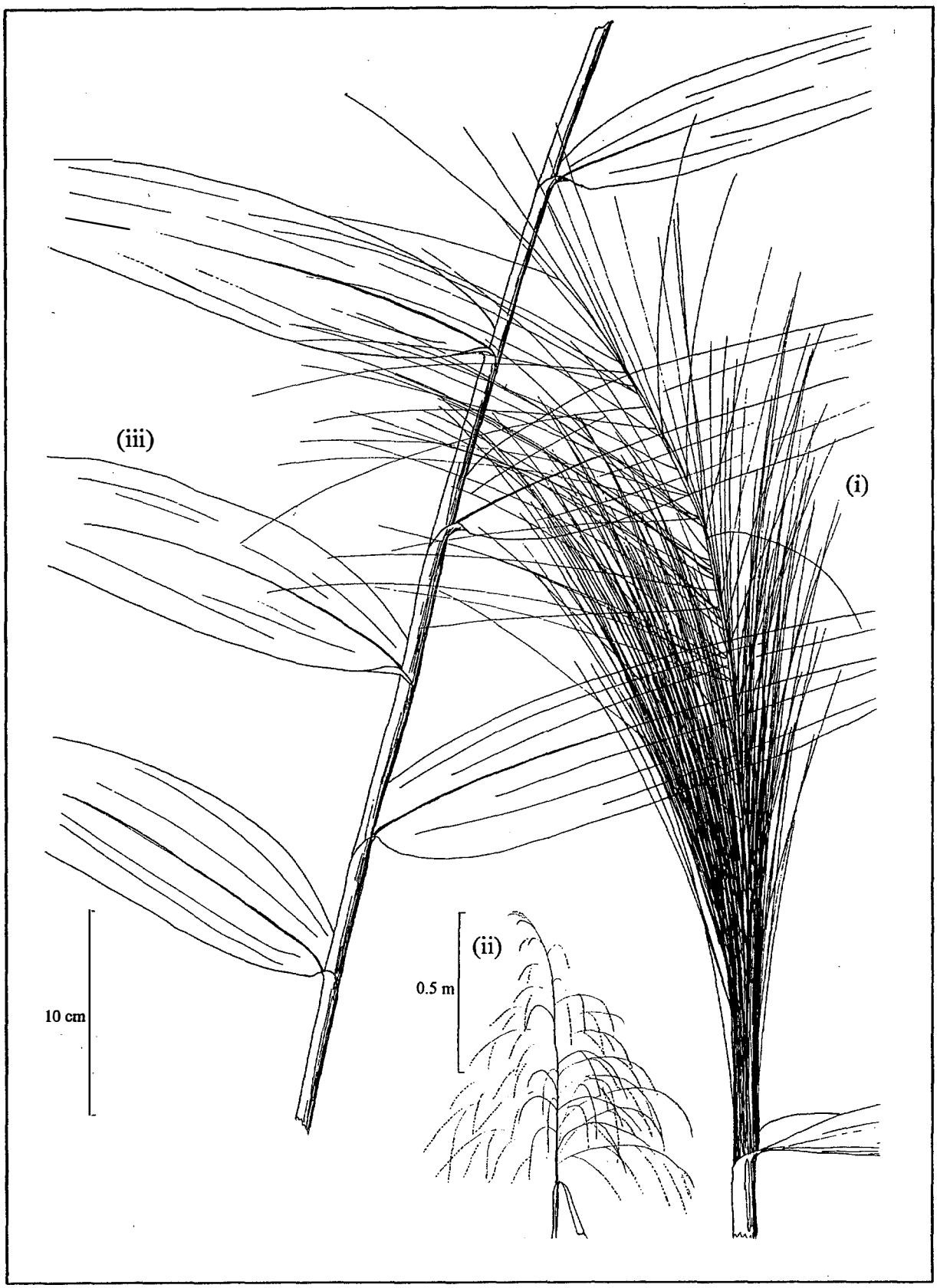


Figure 23. *Thysanolaena latifolia* (i) emerging inflorescence (ii) mature inflorescence (iii) part of culm

Thysanolaena latifolia (Figure 23)
Vernacular names – đót, đông-trùng hạ-thảo (Vietnam); tiger grass (English).

Description – robust perennial with culms to 4 m or more tall, the leaves characteristically crowded on the culm. Leaf sheaths hairy along the margins. Leaf blades up to 60 cm long, 40-80 mm wide, hairless. Ligule a membrane 1-2 mm long. Inflorescence a very large open panicle 15-125 cm long. Spikelets solitary, similar, 1.2-2 mm long, with 2 florets, only the upper one fertile, falling entire with pedicel attached.

Habitat – grows in full sun or light shade, mostly as isolated plants in valleys or on slopes. Often found on soils derived from schists.

Uses for livestock – considered to be an excellent and nutritious forage either for grazing or cut-and-carry. Later flowering than most forages in the region, it retains its quality into the dry season.

Other uses – the inflorescences are used for making brooms.

Deleterious properties – none.

Distribution – Throughout South-east Asia; also India, Burma and China, and cultivated in America as an ornamental. Quite common at altitudes above 500 m in Đắc Lắc Province, especially on the escarpment east of M'Drak; also occurs above 1000 m in the pine tree zone in Lâm Đồng Province.

References – Schmid 1958, as *T. maxima* (p. 343); Bor 1960, as *T. maxima* (p. 650); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960, as *T. maxima* (p. 672); Gilliland 1971, as *T. maxima* (p. 45); Pham-Hoàng Hộ 1972, as *T. maxima* (p. 873); Lazarides 1980, as *T. maxima* (p. 193), Mannetje and Jones 1992 (p. 224); Pham-Hoàng Hộ 1993, as *T. maxima* (p. 785); Hacker *et al.* 1998 (p. 57).

Group 5 – Grasses with open panicles; spikelets awned or prominently hairy, not crowded along panicle branches

Aristida chinensis (Figure 24A)
Description – a perennial forming small tussocks and with culms to 80 cm tall. Leaf sheaths hairless. Leaf blades hairless except for a few long hairs close to the junction with the sheath, up to c. 40 cm long, 1 mm wide, rolled. Ligule a minute rim. Inflorescence a. large, very open panicle up to c. 30 cm long, c. 15 cm wide. Spikelets solitary, all similar, c. 10 mm long excluding the awn, very narrow, hairless, with a single floret which bears a 3-pointed awn, the longer branch c. 10-15 mm long, the 'seed' disarticulating above the glumes.

Habitat – grasslands and shrublands, in sunny situations on sandy soils with some protection from grazing up to an altitude of 700 m.

Uses for livestock –

Other Uses –

Deleterious properties –

Distribution – Thailand, Vietnam, Cambodia, China, Taiwan. Occurs in Gia Lai and Đắc Lắc Provinces at an altitude of c. 500 m.

References – Schmid 1958 (p. 474); Pham-Hoàng Hộ 1972 (p. 895); Lazarides 1980 (p. 150); Pham-Hoàng Hộ 1993 (p. 785).

Arundinella setosa (Figure 24B)
Vernacular names – trúc-thảo lông Vietnam)

Description – perennial with culms to 1.8 m tall. Nodes hairless. Leaf sheaths almost hairless. Leaf blades up to 40 cm long, 3-9 mm wide, almost hairless. Ligule a membrane 1 mm long, with minute hairs along the upper margin. Inflorescence a panicle 10-45 cm long, with spikelets evenly spaced along the branches. Spikelets similar, solitary or in pairs, laterally compressed, 5-7 mm long, excluding the short awn, the glumes very unequal, with 2 florets, only the upper one fertile. The upper floret is awned, with 2 white bristles at the base. The spikelets break up at maturity.

Habitat – generally a species of medium altitudes in Indo-China, growing in full sunlight in open grassland or moderate shade on soils which are to some extent degraded. Also grows in open forests or clearings on seasonally swampy, lateritised soils.

Uses for livestock – has been classed as a minor forage, but also said to be avoided by cattle.

Other uses – none.

Deleterious properties – none.

Distribution – throughout South-east Asia, India, Burma, Malaysia, Indonesia; also in northern Australia. Widespread in Central Vietnam at altitudes from 500-1200 m, in grasslands around M'Drak, Đắc Lắc Provinces and dipterocarp and pine tree woodlands in Đắc Lắc and Lâm Đồng Provinces.

References – Schmid 1958 (p. 460,462); Bor 1960 (p. 424); Gilliland 1971 (p. 95); Pham-Hoàng Hộ 1972 (p. 877); Lazarides 1980 (p. 83); Mannetje and Jones 1992 (p. 237); Pham-Hoàng Hộ 1993 (p. 857); Hacker *et al.* 1998 (p. 51).

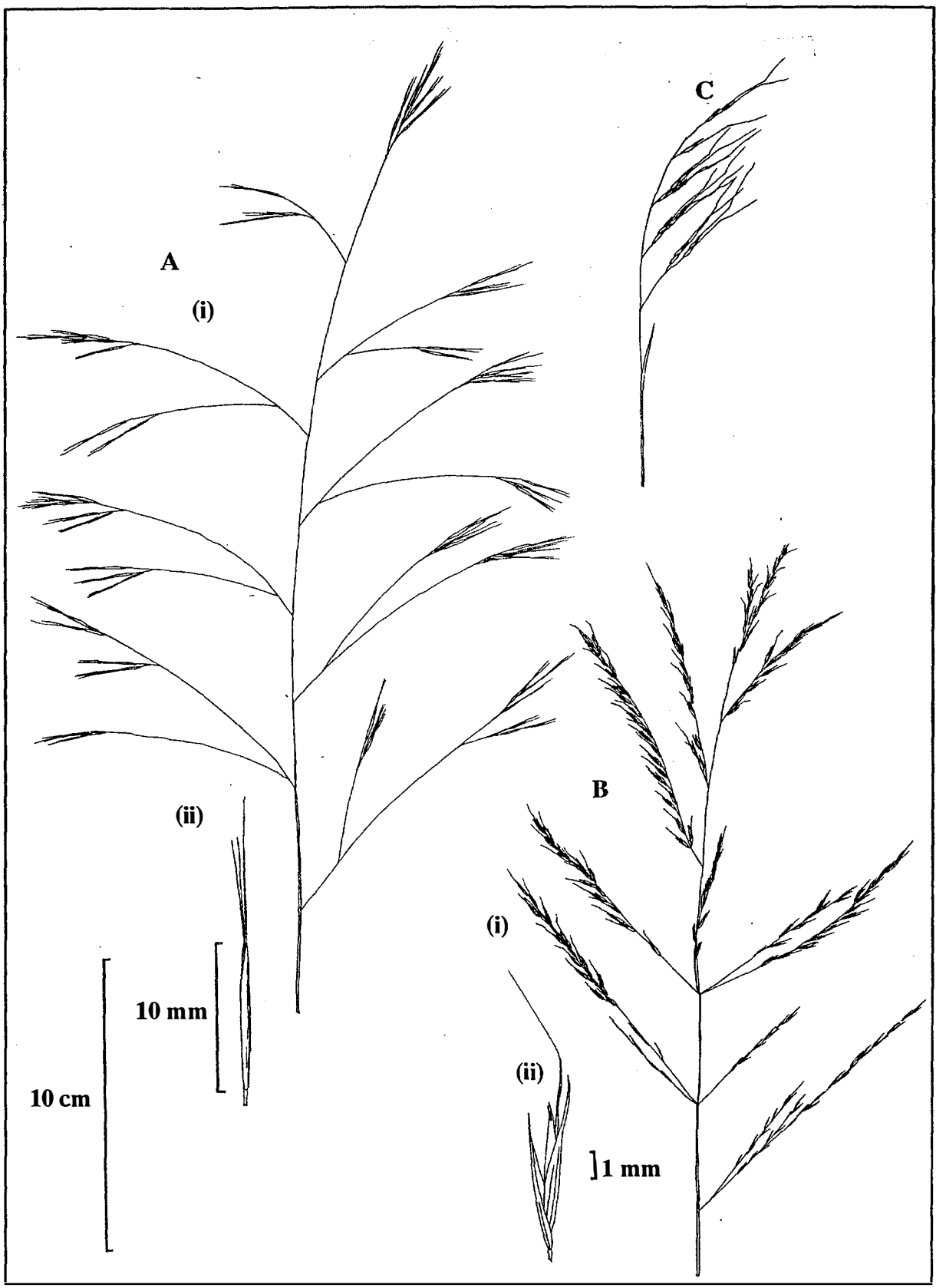


Figure 24. A – *Aristida chinensis* (i) inflorescence (ii) spikelet; B – *Arundinella setosa* (i) inflorescence (ii) spikelet; C – *Capillipedium longisetosum*

Capillipedium longisetosum (Figure 24C)
Description – annual with culms 0.4-0.6 m tall. Nodes densely covered with prominent spreading hairs. Leaf sheaths with a few prominent hairs along the upper margins. Leaf blade 5-12.5 cm long, 1.5-3.5 mm wide, hairless except for a few long hairs along the lower margins. Ligule membranous. Inflorescence a panicle c. 8 cm long, the racemes with 1-4 joints, breaking up at maturity. Spikelets in pairs, similar in shape, dorsoventrally compressed. Sessile spikelet 3.5 mm long, the lower glume 2-keeled, with 2 florets, only the upper one fertile, with a geniculate awn 3-4 cm long.
Habitat – dipterocarp woodlands.

Uses for livestock – of no significance as a forage.

Other Uses – none.

Deleterious properties – none.

Distribution – Thailand. Not previously recorded from Vietnam; occurs in Đắc LắçProvince northwest of Buôn Ma Thuôt at an altitude of 250 m.

References – Lazarides 1980 (p. 25).

Chrysopogon aciculatus (Figure 25A)
Vernacular names – may (Vietnam); Mackies pest (Australia).

Description – strongly rhizomatous perennial, the culms up to 60 cm tall but usually shorter, creeping or decumbent at the base, branching and rooting and forming a dense mat. Leaf blades 3-10 cm long, 4-8 mm wide, blunt-tipped, hairless. Ligule a very short membrane. Inflorescence a panicle 5-12 cm long, c. 2.5 cm wide, with several whorls of branches, each ending in a single cluster of 3 spikelets. Spikelets in pairs, dissimilar, the sessile spikelet fertile and with a 5.2-8 mm awn, the 2 pedicellate spikelets sterile. Sessile spikelet with 2 florets, only the upper one fertile, falling entire.

Habitat – a species of more-or-less impoverished, disturbed, sandy soils, generally in areas which have been heavily grazed.

Uses for livestock – considered to be of average quality for grazing, but not a productive species.

Other uses – the stolons are used for making brushes and the seeds have vermifugal properties (expelling intestinal worms).

Deleterious properties – a difficult weed to eradicate in cultivation. The stiffly hairy "seeds" can penetrate mouths and feet of grazing cattle, causing injury.

Distribution – south and South-east Asia, Vanuatu, Polynesia, northern Australia; introduced to West Africa. In Central Vietnam this species is a major component of heavily grazed grasslands and roadsides at altitudes from 200-1000 m.

References – Schmid 1958 (p. 210); Bor 1960 (p. 115); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 672); Gilliland 1971 (p. 236); Pham-Hoàng Hộ 1972 (p. 977); Lazarides 1980 (p. 26); Tothill and Hacker 1983 (p. 162); Mannetje and Jones 1992 (p. 92); Pham-Hoàng Hộ 1993 (p. 874); Hacker *et al.* 1996 (p. 31); 1998 (p. 62).

Melinis minutiflora (Figure 25B)
Vernacular names – mật-kê hoa-nhỏ (Vietnam); molasses grass (Australia).

Description – perennial with culms to 1 m tall, stoloniferous, forming a mat. Nodes covered in long,

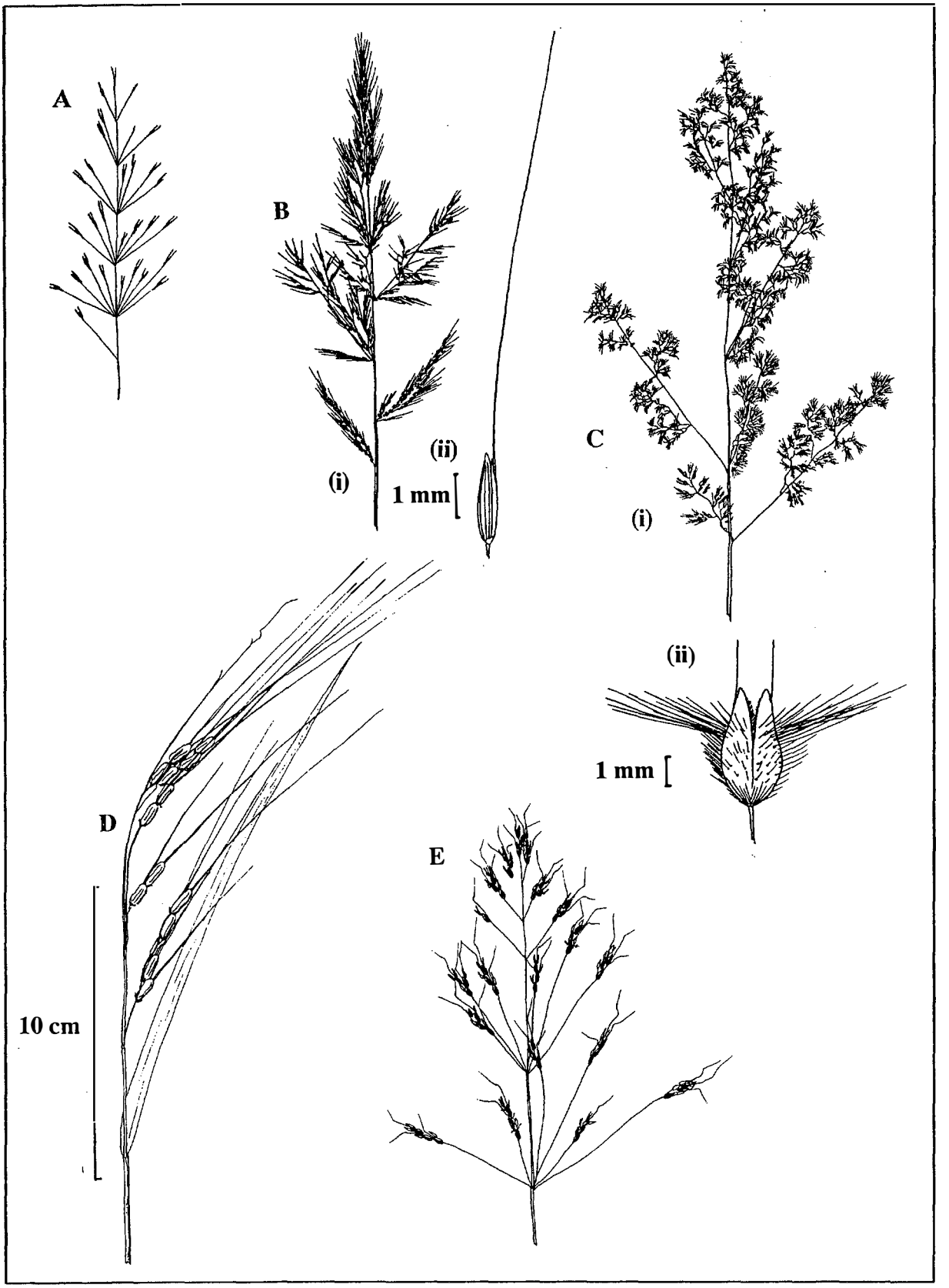


Figure 25. A – *Chrysopogon aciculatus*; B – *Melinis minutiflora* (i) inflorescence (ii) spikelet; C – *M. repens* (i) inflorescence (ii) spikelet; D – *Oryza rufipogon*; E – *Sorghum nitidum*

silky hairs. Leaf sheaths and blades densely covered with short, sticky hairs, which give off a strong scent of molasses. Leaf blades 5-15 cm long, 5-10 mm wide. Ligule a rim of short hairs. Inflorescence a narrow panicle up to 20 cm long, the branches arranged in clusters on either side of the axis. Spikelets solitary, similar, c. 2 mm long, with 2 florets, the lower sterile and bearing a 3-10 mm awn, the upper fertile, falling entire.

Habitat – prefers cooler climates and moderately fertile soils. Spreads successfully on disturbed land, often forming a monospecific sward.

Uses for livestock – highly regarded as a palatable species for livestock, but not tolerant of heavy grazing or fire.

Other uses – reputed to have insecticidal properties and used in Africa for beds for sitting fowls and dogs giving birth.

Deleterious properties – none.

Distribution – native to Africa, but now pan-tropical. Occurs in Lâm Đồng Province at an altitude of c. 850 m, where it had escaped from sown pastures.

References – Schmid 1958 (p. 347, 655); Bor 1960 (p. 315); Pham-Hoàng Hộ 1972 (p. 923); Lazarides 1980 (p. 123); Tothill and Hacker 1983 (p. 305); Mannettje and Jones 1992 (p. 240); Pham-Hoàng Hộ 1993 (p. 837).

Melinis repens (Figure 25C)
Vernacular names – hồng-nhung (Vietnam); Natal grass (Australia).

Description – erect annual or weakly stoloniferous or loosely tufted perennial with culms mostly 0.5-1 m tall. Nodes covered with dense, short hairs. Leaf sheaths hairy or hairless. Leaf blades 5-20 cm long, 4-10 mm wide, with short hairs on both surfaces. Ligule a row of prominent hairs 0.5-1 mm long. Inflorescence an open panicle 8-15 cm long, 4-7 cm wide, reddish in colour. Spikelets solitary, similar, laterally compressed, densely covered in the upper part with long, reddish hairs, c. 4 mm long, with 2 florets, each with an awn 1-5 mm long, only the upper one fertile, falling entire.

Habitat – a grass of warm to coolish climates, rapidly colonizing disturbed ground, but not persisting with grazing. Tolerant of a wide range of soils, including dry situations.

Uses for livestock – an unproductive grass which is palatable when young but rapidly becomes stemmy.

Other uses – none.

Deleterious properties – none.

Distribution – native to southern Africa; now pantropical. Occasionally found at medium to high altitudes in Central Vietnam.

References – Bor 1960 (p. 355); Gilliland 1971 (p. 150); Pham-Hoàng Hộ 1972 (p. 923); Lazarides 1980 (p. 138); Tothill and Hacker 1983 (p. 363); Pham-Hoàng Hộ 1993 (p. 837) (all as *Rhynchelytrum repens*).

Oryza rufipogon (Figure 25D)
Vernacular names – Lúa hoang (Vietnam)

Description – perennial with culms to 90 cm (rarely to 4 m) tall. Nodes hairless. Leaf sheaths hairless . Leaf blades 20–60 cm long, 5-25 mm wide, hairless. Ligule a membrane 4.5-38 mm long. Inflorescence

a narrow panicle. Spikelets solitary, all similar, laterally compressed, 7.5-11.5 mm long and 2-4.5 mm wide, 2.7-4.4 times as long as wide, and with a straight awn up to 110 mm long.

Habitat – grows in swampy conditions.

Uses for livestock – moderately palatable as a forage to water buffaloes, but the foliage is coarse and it is less acceptable to cattle.

Other Uses – the grain is eaten in times of famine.

Deleterious properties – usually regarded as a noxious weed, as it is difficult to eradicate from rice fields.

Distribution – throughout South-east Asia and the tropics and subtropics of Asia, Australia and the Americas. Occurs in Đắc Lắc Province at low to medium altitudes in seasonally swampy sites.

References – Bor 1960 (p. 605); Pham-Hoàng Hộ 1972 (p. 871); Lazarides 1980 (p. 183, 184); Mannetje and Jones 1992, as *O. fatua* (p. 241); Pham-Hoàng Hộ 1993 (p. 776).

Sorghum nitidum (Figure 25E)
Vernacular names – brown sorghum (Australia)

Description – slender perennial with culms to 2 m tall. Nodes with a ring of white hairs. Leaf sheaths hairless. Leaf blades up to 110 cm long, 11 mm wide, hairless. Ligule a membrane 1.5-2 mm long, with or without minute hairs along the upper margin. Inflorescence a moderately open panicle with branches in whorls, each bearing a cluster of spikelets c. 10 mm long at the ends. Spikelets dissimilar, in pairs, the sessile spikelet fertile, the pedicellate spikelet sterile (the terminal group has 2 pedicellate sterile spikelets). Sessile spikelet 3.5-7 mm long with 2 florets, only the upper one fertile, with or without a geniculate awn up to 2.5 cm long, black when ripe, densely covered with dark brown hairs, falling entire.

Habitat – occurs in grasslands and savannas; tends to prefer well-drained sites.

Uses for livestock – a forage of minor importance, palatable to stock, and useful for grazing where it is abundant.

Other uses – none.

Deleterious properties – none.

Distribution – south and South-east Asia, S. China, Indonesia, Philippines, northern Australia. In Central Vietnam frequent as a minor component of grasslands under dipterocarp woodland or open grassland at medium altitude; also at higher altitudes in pine tree woodland.

References – Bor 1960 (p. 245); Pham-Hoàng Hộ 1972 (p. 980); Lazarides 1980 (p. 72,73); Tothill and Hacker 1983 (p. 380); Mannetje and Jones 1992 (p. 243); Pham-Hoàng Hộ 1993 (p. 878); Hacker *et al.* 1996 (p. 32); 1998 (p. 63).

Group 6 – Grasses with racemose panicles; spikelets crowded along panicle branches; spikelets awnless or awn short and indistinct

Axonopus compressus (Figure 26A)
Vernacular names – cỏ la-gừng (Vietnam); broad-leaved carpet grass, mat grass (Australia)

Description – prostrate and rhizomatous perennial with culms to 50 cm tall. Nodes often densely hairy. Leaf sheaths strongly compressed and overlapping. Leaf blades 4-25 cm long, mostly short in grazed pastures, 4-10 mm wide, blunt-tipped, hairless on lower surface but with sparse, long hairs on upper surface and along margins. Ligule a short membrane with minute hairs along the upper margin. Inflorescence a subdigitate panicle, barely extruded from the upper leaf sheath, with 2-5 slender racemes 3-11 cm long. From one to five inflorescences arise from the upper leaf sheath. Spikelets solitary, all similar, dorsoventrally compressed, 2-3.5 mm long, arranged in 2 overlapping rows on the underside of the axis, falling entire at maturity. They lack a lower glume and have 2 florets, only the upper one fertile.

Habitat – adapted to short, open grasslands and also shade tolerant. Grows on a range of soil types but prefers lighter soils, generally moderately fertile but well-drained.

Uses for livestock – considered to be a useful grass for grazing, although not as productive as some other grasses and becomes unpalatable late in the wet season.

Other Uses – in some countries, used as a lawn grass.

Deleterious properties – can be a troublesome weed in gardens and plantations.

Distribution – native to tropical America, now widespread through the tropics and subtropics of the world. In the Central Vietnam, widespread in heavily grazed grasslands and along roadsides at low to medium altitudes, often with *Paspalum conjugatum*.

References – Schmid 1958 (p. 309); Bor 1960 (p. 278); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 660); Gilliland 1971 (p. 187); Pham-Hoàng Hộ 1972 (p. 938); Lazarides 1980 (p. 106); Tothill and Hacker 1983 (p. 125); Mannetje and Jones 1992 (p. 53); Pham-Hoàng Hộ 1993 (p. 815); Hacker *et al.* 1998 (p. 65).

Cynodon dactylon (Figure 26B)
Vernacular names – cỏ-chỉ (Vietnam); green couch, common couch (Australia); Bermuda grass (USA)

Description – stoloniferous and/or rhizomatous perennial, the culms up to 40 cm tall, often much shorter. Nodes hairless. Leaf sheaths hairless. Leaf blades 3-6 cm long, 2-3 mm wide, hairy or hairless, stolon leaves mostly in groups of 3. Ligule a dense row of short hairs with a tuft of longer hairs at either end. Inflorescence a digitate panicle with 1-6 spikes, each 2-5 cm long, with sessile spikelets borne in 2 overlapping rows on the underside of the axis. Spikelets solitary and similar, 2-2.5 mm long, laterally flattened, with a single floret, which is fertile, breaking up at maturity.

Cultivars and forms of the species found in other regions may be more robust, with larger leaves and inflorescences.

Habitat – occurs at all altitudes in Indo-China, on cleared land and in sunny to lightly shaded situations. Adapted to well-drained soils but will tolerate flooding. Grows on alkaline to rather acid soils, but does not tolerate extreme acidity. Adapted to heavy grazing.

Uses for livestock – this species is considered to be a good grazing grass and is particularly relished by horses. A number of very productive cultivars have been bred in the USA.

Other Uses – a good soil binder (erosion control), especially under dry conditions, Also used as a lawn grass, for tennis courts and golf courses in Australia, USA and elsewhere.

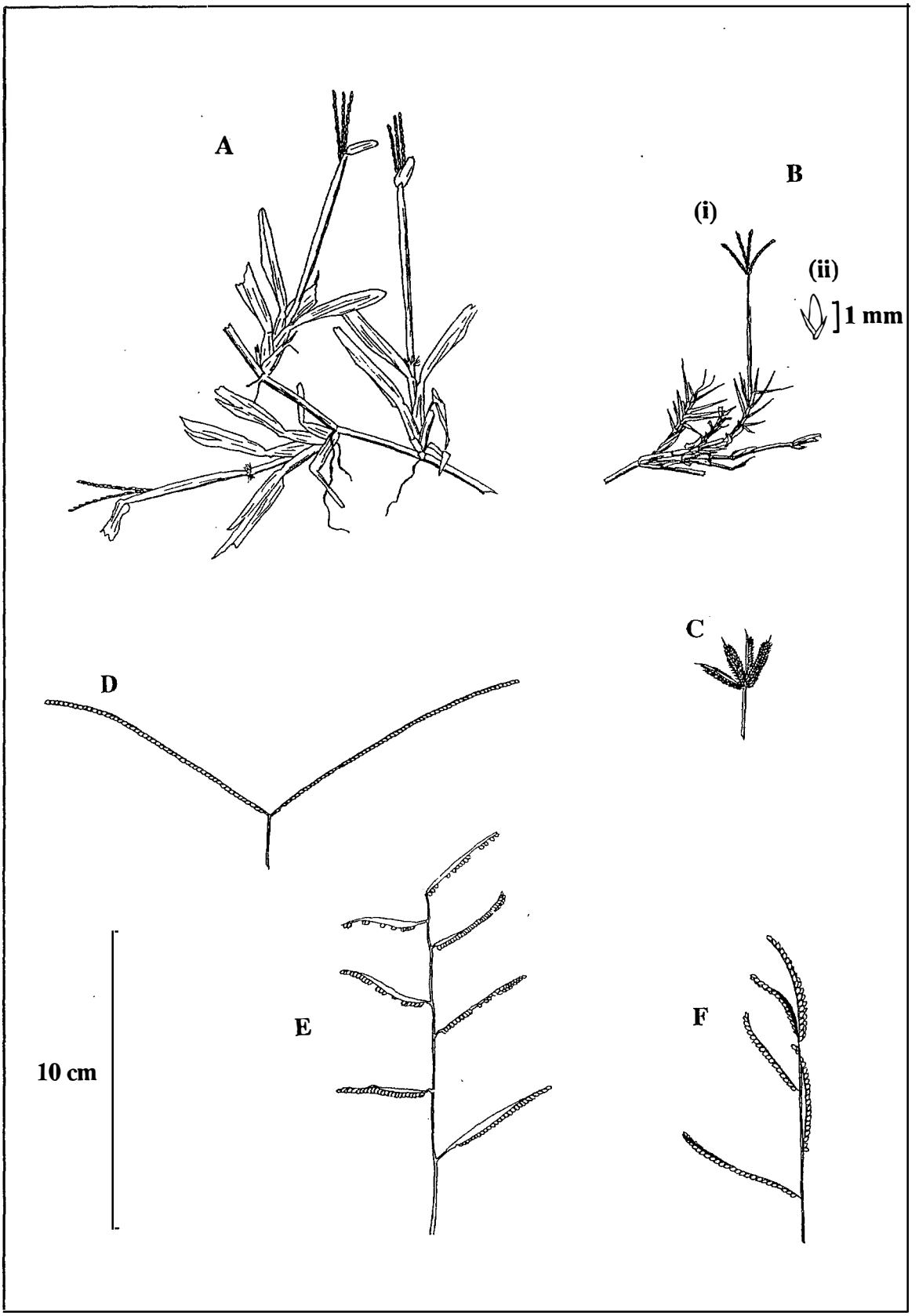


Figure 26. A – *Axonopus compressus*; B – *Cynodon dactylon* (i) plant, (ii) spikelet; C – *Dactyloctenium aegyptium*; D – *Paspalum conjugatum*; E – *P. orbiculare*; F – *P. scrobiculatum* var. *bispicatum*

Deleterious properties – can be a troublesome weed of cultivation. When wilted, can become toxic to livestock, although this is unusual. Pollen is said to be allergenic.

Distribution – occurs throughout the world's tropics and subtropics, also extending into temperate latitudes. Sometimes found as a minor component in grazed pastures and along roadsides in Central Vietnam at altitudes of 500-700 m, but likely to extend both to low altitudes and altitudes >1000 m.

References – Schmid 1958 (p.510,513); Bor 1960 (p.469); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 656); Gilliland 1971 (p. 90); Pham-Hoàng Hộ 1972 (p. 899); Lazarides 1980 (p.159); Tothill and Hacker 1983 (p.175); Mannetje and Jones 1992 (p.100) ; Pham-Hoàng Hộ 1993 (p. 802); Hacker *et al.* 1998 (p. 65).

Dactyloctenium aegyptium (Figure 26C)
Vernacular names – cỏ chân-gà (Vietnam); coast button grass (Australia)

Description – mat-forming annual with culms to 0.7 m tall. Nodes hairless. Leaf sheaths flattened, hairless. Leaf blades 3-25 cm long, up to 12 mm wide, hairy especially along the margins. Ligule a narrow membrane. Inflorescence a digitate panicle consisting of a single whorl of 3-6 spreading spikes 1-6.5 cm long, each spike ending in a prominent point. Spikelets similar and solitary, laterally compressed, 2.5-4 mm long, in 2 alternate rows on the underside of the rachis, each with 3-4 florets, breaking up at maturity.

Habitat – adapted to a wide range of soil types, but prefers sandy soils. Most commonly found on disturbed sites.

Uses for livestock – a palatable species, widely used as a forage. It is also reputed to make good hay.

Other Uses – grain may be used for human consumption when food is scarce, but is reputed to cause internal disorders.

Deleterious properties – a troublesome weed of cultivation.

Distribution – Old World tropics and subtropics; introduced to the New World. In Central Vietnam commonly found at altitudes of up to 1000 m on disturbed ground and as a weed of cultivation.

References – Schmid 1958, as *D. aegyptiacum* (p.518); Bor 1960 (p.489); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960, as *D. aegyptiacum* (p. 660); Gilliland 1971 (p. 81); Pham-Hoàng Hộ 1972, as *D. aegyptiacum* (p.890); Lazarides 1980 (p.167); Tothill and Hacker 1983 (p.179); Mannetje and Jones 1992 (p.104); Pham-Hoàng Hộ 1993 (p. 799).

Digitaria effusa (Figure 27A)
Description – perennial with culms 25-40 cm tall, rooting from lower nodes. Nodes hairless. Leaf sheaths sparsely covered with spreading hairs. Leaf blades 4- 9 cm long, 6-11 mm wide, sparsely hairy on both surfaces. Ligule a membrane 1 mm long, lacking hairs along the upper margin. Inflorescence a racemose panicle, with 5-8 spreading, alternate racemes 35-55 mm long borne on an axis 10-30 mm long. Spikelets paired, one borne on a short pedicel, the other on a longer pedicel, all similar, dorsoventrally compressed, hairless, 2 mm long, falling separately at maturity, the fruit yellow when ripe.

Habitat – disturbed ground.

Uses for livestock – of no significance as a forage.

Other Uses – none.

Deleterious properties – none.

Distribution – a newly described species which occurs in Lâm Đồng Province in pine tree woodlands at altitudes more than 1000 m.

Digitaria heterantha (Figure 27B)
Vernacular names – túc-hình dị-hoa (Vietnam)

Description – loosely tufted stoloniferous perennial with culms to 0.8 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades up to 7 cm long, 4-10 mm wide, hairless. Ligule a membrane c. 1 mm long. Inflorescence a digitate panicle with 2-4 racemes 4.5-24 cm long, from a short rhachis. Spikelets in dissimilar pairs, 3.5-6 mm long, the sessile spikelet hairless, the pedicellate spikelet with long hairs, spreading with maturity, falling entire. Both spikelets have 2 florets, the lower sterile, the upper fertile; the fruit is yellowish when ripe.

Habitat – occurs on disturbed ground and old cultivation.

Uses for livestock –

Other Uses –

Deleterious properties –

Distribution – Vietnam, Philippines, Malaysia, Indonesia, Papua-New Guinea, China. Occurs in Gia Lai Province, as an occasional weed in areas of cultivation and grazing.

References –Phạm-Hoàng Hộ 1972 (p. 935); Lazarides 1980 (p. 115); Pham-Hoàng Hộ 1992 (p. 838).

Digitaria longiflora (Figure 27C)
Vernacular names – túc-hình hoa-dài (Vietnam)

Description – a mat-forming annual or perennial with initially prostrate culms rooting extensively from lower nodes and ascending to a height of 10-50 cm. Nodes hairless. Leaf sheaths hairless. Leaf blades usually 1-6 cm long, 2-5 mm wide, hairless or with a few coarse hairs along the margins close to the base, often less than 3 cm long and c. 4 mm wide on stolon leaves, but longer where plants have not been heavily grazed. Ligule a membrane 1 mm long. Inflorescence a. digitate panicle with 2-3 racemes c. 3 cm long arising from the tip of the peduncle, or from a short, common axis. Spikelets solitary, all similar, dorsoventrally compressed, c. 1.5 mm long, hairless, with 2 florets, only the upper one fertile, shedding entire, the fruit yellowish or brownish.

Habitat – grasslands, woodlands and roadsides, particularly where grazing has been heavy, up to 1200 m altitude.

Uses for livestock – classed as a minor forage, but palatable to livestock and a major component of some grazed grasslands. Tolerant of heavy grazing

Other Uses – has been used as a lawn grass.

Deleterious properties – none.

Distribution – widespread in tropical Asia, Africa and Australia; introduced to the Americas. In Đắc Lắc and Gia Lai Provinces, often a dominant species in heavily grazed areas of grasslands at altitudes of up to 700 m.

References – Schmid 1958 (p. 306, 309); Bor 1960 (p. 302); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 656); Gilliland 1971 (p. 192); Phạm-Hoàng Hộ 1972 (p. 937); Lazarides 1980 (p. 113, 115); Tothill and Hacker 1983 (p. 195); Mannetje and Jones 1992 (p. 238); Pham-Hoàng Hộ 1993 (p. 841).

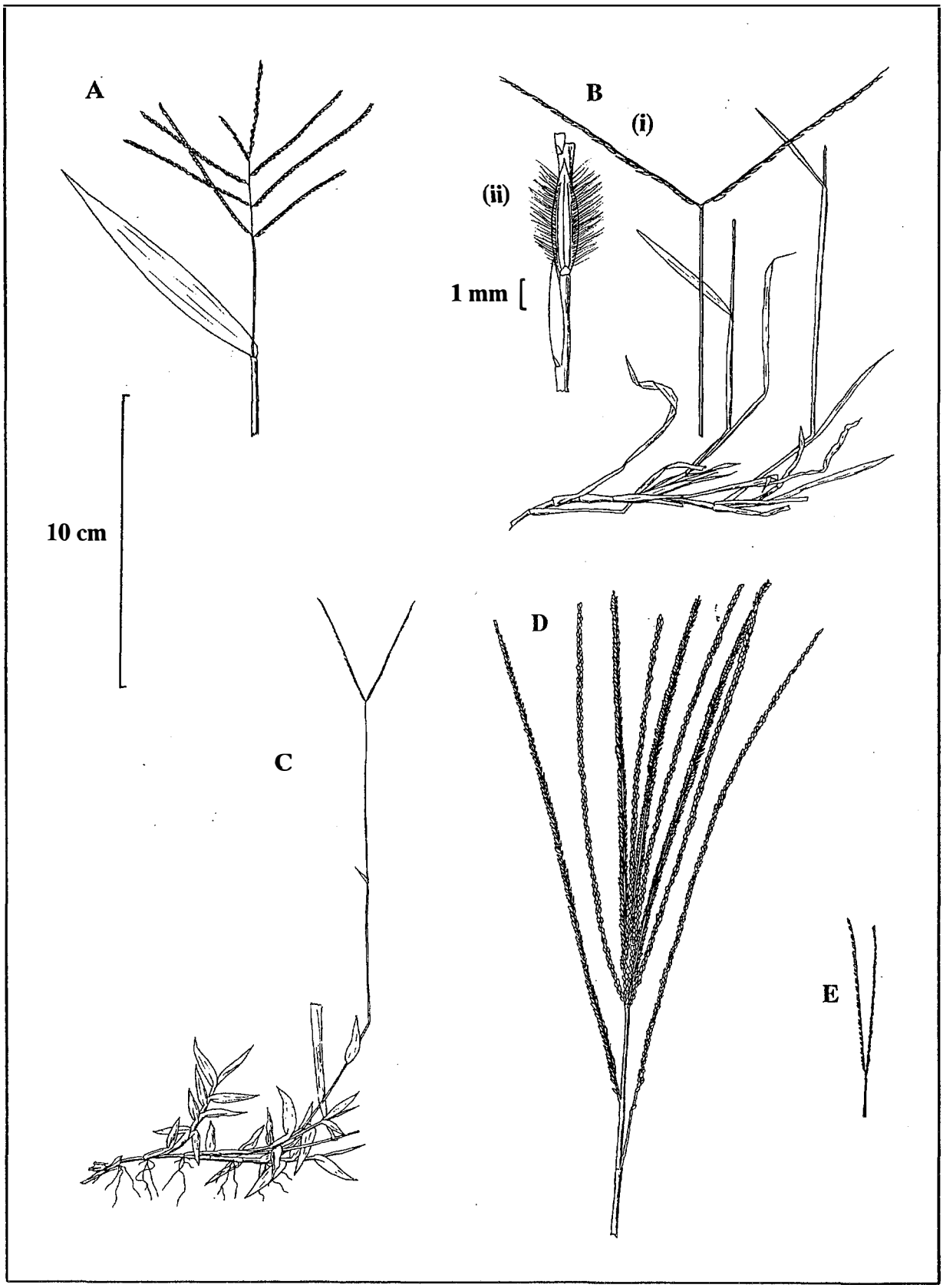


Figure 27. A – *Digitaria effusa*; B – *D. heterantha* (i) plant, (ii) pair of spikelets; C – *D. longiflora*; D – *D. ternata*; E – *D. violascens*

Digitaria ternata (Figure 27D)
Vernacular names –

Description – tufted annual with culms to 1.25 m tall. Nodes hairless. Leaf sheaths hairless. Leaf blades up to 60 cm long, 10 mm wide, hairless or with a few long hairs close to the junction with the sheath. Ligule a membrane 2 mm long. Inflorescence a subdigitate panicle with 2-10 racemes up to c. 20 cm long, borne on a common axis 0-6 cm long. Spikelets solitary, all similar, dorsoventrally compressed, clustered in uneven rows on the underside of the rhachis, 1.5-2.5 mm long, densely covered with short, coarse hairs along the margins, the 'fruit' dark brown to very dark purple, shedding entire.

Habitat – disturbed ground, cultivation.

Uses for livestock – of minor importance as a forage.

Other Uses – none.

Deleterious properties – a weed of cultivation.

Distribution – widespread in South-east Asia, and tropical Asia and Africa. Introduced to Australia and the Americas. Occurs in Gia Lai and Đắc Lắc Provinces as a weed of cultivation and in other disturbed areas.

References – Bor 1960 (p. 306); Lazarides 1980 (p. 117); Mannetje and Jones 1992 (p. 238); Pham-Hoàng Hộ 1993 (p. 840).

Digitaria violascens (Figure 27E)
Vernacular names – túc-hình tím (Vietnam)

Description – annual with erect culms to 70 cm tall. Nodes hairless. Leaf sheaths hairless. Leaf blades mostly 4-17 cm long, 3-5 mm wide, hairless except for a few hairs near the base. Ligule a membrane, lacking hairs on the upper margin. Inflorescence with 2-7 digitately arranged racemes 5-15 cm long, on a common axis up to 2.5 cm long. Spikelets similar, dorsoventrally compressed, 1-2 mm long, in groups of 3, each with a minute lower glume and 2 florets, only the upper one fertile. The fruit is chestnut-brown, becoming purple when ripe, and falls entire.

Habitat – common along roadsides at medium to high altitudes in Indo-China. Widespread and common in disturbed areas, such as abandoned fields, and also a minor component of natural grasslands.

Uses for livestock – considered to be a minor forage species.

Other Uses – none.

Distribution – pan-tropical. Occurs in Đắ Lắc Province near M'Drak as a minor species in secondary shrubland and likely to be widespread in Central Vietnam.

References – Schmid 1958 (p. 306,309); Bor 1960 (p. 307); Gilliland 1970 (p. 191); Pham-Hoàng Hộ 1972 (p. 936); Veldkamp 1973 (P. 63); Lazarides 1980 (p. 113,118); Tothill and Hacker 1983 (p. 196); Mannetje and Jones 1992 (p. 238); Pham-Hoàng Hộ 1993 (p. 843); Hacker *et al.* 1998 (p. 68).

Eleusine indica (Figure 28)
Vernacular names – mần-trầu, ngưu-cân (Vietnam); crowsfoot (Australia)

Description – annual to 60 cm tall, often much shorter where it is grazed or in pathways. Nodes hairless.

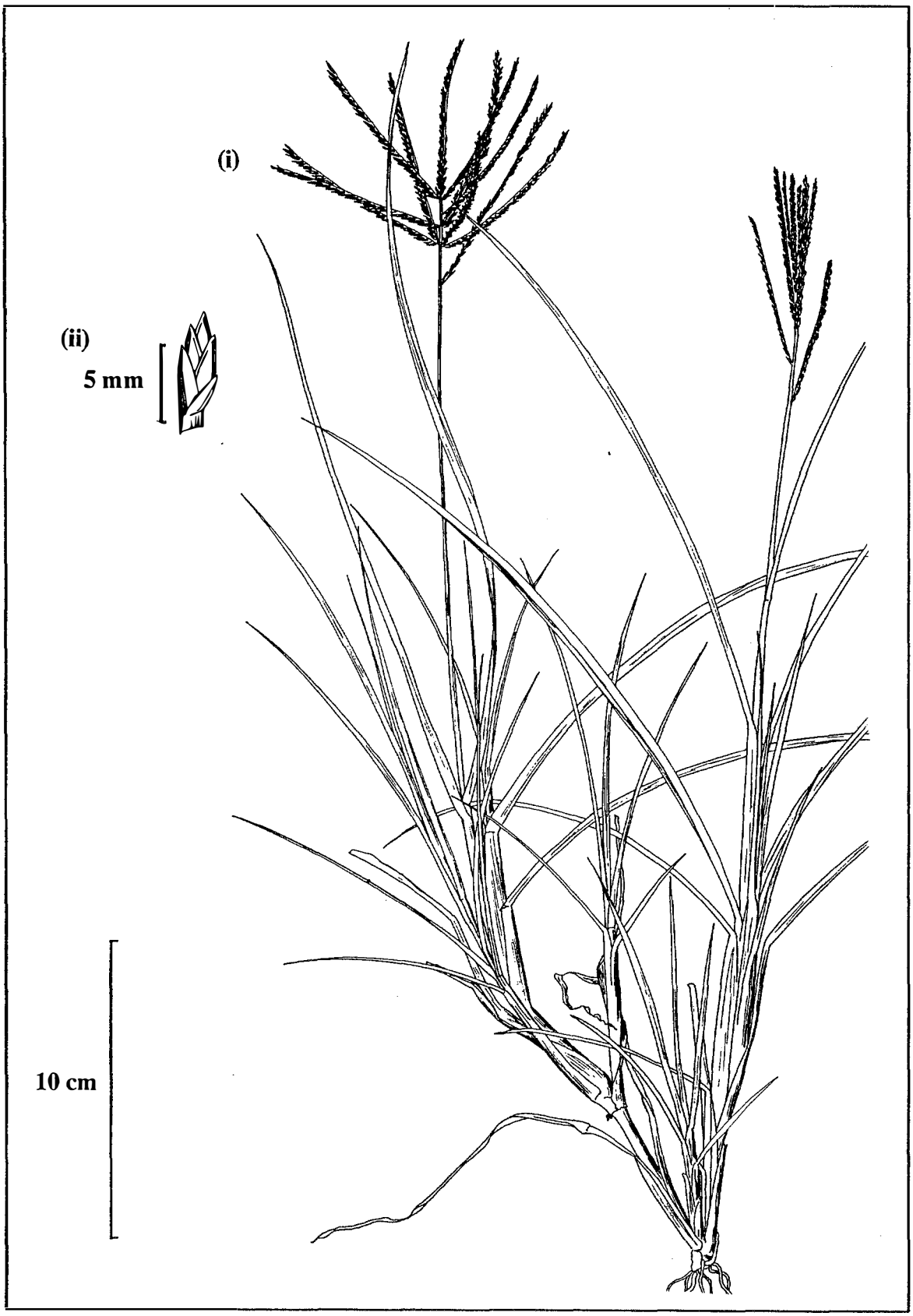


Figure 28. *Eleusine indica* (i) plant, (ii) spikelet

Leaf sheaths slightly hairy along the upper margins. Leaf blades 3-8 mm wide, folded towards the base, hairless except for a few hairs along the lower margins. Ligule a membrane 0.6-1 mm long, with minute hairs along the upper margin. Inflorescence a digitate panicle, with 2-7 spikes 4-15 cm long, sometimes with 1 or more spikes below the main group. Spikelets solitary, similar, hairless, flattened, with 3-9 florets, all except the upper ones fertile, breaking up at maturity.

Habitat – common on disturbed ground throughout Indo-China, at all altitudes; sometimes occurs in pastures where grazing is heavy and it can establish in spaces between other plants. Frequently found as a weed in towns and villages, and along roadsides.

Uses for livestock – a nutritious grass which may be used as a cut-and-carry forage and can also be made into hay or silage.

Other Uses – eaten in parts of Laos as a green vegetable. Although an annual grass, a good soil-binder.

Deleterious properties – a significant weed of cultivation; when wilted, it can be toxic to stock.

Distribution – occurs throughout the tropical and subtropical regions of the world. In Central Vietnam frequent on disturbed ground up to and exceeding 1000 m.

References – Schmid 1958 (p.518); Bor 1960 (p.493); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 656); Gilliland 1971 (p. 78); Pham-Hoàng Hộ 1972 (p. 890); Lazarides 1980 (p.171); Tothill and Hacker 1983 (p.215); Pham-Hoàng Hộ 1993 (p. 798); Hacker *et al*. 1998 (p. 69).

Paspalum conjugatum (Figure 26D)
Vernacular names – san cặp (Vietnam); sour grass (Australia)

Description – vigorous stoloniferous perennial, the culms to 80 cm or more tall. Leaf sheaths compressed, with hairs along the margins. Leaf blades 8-20 cm long 5-15 mm wide, hairless or with short hairs along the lower margins of the leaf blade. Ligule a membrane 1-1.5 mm long, lacking hairs along the upper margin. Inflorescence digitate, with 2 (rarely 3) racemes 7-16 cm long. Spikelets solitary, similar, in 2 overlapping rows, 2 mm long, with a fringe of hairs along the margin, green, with 2 florets, only the upper one fertile, falling entire.

Habitat – Occurs in shady and humid, but not swampy, situations at lower and middle altitudes in Indo-China. A dominant grass in many heavily grazed pastures in open and moist situations at medium altitudes.

Uses for livestock – palatable to both cattle and pigs, but more palatable to water buffaloes than cattle. *P. conjugatum* dominance is generally considered to be indicative of overgrazing.

Other uses – none.

Deleterious properties – a common weed in waste ground, cultivation areas and plantations.

Distribution – occurs throughout the tropics and subtropics of the whole world. In Central Vietnam, widespread at low to medium altitudes in heavily grazed areas including roadsides.

References – Schmid 1958 (p.302,304); Bor 1960 (p.336); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 658); Gilliland 1970 (p. 180); Pham-Hoàng Hộ 1972 (p. 912); Lazarides 1980 (p.132,133); Tothill and Hacker 1983 (p.334); Koning and Sosef 1985 (p. 290); Mannetje and Jones 1992 (p. 177); Pham-Hoàng Hộ 1993 (p. 834); Hacker *et al*. 1998 (p. 69).

Paspalum orbiculare (Figure 26E)
Vernacular names – san tròn (Vietnam)
Description – tufted perennial with culms to 0.3-1 m tall. Nodes hairless. Leaf sheaths hairless. Leaf

blades 8-25 cm long, 4-7 mm wide, hairless except for short hairs at the base. Ligule a membrane 2 mm long. Inflorescence a racemose panicle borne on a long peduncle, with 2-4, sometimes up to 6 racemes borne singly on a long axis, the raceme axis 1-1.5 mm wide, the lowermost racemes 1-6.5 cm long. Spikelets solitary, all similar, dorsoventrally compressed, borne in 2 even rows on the underside of the axis, c. 2 mm long and 1.5 mm wide, hairless, with 2 florets, only the upper one fertile, shedding entire.

Habitat – disturbed ground, sometimes in intermittently flooded areas.

Uses for livestock – of some value as a fodder.

Other Uses – none.

Deleterious properties – none.

Distribution – India, South-East Asia to Australia. Found occasionally in Đắc Lắc Province in moist situations in the vicinity of M'Drak.

References – Schmid 1958 (p. 300, 302); Bor 1960 (p. 340); Gilliland 1971 (p. 184); Phạm-Hoàng Hộ 1972 (p. 913); Lazarides 1980, as *P. scrobiculatum* (p. 133); Tothill and Hacker 1983 as *P. scrobiculatum* (p. 334); Mannetje and Jones 1992 (p. 186); Pham-Hoàng Hộ 1993 (p. 835).

Paspalum scrobiculatum* var. *bispicatum (Figure 26F)
Vernacular names – san tròn (Vietnam); scrobic, ditch millet (Australia)

Description – perennial forming tussocks and with culms 8-70 cm tall. Nodes hairless. Leaf sheaths hairless. Leaf blades 10-25 cm long, 4-9 mm wide, hairless except for appressed hairs behind the ligule. Ligule a minute rim. Inflorescence a racemose panicle, with 2-6 or more racemes, the longest 1.5-9 cm long, arranged on either side of the axis. Spikelets solitary, all similar, dorsoventrally compressed, densely arranged in 2 overlapping rows, 2-2.5 mm long, almost circular, hairless, with 2 florets, only the upper one fertile, shedding entire.

Habitat – grasslands and cultivated or disturbed areas, sometimes in woodlands, up to an altitude of 2000 m. Tolerates water-logged soils but prefers a reasonably high level of soil fertility.

Uses for livestock – a palatable species considered to be of high quality. Cultivated in India as a fodder crop.

Other Uses – in India, also cultivated as a grain crop.

Deleterious properties – none. The related var. *scrobiculatum* is reputed to be toxic, both to animals and humans, under some situations.

Distribution – occurs throughout the World's tropics. In Central Vietnam, this species is quite common in heavily grazed areas at altitudes of 500-700 m.

References – Schmid 1958 (p. 300, 302); Bor 1960 (p. 340); Gilliland 1971 (p. 185); Phạm-Hoàng Hộ 1972 (p. 913); Lazarides 1980 (p. 132, 133); Tothill and Hacker 1983 (p. 334); Mannetje and Jones 1992 (p. 184); Pham-Hoàng Hộ 1993 (p. 836).

Urochloa (Brachiaria) decumbens (Figure 29)
Vernacular names – signal grass (Australia)

Description – tufted perennial with erect or ascending 0.3-1.5 m tall. Nodes hairless. Leaf sheaths sparsely covered with short hairs. Leaf blades up to 40 cm long, 7-20 mm wide, sparsely hairy on both surfaces, bright green. Ligule a short hairy rim. Inflorescence a racemose panicle with 2-7 racemes

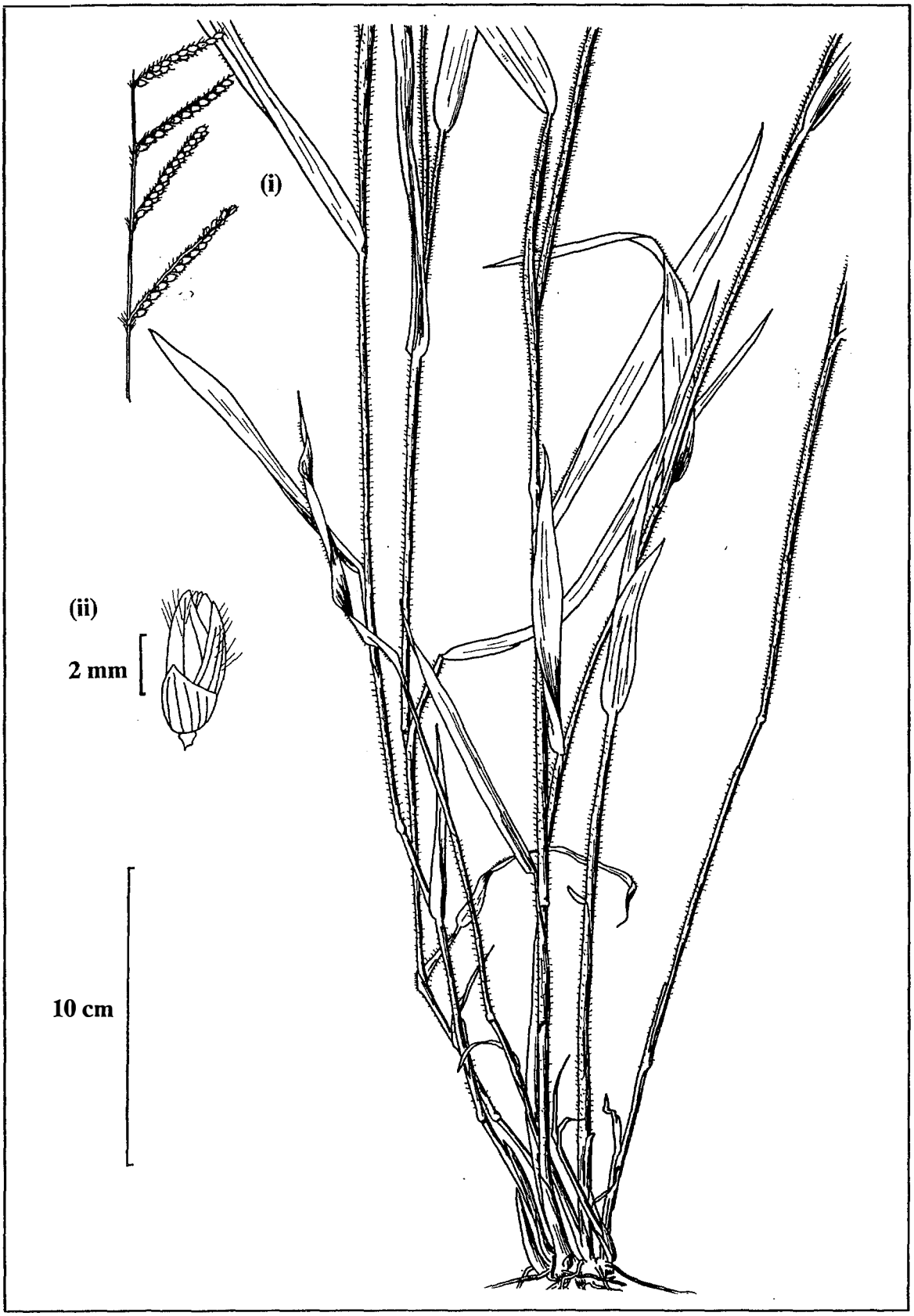


Figure 29. *Urochloa (Brachiaria) decumbens* (i) plant, (ii) spikelet

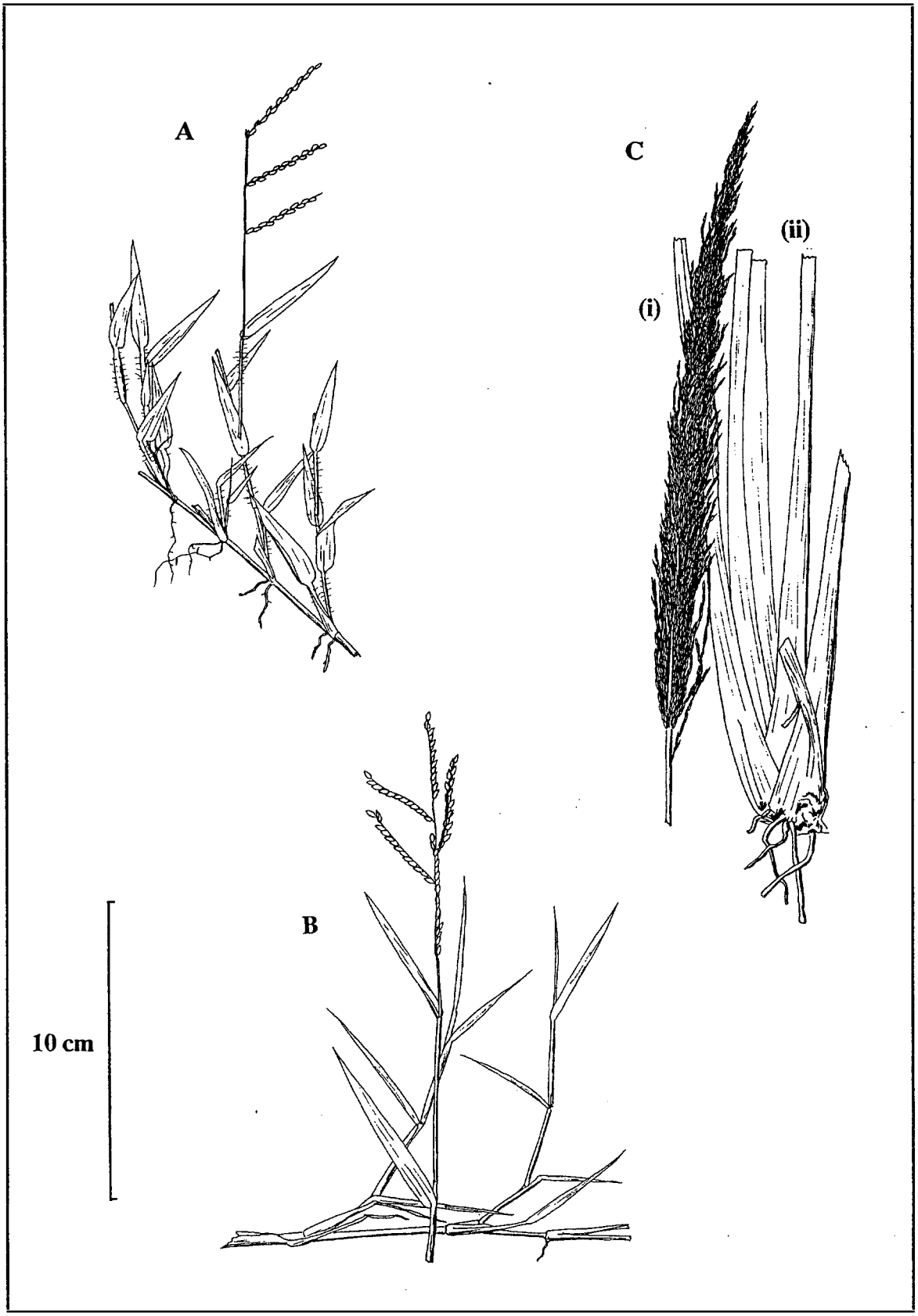


Figure 30. A – *Urochloa (Brachiaria) distachya*; B – *Urochloa (Brachiaria) subquadripara*; C – *Vetiveria festucoides* (i) inflorescence, (ii) tiller base

borne singly on an axis 2-10 cm long, the racemes 1-5 cm long. Spikelets borne in 2 even rows on the under side of the raceme axis, usually with part of the raceme or even a whole raceme with spikelets in a single row. Spikelets solitary, all similar, rounded in cross section, 4-6 mm long and 2 mm wide, with 2 florets, only the upper one fertile, falling entire.

Habitat – in Vietnam occurs as an escape from sown pastures, occurring on disturbed ground and roadsides. Grows well in full sun or light shade and tolerant of acid soils.

Uses for livestock – an excellent pasture grass, palatable to livestock.

Other Uses – none.

Deleterious properties – under some situations can cause photosensitisation in sheep.

Distribution – native to tropical Africa, now widespread through the tropics and subtropics as a sown pasture grass and frequently as a naturalised species. In Central Vietnam it is being sown and utilised by farmers in Đắc Lắc and Lâm Đồng Provinces at altitudes from 500-1000 m, and is occasionally found as an escape at higher altitudes.

References –Bor 1960 (p. 281); Phạm-Hoàng Hộ 1972, as *B. brizantha* (p. 944); Mannetje and Jones 1992, as *Brachiaria decumbens* (p. 58); Tothill and Hacker 1983, as *Brachiaria decumbens* (p.133); Pham-Hoàng Hộ 1993, as *Brachiaria brizantha* (p. 818).

Urochloa (Brachiaria) distachya (Figure 30A)
Vernacular names – Cỏ mật (Vietnam); green summer grass (English)

Description – tufted annual or perennial, not stoloniferous or rhizomatous, but rooting at lower nodes, ascending to 35 cm tall. Nodes sparsely covered with spreading hairs. Leaf sheaths sparsely covered with long, spreading hairs. Leaf blades 2-8 cm long, 3- 6 mm wide, sparsely hairy on both surfaces. Ligule rim-shaped, with a row 0.5 mm hairs. Inflorescence a racemose panicle, the peduncle hairy below the inflorescence, with 2-4 racemes 20-35 mm long borne singly along an axis c.15-25 mm long. Spikelets solitary, all similar, rounded in cross section or dorsoventrally compressed, borne in 2 loosely overlapping rows on the underside of the rhachis, 2.5-3 mm long, twice as long as broad, falling entire. Spikelets have 2 florets, only the upper one fertile.

Habitat – moist or dry situations in disturbed ground or overgrazed pastures at altitudes below 450 m, often on sandy soils. Grows in full sun or light shade.

Uses for livestock – very palatable to livestock.

Other Uses – none.

Deleterious properties – a weed of cultivated ground.

Distribution – India and South-east Asia, tropical Australia. In the Central Highlands of Vietnam, Locally common in Gia Lai Province in bare, heavily grazed areas at c. 600 m altitude, and likely to be widespread in Central Vietnam at lower altitudes.

References – Schmid 1958 (p. 316, 318); Bor 1960 (p. 281); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 678); Gilliland 1971 (p. 176); Phạm-Hoàng Hộ 1972 (p. 942); Lazarides 1980 (p.107, 108); Mannetje and Jones 1992 (p. 61); Pham-Hoàng Hộ 1993 (p. 816) (all as *Brachiaria distachya*).

Urochloa (Brachiaria) subquadripara (Figure 30B)
Vernacular names – cori grass (English)

Description – stoloniferous perennial (possibly sometimes annual) with culms 25-60 cm tall, rooting at

lower nodes. Nodes hairless. Leaf sheaths with hairy margins, otherwise hairless. Leaf blades 3-13 cm long, 3.5-7 mm wide, hairless. Ligule 0.3 mm long, with a dense fringe of hairs along the upper margin. Inflorescence a racemose panicle, with c. 5 racemes borne singly along an axis c. 7 cm long. Spikelets solitary, all similar, rounded in cross section or dorsoventrally compressed, borne in 2 overlapping rows on the underside of the raceme axis, 3-4 mm long, hairless, shedding entire.

Habitat – a shade-tolerant species which occurs in open forests on moderately fertile, medium-light textured soils up to an altitude of 1200 m, and also to be found in cultivated and disturbed land.

Uses for livestock – a useful pasture grass, particularly in plantations.

Other Uses – also grown as a lawn grass.

Deleterious properties – a minor weed of cultivation.

Distribution – South-east Asia, tropical Asia, northern Australia; introduced to the Americas. Occurs in Đắc Lắc Province, in the vicinity of M'Drak, on disturbed soils.

References – Bor 1960 (p. 286); Phạm-Hoàng Hộ 1972 (p. 942); Lazarides 1980 (p. 107, 109); Tothill and Hacker 1983 (p. 134); Mannetje and Jones 1992 (p. 67); Pham-Hoàng Hộ 1993 (p. 817).

Vetiveria festucoides (Figure 30B)
Description – perennial forming large tussocks and with culms 1.5-2.5 tall, the roots not aromatic. Tillers broad and strongly flattened at the base. Nodes hairless. Leaves mostly basal. Leaf sheaths hairless, the lower sheaths shiny. Leaf blades 17-100 cm long, 4-13 mm wide, hairless but very rough along the margins. Ligule a rim with minute hairs along the upper margin. Inflorescence a dense, narrow panicle, dark purple in colour. Spikelets in similar pairs, overlapping along the whole length of primary inflorescence branches, awnless, hairless, 4-5.5 mm long. Both spikelets have 2 florets, the upper floret fertile and with a 2.5-5 mm awn only in the sessile spikelet, the pedicelled spikelet male and dorsoventrally compressed, the 2 spikelets falling entire with the adjacent rhachis internode.

Habitat – open grassland.

Uses for livestock – none.

Other Uses – the related *V. zizanioides* is a source of vetiver oil for perfumery and is also used for thatching, mats and paper pulp as well as medicinal uses. Sterile forms of *V. zizanioides* are used for erosion control. *V. festucoides* is clearly a fertile species (from the evidence of abundant plants, including seedlings, and the tussock form of the grass) and should not be used for this purpose.

Deleterious properties – unpalatable to livestock except when very young. Apparently becoming increasingly dominant in areas near M'Drak where heavy grazing is practiced.

Distribution – This species is considered to be very rare, and has not previously been confirmed as occurring in Vietnam, where it is very common at medium altitudes in Đắc Lắc Province in the vicinity of M'Drak. It also occurs in India, Thailand, Lao PDR, Indonesia and the Philippines. Some authors include it in the species *Vetiveria zizanoides*, known in Vietnam as hương-bài.

References – *Vetiveria festucoides*: Lazarides 1980 (p. 79); Pham-Hoàng Hộ 1993, as *V. lawsonii*? (p. 879).
Vetiveria zizanioides: Schmid 1958 (p. 214-216); Bor 1960 (p. 258); Phạm-Hoàng Hộ 1972 (p. 980); Lazarides 1980 (p. 79); Mannetje and Jones 1992 (p. 253).

Group 7 – Grasses with racemose panicles and/or with spikelets crowded along panicle branches; spikelets awned or with a bristle

Arthraxon hispidus (Figure 31A)
Vernacular names – tiết-trục phún (Vietnam)

Description – delicate tufted or weakly stoloniferous annual with culms 45-100 cm tall. Nodes hairless. Leaf sheaths hairless. Leaf blades 0.5-7.5 cm long, 2-8 mm wide, broad at the base, hairless except for bristles along the lower margins. Ligule a membrane 0.5-1 mm long, minutely hairy along the upper margin. Inflorescence a racemose panicle with 3-15 spikes 2-5 cm long, breaking up at maturity. Spikelets solitary, laterally compressed, asymmetrical in side view, 2-8 mm long, with a fine, straight awn, and with 2 florets, only the upper one fertile, falling entire with the adjacent rhachis internode.

Habitat – Occurs in moist and shady situations on stream banks and along roadsides at medium altitudes. An early coloniser after shifting cultivation, occurring at altitudes up to 2,850 m.

Uses for livestock – likely to be palatable to cattle and buffalo, but an unproductive grass of little significance to livestock.

Other uses – none.

Deleterious properties – none.

Distribution – most parts of South-East Asia, India, China, Malaysia, Indonesia, Japan, tropical Africa, eastern Australia; introduced to North America. A widespread species in Indo-China at medium to high altitudes; in Central Vietnam occurs at 1,000 m in Lâm Đồng Province, and likely to be widespread in the region.

References – Schmid 1958, as *A. ciliaris* (p. 199, 200); Bor 1960 (p. 97, 99); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960, as *A. ciliaris* (p. 660); Pham-Hoàng Hộ 1972 (p. 972); Lazarides 1980 (p. 21); Tothill and Hacker 1983 (p. 113); Mannetje and Jones 1992 (p. 236); Pham-Hoàng Hộ 1993 (p. 894); Hacker *et al.* 1998 (p. 73).

Arthraxon lanceolatus (Figure 31B)
Description – perennial with culms rooting from the lower nodes, up to 1 m tall. Nodes hairless. Leaf sheaths sparsely to densely covered in coarse spreading hairs. Leaf blades up to 1-15 cm long, 3-19 mm wide, broad-based, with coarse hairs along the veins on both surfaces and along the lower margins. Ligule a membrane 1 mm long, hairy along the upper margin. Inflorescence a panicle with 2-several racemes borne along a short axis, the racemes breaking up at maturity. Spikelets in dissimilar pairs, the sessile spikelet c. 10 mm long, 0.5-2 mm wide, laterally compressed, assymetrical in side view, bearing a geniculate awn 10 mm long, with 2 florets, only the upper one fertile. Pedicellate spikelet 3-8 mm long, awnless, not fertile. The two spikelets fall entire with the adjacent internode.

Habitat – woodlands.

Uses for livestock – of no significance for livestock.

Other Uses – none.

Deleterious properties – none.

Distribution – Indo-China and India. Occurs in Lâm Đồng Province in pine tree woodlands at altitudes of c. 1000 m.

References – Schmid 1958 (p. 199); Bor 1960 (p. 100); Lazarides 1980 (p. 21); Pham-Hoàng Hộ 1993 (p. 894).

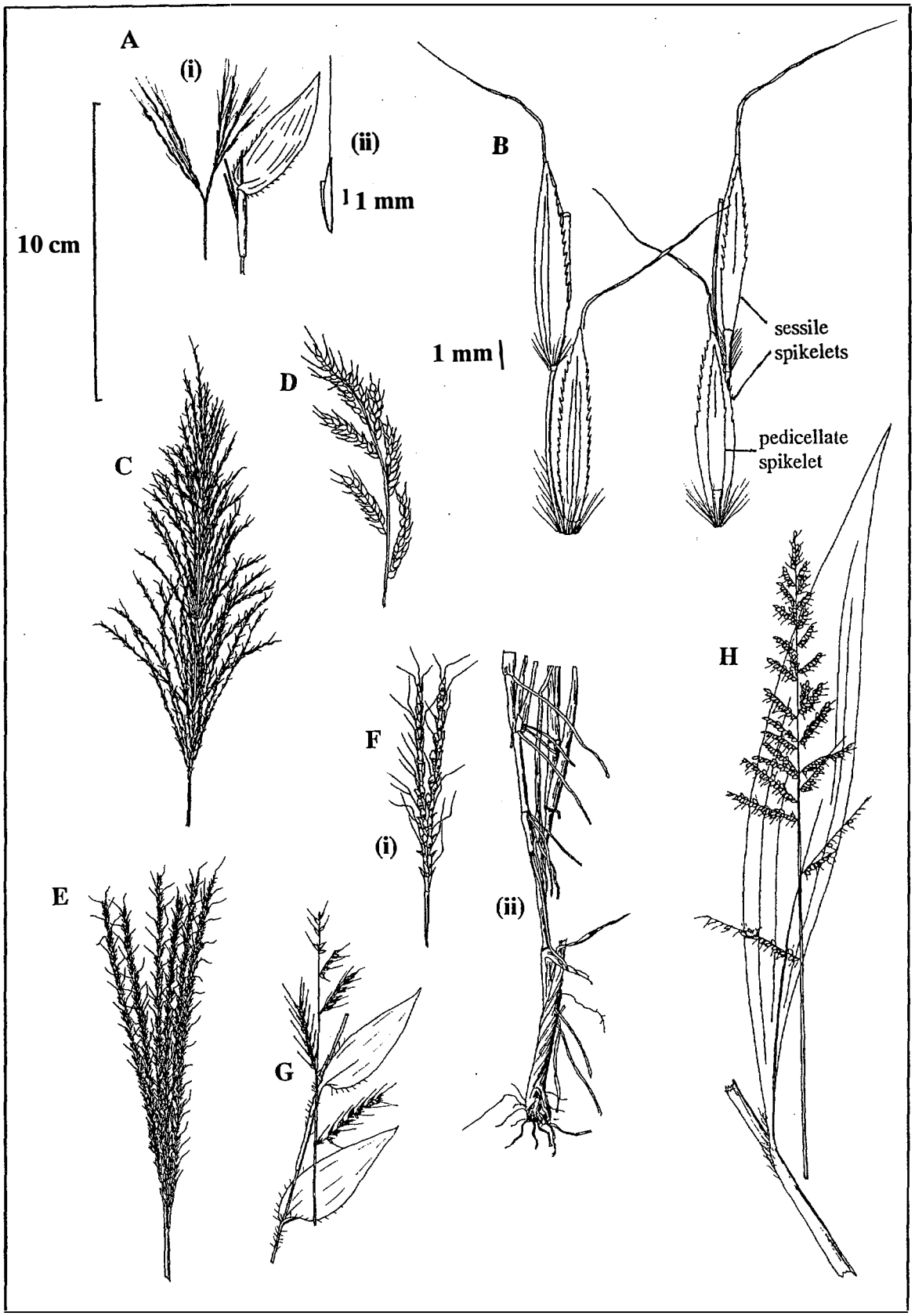


Figure 31. A – *Arthraxon hispidus* (i) inflorescence, (ii) spikelet; B – *A. lanceolatus*, portion of raceme showing 2 spikelet pairs from front and back; C – *Capillipedium parviflorum* ssp. *capilliflorum*; D – *Echinochloa crus-galli*; E – *Eulalia* sp.; F – *Ischaemum rugosum* (i) inflorescence, (ii) tiller base; G – *Oplismenus compositus*; H – *Setaria barbata*

Capillipedium parviflorum (Figure 31C)
Vernacular names – mao-cước hoa-nhơ (Vietnam)

Description – annual with erect culms 0.5-2 m tall. Nodes with a prominent ring of white, spreading hairs. Leaf sheaths sparsely to densely hairy. Ligule a membrane 0.5-2 mm long. Leaf blades 10-45 cm long, 4-11 mm wide, very sparsely to densely hairy on both surfaces, rough along the margins. Inflorescence an open panicle 8-25 cm long, with branches in whorls, sometimes with some secondary branching, the branches tipped by racemes of 3-17 spikelets. Spikelets in pairs, similar in shape, dorsoventrally compressed, the sessile spikelet fertile and awned, the pedicellate spikelet sterile and awnless (the terminal group of spikelets includes 1 sessile and 2 pedicellate spikelets). Sessile spikelets 2.5-4 mm long excluding the awn, the lower glume 2-keeled, with 2 florets, the lower sterile, the upper fertile and bearing a 10-15 mm geniculate awn, falling entire with the adjacent internode and pedicellate spikelet.

C. parviflorum ssp. *capilliflorum*, has racemes with 7-17 spikelets, whereas ssp. *parviflorum* has racemes with 3-7 spikelets. Both subspecies occur in Central Vietnam.

Habitat – a common constituent of grasslands and open forests, particularly on heavy-textured soils.

Uses for livestock – in India, eaten by sheep, cattle and goats.

Other uses – none.

Deleterious properties – in some countries occurs as a weed of settled areas.

Distribution – throughout Southeast Asia and the tropics of the Old World. In Central Vietnam this is a common species in dipterocarp woodlands and grasslands of Đắc Lắc and Gia Lai Provinces.

References – Schmid 1958 (p. 206,208); Bor 1960 (p. 112); Gilliland 1971 (p. 279); Pham-Hoàng Hộ 1972 (p. 975); Lazarides 1980 (p.24,25); Tothill and Hacker 1983 (p. 147); Pham-Hoàng Hộ 1993 (p. 873, 874); Hacker *et al.* 1998 (p. 62).

Echinochloa crus-galli (Figure 31D)
Vernacular names – long vực (Vietnam); barnyard millet (Australia)

Description – annual with culms to 1.8 m tall. Nodes hairless. Leaf sheaths hairless or hairy. Leaf blades 5-50 cm long, 2-30 mm wide, hairless. Ligule absent. Inflorescence a. racemose panicle, with 4-7 branches borne alternately on either side of a persistent rhachis c. 3-6 cm long, the lowermost raceme usually shortly branched at the base. Spikelets solitary, all similar, c. 4 mm long, usually not clearly arranged in 4 rows, the tip pointed or often extended into a short, straight awn, the awn up to 10 mm (rarely to 50 mm) long, with 2 florets, only the upper one fertile, shedding entire.

Habitat – disturbed ground, flooded ground, swamps and marshes, from sea level to 2000 m altitude.

Uses for livestock – a good fodder, relished by cattle and water buffaloes.

Other Uses – the grain is sometimes eaten by humans.

Deleterious properties – a weed of rice crops.

Distribution – South-east Asia, tropical and subtropical Asia, Africa and Australia. Occurs in Lâm Đồng Province at altitudes around 1000 m, and likely to be widespread through the region.

References – Schmid 1958 (p. 320); Bor 1960 (p. 310); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 648, 678); Gilliland 1971 (p. 168); Phạm-Hoàng Hộ 1972 (p. 945); Lazarides 1980 (p. 118,

119); Tothill and Hacker 1983 (p. 206); Mannetje and Jones 1992 (p. 126); Pham-Hoàng Hộ 1993 (p. 810).

***Eulalia* sp.** (Figure 31E)
Description – a grass with culms to 2 m tall from a tiller base which is covered with brown hairs. Sheaths densely covered with white hairs. Leaf blades up to c. 75 cm long, 3-7 mm wide, Hairy on the upper surface, hairless on the lower surface. Ligule a collar with short hairs along the upper margin. Inflorescence a racemose panicle with several loosely appressed racemes c. 12 cm arising from a short common axis, covered with silky white hairs, breaking up at maturity. Spikelets in pairs, one sessile and the other pedicellate, similar, dorsoventrally compressed. Sessile spikelet c. 6.5 mm long, with no lower floret, the upper floret fertile and with a geniculate awn c. 20 mm long.

Habitat – pine tree woodlands at an altitude of 1000-1200 m.

Uses for livestock – *Eulalia* spp. are of minor importance as forages.

Other Uses – none.

Deleterious properties – none.

Distribution – Lâm Đồng Province, at higher altitudes.

Ischaemum ciliare
Vernacular names – mồm ấn (Vietnam); Batiki blue grass (English)

Description – stoloniferous and mat-forming perennial with culms 15 cm –1.3 m tall, rooting freely at the lower nodes. Leaf sheaths hairy around the node, otherwise hairy or nearly hairless. Leaf blades 5-60 cm long, 3-22 mm wide, sparsely to densely hairy. Ligule a membrane 0.8-2 mm long, lacking hairs along the upper margin. Inflorescence a digitate panicle with 2 appressed racemes 2-10 cm long, breaking up at maturity. Spikelets in pairs, dissimilar, one sessile and one pedicellate, each dorsoventrally compressed. Sessile spikelet 3-5 mm long, with a lower sterile floret and upper fertile floret, the fertile floret with a geniculate awn up to 15 mm long.

Habitat – occurs at all altitudes in Indo-China, growing in open or disturbed situations, including swampy areas. Tolerant of infertile and acidic soils.

Uses for livestock – considered a useful forage in parts of South-east Asia, and may be grazed or used for cut-and-carry. As with most grasses, cutting should be before the flower heads emerge as quality falls rapidly with later stages of maturity.

Other uses – none.

Deleterious properties – none.

Distribution – South-east Asia, including Peninsular Malaysia, Vietnam, Laos, Indonesia and Philippines. Introduced to West Africa, Australia and Pacific Islands. Occurs in Lâm Đồng Province at an altitude of c. 850 m, as a dominant species in hillside grasslands.

References – Schmid 1958 (p. 177,179); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 651); Gilliland 1971, as *I. indicum* (p. 263); Pham-Hoàng Hộ 1972, as *I. indicum* (p. 964); Mannetje and Jones 1992 (p. 142); Pham-Hoàng Hộ 1993 (p. 883); Hacker *et al.* 1998, as *I. indicum* (p. 77).

Ischaemum rugosum (Figure 31F)
Vernacular names – Mồm u (Vietnam); wrinkled grass, wrinkle duck-beak (English)

Description – annual or perennial with culms 0.1-1.8 m tall, rooting strongly from lower nodes. Nodes covered with loosely appressed white hairs . Leaf sheaths hairless. Leaf blades 9-42 cm long, 8-40 mm wide, hairless. Ligule a membrane 2-3 mm long, lacking hairs along the upper margin. Inflorescence a digitate panicle, with 2 loosely appressed racemes 3-10 cm long, breaking up at maturity. Spikelets paired, dissimilar, dorsoventrally compressed, the sessile spikelet 3.5-5 mm long, heavily transversely ridged, bearing a geniculate awn 8-20 mm long, the pedicellate spikelet mostly much smaller and awnless.

Habitat – moist and swampy areas up to an altitude of 300 m.

Uses for livestock – eaten by cattle and horses when young.

Other Uses – grain has been eaten by humans in times of famine.

Deleterious properties – a weed of rice fields.

Distribution – India, South-east Asia, China, northern Australia; introduced to most tropical countries. Occurs in Đắc Lắc Province at an altitude of c. 200 m in moist situations in disturbed dipterocarp woodlands.

References – Schmid 1958 (p. 175, 179); Bor 1960 (p. 184); Gilliland 1971 (p. 259); Phạm-Hoàng Hộ 1972 (p. 965); Lazarides 1980 (p. 50, 53); Tothill and Hacker 1983 (p. 283); Mannetje and Jones 1992 (p. 146); Pham-Hoàng Hộ 1993 (p. 884).

Oplismenus compositus (Figure 31G)
Description – perennial with culms 0.3-1 m long, trailing and rooting at the nodes, and ascending to 60 cm. Nodes minutely hairy. Leaf sheaths with upward-pointing hairs below the junction with the blade, otherwise hairless or hairy. Leaf blades up to 4-12 cm long, 18 mm wide, hairy along the margins, otherwise softly hairy or hairless. Ligule a membrane lacking hairs along the upper margin. Inflorescence a racemose panicle with several racemes quite widely distributed along an axis of up to 10 cm or more long, the lower racemes up to 2.5-10 cm long, the upper ones progressively shorter. Spikelets similar, in pairs, 3.5-4 mm long, excluding awn, the lower glume with a 0.5-5 mm straight awn, with 2 florets, only the upper one fertile, falling entire.

Habitat – occurs at all altitudes in Indo-China but is a species restricted to moist and shaded situations. *O. compositus* is one of the few grasses that can grow in dense forest.

Uses for livestock – a minor forage of little significance, although considered to be of high quality.

Other uses – none.

Deleterious properties – none.

Distribution – at all altitudes in South-east Asia, and widespread in Old World tropics; also in tropical America. Occurs in pine tree woodlands in Lâm Đồng Province at an altitude of 1200 m and likely to be widely distributed in Central Vietnam in shaded situations.

References – Schmid 1958 (p. 320,322); Bor 1960 (p. 317); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 678); Gilliland 1971 (p. 171); Lazarides 1980 (p. 124, 125); Tothill and Hacker 1983 (p. 317); Mannetje and Jones 1992 (p. 241); Hacker *et al.* 1998 (p. 79); Pham-Hoàng Hộ 1993 (p. 807).

Setaria barbata (Figure 31H)
Vernacular names – tơ-vĩ râu (Vietnam)

Description – annual with culms rooting at lower nodes and sometimes scrambling through surrounding

vegetation, up to 2 m tall. Nodes hairless. Leaf sheaths below the junction with the leaf blade with long hairs. Leaf blades longitudinally folded (like the leaf of a palm seedling), 6-45 cm long, 7-45 mm wide, narrowing and densely hairy towards ligule, with sparse long hairs along the veins on both surfaces and bristles along the lower margins. Ligule a rim with a fringe of hairs along the upper margim. Inflorescence an open but narrow panicle 5-60 cm long, the common axis hairy, the lower branches 5 cm or more long, the upper ones progressively shorter, and with short secondary branches with 1-4 or more crowded spikelets, each branch ending in a long bristle. Spikelets solitary, all similar, c. 2.5 mm long, each with 2 florets, only the upper one fertile, falling entire.

Habitat – disturbed ground, often around villages or fields.

Uses for livestock – a minor forage of little significance for livestock.

Other Uses – none.

Deleterious properties – none.

Distribution – South-east Asia, tropical Asia, Africa and Australia; introduced to the Americas. Occurs in Gia Lai Province at c. 500 m altitude.

References – Schmid 1958 (p. 350, 353); Bor 1960 (p. 360); Pham-Hoàng Hộ and Nguyễn-Van-Dương 1960 (p. 654); Phạm-Hoàng Hộ 1972 (p. 927); Lazarides 1980 (p. 141); Tothill and Hacker 1983 (p. 376); Mannetje and Jones 1992 (p. 243) Pham-Hoàng Hộ 1993 (p. 831).

Glossary of botanical terms

Anther	organ within the floret which contains the pollen
Awn	long bristle (stout hair) on lemmas or glumes of some grasses
Axil (leaf)	the angle formed by a culm and its branch, leaf or bract
Axillary	borne within an axil
Blade (leaf)	the upper, mostly flattened, part of a grass leaf
Bract	scale-like modified leaf
Culm	stem of a grass, which mostly develops a terminal flower head
Digitate	with spikes or racemes at tip of culm
Dorsoventrally compressed (spikelet)	compressed with the glumes on the 2 flatter sides of the spikelet
Fertile (floret or spikelet)	bearing an ovary (often also anthers), hence capable of bearing a seed
Floret	"flower" of a grass, consisting of lemma, palea and parts within
Geniculate (awn)	bent like a knee
Glume	lowermost bract of a spikelet (commonly in pairs)
Inflorescence	flower head of a grass
Laterally compressed (spikelet)	compressed with the glumes on the 2 narrower sides of the spikelet
Lemma	lowermost of two bract-like scales of a floret
Ligule	a small collar-like structure (membranous or a fringe of hairs) at the junction of the leaf blade and sheath
Node	structure on culm from which leaves and secondary branches originate
Palea	uppermost of two bract-like scales of a floret
Panicle	branched inflorescence
Pedicel	short stalk on which a spikelet is borne
Pedicellate	with a pedicel
Raceme	a single axis bearing spikelets on pedicels
Rhachilla	axis of a spikelet, on which florets are borne
Rhachis	axis of an inflorescence
Rhizome	underground, creeping stem, leafless but bearing bracts
Rhizomatous	bearing rhizomes
Sessile	without a stalk or pedicel
Seta (setae)	a fine bristle
Sheath (leaf)	the lower part of a grass leaf, mostly enveloping the culm or younger leaves
Spathe	modified leaf enclosing part or whole of inflorescence
Spatheate (panicle)	one with branches subtended by modified leafy bracts
Spike	a single individual axis bearing spikelets which lack pedicels
Spikelet	unit of a grass inflorescence typically with two glumes and one or more florets
Sterile (floret or spikelet)	lacking an ovary (but sometimes with anthers), hence not capable of bearing a seed
Stolon	creeping above-ground stem that may produce roots and shoots at nodes
Stoloniferous	bearing stolons
Subdigitate	with spikes or racemes mostly at tip of culm, but with one or more clearly lower
Whorl	a ring of branches, arranged like the spokes of a wheel

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Vietnamese names of species covered

Apluda mutica	rếp, trấu-thảo
Arthraxon hispidus	tiết-trục phún
Arundinella setosa	trúc-thảo lông
Axonopus compressus	cỏ la-gừng
Capillipedium parviflorum	mao-cước hoa-nhơ
Chrysopogon aciculatus	may
Cynodon dactylon	cỏ-chỉ
Cyrtococcum accrescens	cầu-dĩnh mọc
Cyrtococcum patens	cầu-dĩnh bò
Cyrtococcum oxyphyllum	cầu-dĩnh là nhọn
Dactyloctenium aegyptium	cơ chân-gà
Digitaria heterantha	túc-hình dị-hoa
Digitaria longiflora	túc-hình hoa-dài
Digitaria violascens	túc-hình tím
Echinochloa crus-galli	long vực
Eragrostis cumingii	Xuân-thảo tich-lanh
Eragrostis japonica	xuân thảo nhật
Eragrostis unioloides	xuân thảo dơ
Eremochloa ciliatifolia	bần-thảo rìa
Heteropogon contortus	dị-thảo vặn
Heteropogon triticeus	dị-thảo to
Hyparrhenia filipendula	hạ-hùng thòng
Imperata cylindrica	tranh
Kerriochloa siamensis	kiết-thảo
Leersia hexandra	bạc
Melinis repens	hồng-nhung
Melinis minutiflora	mật-kêhoa-nhỏ
Miscanthus floridulus	lò
Mnesithea laevis	ký-vĩ láng
Mnesithea mollicoma	ký-vĩ
Neyraudia arundinacea	sậy unỏ
Oryza rufipogon	lúa hoang
Panicum humile	kê nam-á
Panicum maximum	kê lo
Panicum notatum	kê nhỏ
Panicum sarmentosum	kê trườn, cỏ voi
Paspalum commersonii	cỏ trứng, san trứng
Paspalum conjugatum	san cặp
Paspalum longifolium	san lá-dài
Paspalum orbiculare	san tròn
Paspalum scrobiculatum	san tròn
Pennisetum polystachion	đuôi-voi nhỏ
Pennisetum purpureum	cỏ đuôi-voi
Rottboellia cochinchinensis	cỏ-mia
Saccharum arundinaceum	lách
Sacciolepis indica	bấc nhỏ
Sacciolepis myosuroides	bấc duôi-chột
Schizachyrium brevifolium	tiết-phưởng lá-ngắn
Schizachyrium sanguineum	tiết-phưởng máu
Setaria barbata	tơ-vĩ râu
Setaria parviflora	đuôi-chồn
Sporobolus indicus	xạ-tử ấn
Themeda arguens	lô nhọn
Themeda arundinacea	lô sậy, cỏ-dê
Themeda caudata	lô duôi, cỏ-phao
Themeda triandra	lô tam-húng

Themeda villosa	lô mía
Thysanolaena latifolia	đot, đông-trùng hạ-thảo
Saccharum arundinaceum	lách
Sorghum propinquum	mía miến
Urochloa distachya	cỏ mật
Vetiveria zizanoides	hương-bài

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Plant names in italics are names that appear in the literature but which are now no longer used. Page numbers in italics show illustrations