3. Result and Discussion

3.1. Collection and Identification

COLLECTION

Field visits were conducted during the year 2009-2012 at a reagular interval of 10-15 days. Different grass birs of Panchmahal and Dahod districts were visited at a regular interval and details of it's given in Table 1 to Table 6 respectively. During the field visits the grasses which are collected along with root, whole clump of grasses collected. Few species have single tiller per clump and some have more tillers per clump. All the collected grass species tagged with the numbers and pressed for the making herbarium and bring them in the laboratory for the identification. Collected species were dissected under binocular microscope and identified by using different floras like Gujarat flora, The Bombay grasses, Saurashtra flora, The flora of Bomaby presidency, Flora of Maharastra, Grasses of Gujarat, etc. and listed in Table 7.

PANCHMAHAL

Panchmahal district is bounded by state of Rajasthan and the Sabarkantha district of Gujarat state in North, Dahod district in East, Baroda district in South and Baroda, Kheda and Sabarkantha districts in West. The Western and South Western parts are generally flat lying between 120 m to 210 m. above mean sea level. A series of hills comprise the South Eastern part of the area which are the extreme western limit of Vindhyan Mountains. The Northern and Eastern parts of the area are undulating and occasionally interrupted by hills of 300 to 500 m. height. which are the Southern extensions of Aravallis. The tract is drained by the rivers Mahi, Panam, Hadaf, Meshri, Kun, Karad, Goma, Shedhi, Dev and Vishwmitri.

The forests are spread over all the talukas of Panchmahal district. They cover hilly portions of the Northern and Eastern part of Panchmahal district and the undulating, easy and flat planis in the West and the South-Western Panchmahals. In Lunawada and Santrampur talukas the terrain is hilly in nature, whereas in Halol taluka, the Pavagadh hill stands in the middle. Panchmahal has very dry teak forest. The forests lie between parallels of latitudes, 22º 14' and 23º 28' N and meridians of longitudes 73º8'E and 74º 29' E. The extreme lengths lying north south is about 136 Kms and that lying East-West is about 120 Kms.

The Panchmahal district has two major forest divisions: Godhra and Godhra SF. The total geographical area of the Panchmahal district is 5210.00 Sq. Km. The total forest area covered is 110029.91 ha. Out of which 107385.69 ha is reserved

forest, 450.32 ha. is protected forest area and 2193.90 ha. is unclassed forests (Table 1, 2 and 3). That means 23.30% forest area out of total geographical area.

Table 1: Distribution of forest areas of Panchmahl district

Name of Taluka	Reserved Area (ha)	Protected Area (ha)	Unclassed Area (ha)	Total
Godhra	15786.63	0	511.45	16298.08
Morva	4747.99	14.00	300.12	5062.11
Shahera	16520.05	90.41	159.75	16770.21
Lunawada	10192.33	20.28	493.10	10705.71
Khanpur	8536.38	273.50	729.48	9539.36
Halol	6400.20	0.72	0	6400.92
Kalol	3558.77	36.41	0	3595.18
Ghoghmba	9400.71	0	0	9400.71
Satrampur	15889.99	15.00	0	15904.99
Kadana	16352.64	0	0	16352.64
Total	**107385.69**	**450.43**	**2193.90**	**110029.91**

Table 2: Grass bir, Grass garuchers and Grass godowns of Panchmahl district

District	Reserve vidis		Other vidis		Grass collected (In Kg.)	Grass Godowans (Number)	Platform Godowans (Number)	Storage Capacity (In Kg.)
	No.	Area (In Hq.)	No.	Area (In Hq.)				
Panchmahal	1	754.04	0	0	21 Lakh	5	8	1.60 Lakh

Table 3: List of grass bir of Panchmahl district

Range	Round	Village	Total area (ha.)
Godhra	Bandheli	Bandheli	754.04

Geology:

A major portion of the district in the central and northern parts is covered by metasediments which represent the extension of the main Aravalli group of rocks in Rajasthan, while in the Southern parts are found the formations which have been referred to as the Champaner series. These metasedimentary groups of rocks are separated by intrusive granites and gneisses. In the eastern part of the distirct, Deccan traps occupy a large and at places on their fringes are found the infra trappeans.

The area of Godhra range and also of Shahera range is all on Granite and Granodiorite rock. It is the area which is having very deep well drained, coarse soil. It is favorable to good quality teak forest. The area in other ranges which lies north of Godhra ranges such as Morwa, Lunawada and Santrampur is on rocks of Phyllite. The area consists of undulating hills.

Soil:

Throughout the tract, the soil varies considerably in composition and constitution. Due to the mixed nature of granite and trap rock formations, the soils

vary in fertility also. In general the eastern areas have shallow sandy soils whereas the western areas have fertile soils. Near the Mahi river in the north-west of Godhra, the soil is alluvial; towards south of this, there is a belt of black soil. To the north-east of Godhara a rich medium black soil is seen. In Halol, it is chiefly sandy loam and black soil. In Kalol taluka mostly light goradu (gravelly) soil seen but rarely black soil is also seen. In the tract as a whole, the soil can be classified as sandy loam, the proportion of sand and loam varying from place to place. The location and state of disintegration of the parent rock causes a wide variation in colour, structure, texture and fertility of the soil. The hilly areas have generally very shallow and poor soils and may be totally devoid of soils at many places. In valley pockets, plains and indentations, soil is comparatively deep and fertile. Except in insignificant isolated pockets in the remote interior, the tract is devoid of humus.

Minerals:

Base metal mineralization has been observed at Zaban, Masabar and north and south of Chelvad. Granite (at Jambughoda, Kaliudungri, Shingedi, etc.), quartzite (at Lunavada, Sant Rampur, Kadana, etc.) and slate (at Zaban) are used as construction material. Graphite occurrences have been common near Jhab. Limestone is available at Umarwen Nani, Manganese, associated with mangniferous phyllite, occurs around Shivrajpur along a 22 km long Shivrajpur-Pani belt. Manganese content varies from 22% to 46%. Phosphatic strimatolite is found within dolomite near Ghanta.

Climate:

The climate of this district is characterized by hot summer and general dryness, except in the monsoon season. The year may be divided into four seasons:

Summer season – March to Mid June

Monsoon season – Mid June to September

Post monsoon season – October to November

Winter season – December to February

Rainfall:

Almost entire rainfall in the area by monsoon during June to September. Only occasionally few showers are received during November to February (winter season) or during April – May. Rainfall is very irregular and erratic. It consists of few heavy showers, interspersed with long spells of drought. North Panchmahal receives less rainfall in comparison to South Panchmahals. Total rainfall varies widely from year to year and from place to place. There is scarcity after every two to three years particularly in the northern part. The average rainfall in Panchmahals district varies from 400 mm. to 800 mm. Bulk of the annual precipitation is received in the period of early July to mid September.

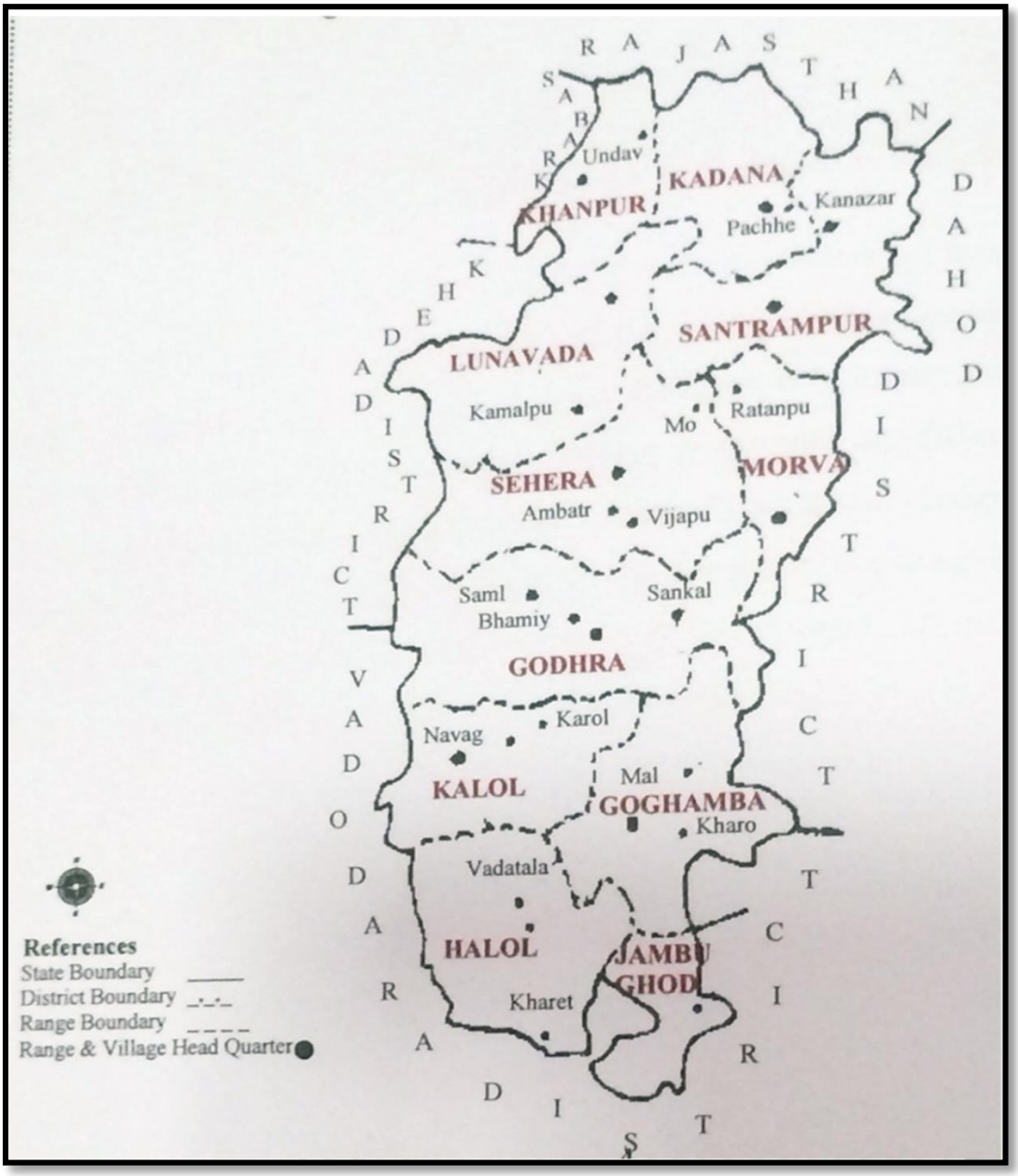
Year	**Rainfall (In mm)**
2009	491
2010	758
2011	792

Temperature:

Seasonal variation of temperature is very wide. The maximum temperature reached during summer was 46ºC and minimum temperature reached during winter was 8ºC during the past years. As normally the minimum temperature does not dip near the freezing point, there are very few instances of crop damage due to frost. Generally, in the months following good monsoon, there is persistant heavy dew upto the end of February. This phenomenon plays an important role in the vegetative growth.

Wind:

Winds are generally light in the post monsoon and winter months and increase in strength during the summer and monsoon season. Winds are predominantly from the south-west or west from April to September. From October onwards, light easterly to north-easterly winds begin to blow. Sometime some negligible amount of damage by winds has been reported due to snapping and uprooting of trees.



MAP I: Showing forest ranges of Panchmahal District (Source: Working Plan circle, Vadodara)

DAHOD

Dahod district is bounded by state of Rajasthan in North, State of Madhya Pradesh and Rajasthan in East, State of Madhya Pradesh and Baroda district in South and Panchmahals districts in West. This district is cover the hilly portion in the northern and eastern part of the distirct and the undulating, easy and flat planis in the west and the south-western part of the district and lying between 120 m to 210 m above the sea level. A series of hills comprise the south eastern part of the area which are the extreme western limit of Vindhyan Mountains. The tract is drained by the rivers the Panam, Khan, Kalutri, Machhan, Anus and other minor rivers.

Dahod has very dry teak forest The forest lie between parallels of latitudes, 22º 30' N to 23º 18' N and meridians of longitudes 73º 48' E to 74º 29' E. The extreme lengths lying north south are about 95 Kms and that lying east-west is about 65 Kms.

The Dahod district has two major forest divisions: Baria and Dahod SF. The total geographical area of the Dahod district is 3655.00 Sq. Km. The total forest area covered is 88031.96 ha. Out of which 86733.46 ha is reserved forest, 359.51 ha. is protected forest area and 938.99 ha. is unclassed forests (Table 3 and 4). That means 24.24% forest area out of total geographical area.

Table 4: Distribution of forest areas of Dahod district

Name of Taluka	Reserved Area (ha)	Protected Area (ha)	Unclassed Area (ha)	Total
Baria	14361.49	91.28	-	14452.77
Limkheda	16825.52	63.16	841.71	17730.39
Dhanpur	19283.45	198.07	97.28	19578.8
Dahod	12363.08	-	-	12363.08
Garbada	4423.44	-	-	4423.44
Jhalod	15410.03	7.00	-	15417.03
Fatepura	4066.45	-	-	4066.45
Total	**86733.46**	**359.51**	**938.99**	**88031.96**

Table 5: Grass bir, Grass garuchers and Grass godowns of Dahod district

District	Reserve vidis		Other vidis		Grass collected (In Kg.)	Grass Godowans (Number)	Platform Godowans (Number)	Storage Capacity (In Kg.)
	No.	Area (In Hq.)	No.	Area (In Hq.)				
Dahod	11	3800.00	0	0	35	59.44	9	14.58

					Lakhs			Lakhs

Table 6: List of Grass Bir of Panchmahl district

Range	Round	Village	Total area (ha.)
Garbada	Tunki	Matva	421.94
Rampura	Muvalia	Muvalia	738.16
		Nimnaliya	92.52
		Rabdal	135.19
	Jekot	Jekot	403.24
		Rozam	375.78
		Kalitalai	1100.47
		Rampura	326.56
	Khodva	Khodva	746.5
		Khujuri	72.6
Jhalod	Chakaliya	Mudaheda	131.37
		Raniar kanbi	110.45
	Chhayan	Tadagola	571.8
	Jhalod	Raipur	33.51
	Limdi	Moti Handi	174.17
		Dageriya	174.85
		Kaligam	291.04
		Dharadungar	343.55
Sanjeli	Velpura	Kharwani	462.4
		Choki	45.22
Sarjumi	Mander	Chhapri	626.6
		Anoppura	300.13
	Mota Ambaliya	Tarmi	318.92
	Randhikpur	Zamri mahudi	65.13
		Baroda	64.35
Limkheda	Chilakota	Jadakheria	294.0
Total			**8707.32**

Geology:

Aravali metasediments, occupying central, eastern and northern parts of the district are represented by mica schists, phyllites, quartzites and lime stones. Mica schists and phyllities occupy the broad valleys in between the long narrow ridges of quartzites and such ridges seen in Devgadh baria area. Phyllites are generally dark grey in colour and vary in hardness and fissility occupies areas near Dahod and Jhalod are variously siliceous, calcareous and chloritic. Dark grey cotton soil covers the elevated planis adjoining the trap mounds and ridges and it is supposed to be extremely fertile.

Soil:

Throughout the tract, the soil varies considerably in composition and constitution. Due to the mixed nature of granite and trap rock formations, the soils

vary in fertility also. In general the eastern areas have shallow sandy soils whereas the western areas have fertile soils. In Dahod and Jhalod talukas, the soil is hard and murramy brown or red with very little black soil and is not very fertile. In Baria taluka light goradu soil is the most common soil. In the tract as a whole, the soil can be classified as sandy loam, the proportion of sand and loam varying from place to place. The location and state of disintegration of the parent rock causes a wide variation in colour, structure, texture and fertility of the soil.

Minerals:

Base metal mineralization has been observed at Baria and Jhlod is quartzite and slate at Jabban, which is used as construction material.

Climate:

The climate of this district is characterized by hot summer and general dryness, except in the monsoon season. The year may be divided into four seasons:

Summer season – March to Mid June

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Post monsoon season – October to November

Winter season – December to February

Rainfall:

Almost entire rainfall in the area by monsoon during June to September. Only occasionally few showers are received during November to February (winter season) or during April – May. Rainfall is very irregular and erratic. It consists of few heavy showers, interspersed with long spells of drought. Total rainfall varies widely from year to year and from place to place. Bulk of the annual precipitation is received in the period of early July to mid September.

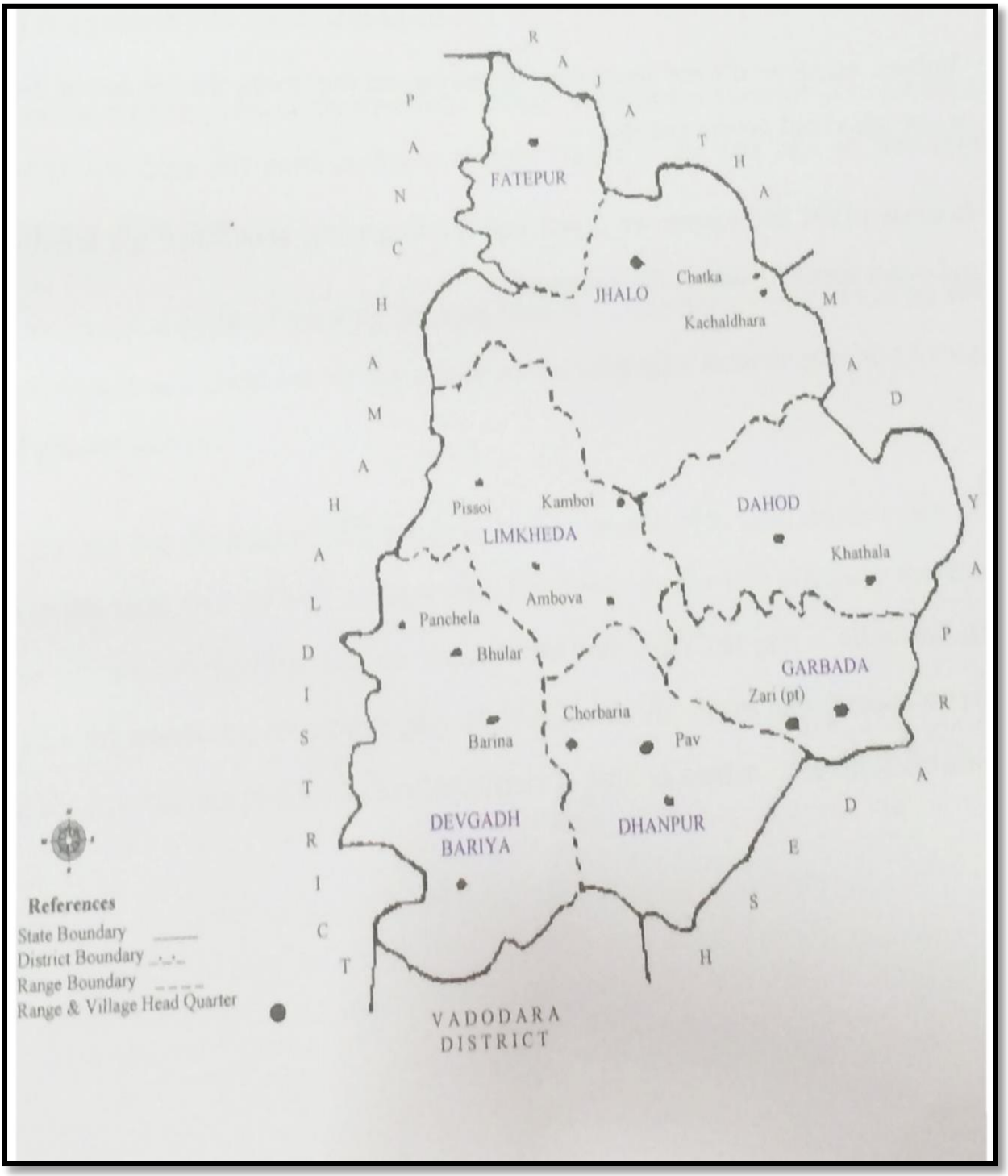
Year	**Rainfall (In mm)**
2009	377
2010	546
2011	575

Temperature:

Seasonal variation of temperature is very wide. The maximum temperature reached during summer was 46.5ºC and minimum temperature reached during winter was 6.5ºC during the past years. As normally the minimum temperature does not dip near the freezing point, there are very few instances of crop damage due to frost. Generally, in the months following good monsoon, there is persistant heavy dew upto the end of February. This phenomenon plays an important role in the vegetative growth.

Wind:

Winds are generally light in the post monsoon and winter months and increase in strength during the summer and monsoon season. Winds are predominantly from the south-west or west from April to September. From October onwards, light easterly to north-easterly winds begin to blow. Sometime some negligible amount of damage by winds has been reported due to snapping and uprooting of trees.



MAP II: Showing forest ranges of Dahod District

(Source: Working Plan circle, Vadodara)

Table 7: List of collected grass species

Sr. No.	Name of Plant	Blatter Herbaria No.
Tribe: Maydeae		
1.	*Chionachne koenigii*(Spr.) Thw.	82654
2.	*Coix lachryma-jobi*L.	82966
Tribe: Andropogoneae		
3.	*Andropogon pumilus* Roxb.	81281
4.	*Apluda mutica*L.	81492
5.	*Arthraxon lanceolatus* (Roxb.) Hochst.	81764
6.	*Bothriochloa pertusa* (L.) A. Camus	82277
7.	*Capillipedium huegelii*(Hack.) A. Camus	82517
8.	*Chrysopogon fulvus*(Spreng.) Chiov.	82861
9.	*Cymbopogon martini* (Roxb.) W.Waston	83110
10.	*Dichanthium annulatum*(Forsk.) Stapf	83432
11.	*Dichanthium caricosum*(L.) A.Camus	83540
12.	*Hackelochloa granularis*(L.) O.	85498
13.	*Heteropogon contortus var. genuinus sub var. typicus* Blatt. & McCann	85546
14.	*Heteropogon contortus var. genuinus sub var. hispidissimus*Blatt. & McCann	85463
15.	*Heteropogon ritchiei*(Hook.f.) Blatt. & McCann	85552
16.	*Heteropogon triticeus*(R.Br.) Stapf ex Craib.	85646
17.	*Imperata cylindrica* (L.) Raeusch.	85722
18.	*Ischaemum indicus*(Houtt.) Merr.	86046
19.	*Ischaemum molle*Hook.f.	86069
20.	*Ischaemum pilosum*(Klein ex Wild.) Wt.	86093
21.	*Ischaemum rugosum*Salib.	86089
22.	*Iseilema laxum*Hack.	86315
23.	*Ophiuros exaltatus*(L.) Kuntze	86555
24.	*Rottboellia exaltata* L.	87841
25.	*Saccharum spontaneum*L.	87860
26.	*Sehima ischaemoides*Forsk.	87966
27.	*Sehima nervosum*(Rottler) Stapf	87970
28.	*Sehima sulcatum*(Hack.) A. Camus	87989
29.	*Sorghum halepense*(L.) Pers.	88271
30.	*Thelepogn elegans*Roth ex R. & S.	88585
31.	*Themeda cymbaria*(Roxb.) Hack.	88603
32.	*Themeda laxa* (Anderess.) A. Camus	88605

Sr. No.	Name of Plant	Blatter Herbaria No.
33.	*Themeda triandra* Forssk.	88713
34.	*Themeda quadrivalvis*(L.) Kuntze	88607
35.	*Triplopogon ramosissimus*(Hack.) Bor	87996
36.	*Vetivaria zinzanoides*(L.) Nash	89045
Tribe: Paniceae		
37.	*Alloteropsis cimicina*(L.) Stapf	81327
38.	*Brachiaria distachya*(L.) Stapf	82437
39.	*Brachiaria eruciformis* (J. E. Smith) Griseb	82472
40.	*Brachiaria ramosa* (L.) Stapf	82413
41.	*Brachiaria reptans* (L.) C.A.Gardner& C. E. Hubb	82445
42.	*Cenchrus biflorus* Roxb.	82554
43.	*Cenchrus ciliaris* L.	87492
44.	*Cenchrus setigerus* Vahl	82608
45.	*Digitaria ciliaris*(Retz.) Koeler	83555
46.	*Digitaria granularis* (Trin. Ex Spr.) Henr.	83702
47.	*Digitaria longiflora*(Retz.) Pers.	83656
48.	*Digitaria stricta* Roth	83685
49.	*Echinochloa colona* (L.) Link	86839
50.	*Echinochloa crusgalli* (L.) Beauv.	84103
51.	*Echinochloa stagnina* (Retz.) Beauv.	85001
52.	*Eremopogon foveolatus* (Del.) Stapf	85288
53.	*Eriochloa procera*(Retz.) C.E. Hubb.	85469
54.	*Oplismenus burmannii* (Retz.) Beauv.	86584
55.	*Oplismenus compositus* (L.) P.Beauv.	86599
56.	*Panicum antidotale* Retz.	86803
57.	*Panicum maximum*Jacq.	86952
58.	*Panicum miliaceum*L.	86948
59.	*Panicum trypheron* Schult	87121
60.	*Paspalidium flavidum* (Retz.) A. Camus	87263
61.	*Paspalidium geminatum*(Forssk.) Stapf	87296
62.	*Paspalum scrobiculatum*L.	87374
63.	*Pennisetum setosum* (Sw.) L. C. Rich	87500
64.	*Setaria glauca* (L.) P. Beauv.	88062
65.	*Setaria tomentosa* (Roxb.) Kunth	88180
66.	*Setaria verticillata* (L.) P. Beauv.	88222
Tribe: Isachneae		
67.	*Isachne globosa* (Thumb.) O. Kuntze	85758

Sr. No.	Name of Plant	Blatter Herbaria No.
Tribe: Aristideae		
68.	*Aristida adscensionis* L.	81527
69.	*Aristida funiculata* Trin. & Rupr.	81567
Tribe: Perotideae		
70.	*Perotis indica* (L.) O. Kuntze	87569
Tribe: Chlorideae		
71.	*Chloris barbata* Sw.	82675
72.	*Choris montana* Roxb.	82741
73.	*Chloris virgata* Sw.	82831
74.	*Cynodon dactylon* (L.) Pers.	83186
75.	*Melanocenchris jaequemontii* Jaub. & Spach	86483
76.	*Oropetium villosulum*Stapf ex Bor.	85247
77.	*Schoenefeldia gracilis* Kunth	82766
78.	*Tetrapogon tenellus*(Roxb.) Chiov.	88578
79.	*Tetrapogon villosus*Desf.	88583
Tribe: Eragrosteae		
80.	*Acrachne racemosa*(Heyne ex Roth) Ohwi	84395
81.	*Dactyloctenium aegyptium* (L.) Beauv.	83274
82.	*Dactyloctenium scindicus*Boiss.	83345
83.	*Desmostachya bipinnata* (L.) Stapf	83400
84.	*Dinebra retroflexa* (Vahl.) Panz.	83950
85.	*Eleusine indica* (L.) Gaerth	84315
86.	*Eragrostiella bachyphylla*(Stapf) Bor	84504
87.	*Eragrostiella bifaria*(Vahl.) Bor	84502
88.	*Eragrostis cilianensis* (All.) Link.	84583
89.	*Eragrostis ciliaris* (L.) R. Br.	84506
90.	*Eragrostis japonica*(Thumb.) Trin.	84802
91.	*Eragrostis nutans*(Retz.) Nees & Steud	84889
92.	*Eragrostis pilosa*(L.) P.Beauv.	84895
93.	*Eragrostis tenella*(L.) Beauv.	85044
94.	*Eragrostis tremula*(Lam.) Hochst. ex Steud.	85060
95.	*Eragrostis unioloides*(Retz.) Nees.	85079
96.	*Eragrostis viscosa*(Retz.) Trin.	85205
Tribe: Sporoboleae		
97.	*Sporobolus coromandelianus*(Retz.) Kunth	88464
98.	*Sporobolus diander*(Retz.) P. Beauv.	88484
99.	*Sporobolus indicus*	89326

Sr. No.	Name of Plant	Blatter Herbaria No.
Tribe: Zoysieae		
100.	*Tragrus biflorus*(Roxb.) Schult.	88777

Table 8: List of other plant species

Sr. No.	Botanical Name of Plant	Habit	Family
1	*Abelmoschus esculentus*	Herb	Malvaceae
2	*Abrus precatorius*	Climber	Papilionaceae
3	*Abutilon indicus*	Herb	Malvaceae
4	*Acacia auriculiformis*	Tree	Mimosaceace
5	*Acacia catechu*	Tree	Mimosaceace
6	*Acacia chundra*	Tree	Mimosaceace
7	*Acacia nilotica*	Tree	Mimosaceace
8	*Acacia tortilis*	Tree	Mimosaceace
9	*Acalypha ciliate*	Herb	Euphorbiaceae
10	*Acalypha indica*	Herb	Euphorbiaceae
11	*Acanthospermum hispidum*	Herb	Acanthaceae
12	*Achyranthes aspera*	Herb	Amaranthaceae
13	*Adina cordifolia*	Tree	Rubiaceae
14	*Aegle marmelos*	Tree	Rutaceae
15	*Agave Americana*	Herb	Agavaceae
16	*Ageratum conyzoides*	Herb	Asteraceae
17	*Albizia lebbeck*	Tree	Mimosaceace
18	*Albizia procera*	Tree	Mimosaceae
19	*Alangium salvifolium*	Tree	Alangiaceae
20	*Alysicarpus bulgaumensis*	Herb	Papilionaceae
21	*Alysicarpus monilifer*	Herb	Papilionaceae
22	*Alysicarpus procumbens*	Herb	Papilionaceae
23	*Alysicarpus tetragonolobus*	Herb	Papilionaceae
24	*Alysicarpus vaginalis*	Herb	Papilionaceae
25	*Amaranthus spinosus*	Herb	Amaranthaceae
26	*Amaranthus tricolor*	Herb	Amaranthaceae
27	*Amaranthus viridis*	Herb	Amaranthaceae
28	*Amorphophallus commutatus*	Herb	Araceae
29	*Andrographis echiodes*	Herb	Acanthaceae
30	*Anisomeles indica*	Herb	Lamiaceae
31	*Annona squamosa*	Tree	Annonaceae
32	*Anogeissus latifolia*	Tree	Combretaceae

Sr. No.	Botanical Name of Plant	Habit	Family
33	*Argemone Mexicana*	Herb	Papaveraceae
34	*Atylosia scarabaeoides*	Herb	Papilionaceae
35	*Bauhinia racemosa*	Tree	Caesalapiniaceae
36	*Blepharis maderaspatensis*	Herb	Acanthaceae
37	*Blepharis molluginifolia*	Herb	Acanthaceae
38	*Blumea eriantha*	Herb	Asteraceae
39	*Boerhavia diffusa*	Herb	Nyctaginaceae
40	*Bombax ceiba*	Tree	Bombacaceae
41	*Borreria articularis*	Herb	Rubiaceae
42	*Borreria stricta*	Herb	Rubiaceae
43	*Boswellia serrata*	Tree	Burseraceae
44	*Brassica nigra*	Herb	Brassicaceae
45	*Bridelia retusa*	Tree	Euphorbiaceae
46	*Butea monosperma*	Tree	Papilionaceae
47	*Capparis sepiaria*	Shrub	Capparaceae
48	*Carissa congesta*	Shrub	Rutaceae
49	*Cassia absus*	Herb	Papilionaceae
50	*Cassia auriculata*	Shrub	Caesalpiniaceae
51	*Cassia fistula*	Tree	Caesalapiniaceae
52	*Cassia obtusifolia*	Herb	Caesalapiniaceae
53	*Cassia occidentalis*	Shrub	Papilionaceae
54	*Cassia tora*	Shrub	Papilionaceae
55	*Cassine glauca*	Tree	Celastraceae
56	*Caesalpinia crista*	Shrub	Caesalapiniaceae
57	*Celosia argentea*	Herb	Amaranthaceae
58	*Calotropis procera*	Shrub	Asclepiadaceae
59	*Calotropis gigantia*	Shrub	Asclepiadaceae
60	*Chlorophytum borivilianum*	Herb	Liliaceae
61	*Cleome viscose*	Herb	Capparaceae
62	*Clerodendrum multiflorum*	Shrub	Verbenaceae
63	*Clitoria ternatea*	Herb	Papilionaceae
64	*Cordia dichotoma*	Tree	Ehretiaceae
65	*Crotalaria albida*	Shrub	Papilionaceae
66	*Crotalaria linifolia*	Shrub	Papilionaceae
67	*Crotolaria burhia*	Shrub	Papilionaceae
68	*Crotolaria calycina*	Shrub	Papilionaceae
69	*Crotolaria filipes*	Shrub	Papilionaceae
70	*Crotolaria juncea*	Shrub	Papilionaceae

Sr. No.	Botanical Name of Plant	Habit	Family
71	*Crotolaria mysorensis*	Shrub	Papilionaceae
72	*Crotolaria notonii*.	Shrub	Papilionaceae
73	*Crotolaria orixensis*	Shrub	Papilionaceae
74	*Crotolaria retusa*.	Shrub	Papilionaceae
75	*Crotolaria spectabilis*	Shrub	Papilionaceae
76	*Commelina benghalensis*	Herb	Commelinaceae
77	*Convolvulus microphyllus*	Herb	Convolvulaceae
78	*Corchorus aestuans*	Herb	Tiliaceae
79	*Corchorus capsularis*	Herb	Tiliaceae
80	*Cuscuta reflexa*	Climber	Cuscutaceae
81	*Cyperus rotundus*	Herb	Cyperaceae
82	*Dalbergia latifolia*	Tree	Papilionaceae
83	*Dalbergia paniculata*	Tree	Papilionaceae
84	*Dalbergia sissoo*	Tree	Papilionaceae
85	*Datura innoxia*	Herb	Solanaceae
86	*Dalbergia lanceolaria*	Tree	Papilionaceae
87	*Desmodium gangeticum*	Herb	Papilionaceae
88	*Dioscorea oppositifolia*	Climber	Dioscoreaceae
89	*Diospyros melanoxylon*	Tree	Ebenaceae
90	*Echinops echinatus*	Herb	Asteraceae
91	*Eclipta alba*	Herb	Asteraceae
92	*Elytraria acaulis*	Herb	Asteraceae
93	*Emblica officinalis*	Tree	Euphorbiaceae
94	*Enicostemma hyssopifolium*	Herb	Gentianaceae
95	*Euphorbia hirta*	Herb	Euphorbiaceae
96	*Euphorbia nivulia*	Shrub	Euphorbiaceae
97	*Euphorbia parviflora*	Herb	Euphorbiaceae
98	*Evolvulus alsinoides*	Herb	Convolvulaceae
99	*Ficus benghalensis*	Tree	Moraceae
100	*Ficus glomerata*	Tree	Moraceae
101	*Ficus hispida*	Shrub	Moraceae
102	*Ficus religiosa*	Tree	Moraceae
103	*Gmelina arborea*	Tree	Verbenaceae
104	*Goniogyna hirta*	Herb	Papilionaceae
105	*Helicteres isora*	Shrub	Sterculiaceae
106	*Hibiscus solandra*	Herb	Malvaceae
107	*Indigofera cordifolia*	Herb	Papilionaceae
108	*Indigofera echinata*	Herb	Papilionaceae

Sr. No.	Botanical Name of Plant	Habit	Family
109	*Indigofera enneaphylla*	Herb	Papilionaceae
110	*Indigofera glandulosa*	Herb	Papilionaceae
111	*Indigofera linifolia*	Herb	Papilionaceae
112	*Indigofera tinctoria*	Herb	Papilionaceae
113	*Ipomoea fistulosa*	Shrub	Convolvulaceae
114	*Ixora arborea*	Shrub	Rubiaceae
115	*Jatropha curcas*	Shrub	Euphorbiaceae
116	*Jatropha gossypifolia*	Shrub	Euphorbiaceae
117	*Lannea coromandelica*	Tree	Anacardiaceae
118	*Lantana camara*	Shrub	Verbenaceae
119	*Leucaena leucocaephala*	Tree	Mimosaceae
120	*Leucas biflora*	Herb	Lamiaceae
121	*Leucas cephalotes*	Herb	Lamiaceae
122	*Madhuca indica*	Tree	Sapotaceae
123	*Mangifera indica*	Tree	Anacardiaceae
124	*Merremia emarginata*	Herb	Convolvulaceae
125	*Merremia gangetica*	Herb	Convolvulaceae
126	*Meyna laxiflora*	Tree	Rubiaceae
127	*Miliusa tomentosa*	Tree	Annonaceae
128	*Mitragyna parvifolia*	Tree	Rubiaceae
129	*Morinda tomentosa*	Tree	Rubiaceae
130	*Moringa concanensis*	Tree	Moringaceae
131	*Mucuna pruriens*	Climber	Papilionaceae
132	*Nyctanthes arbortristis*	Shrub	Nyctaginaceae
133	*Ocimum canum*	Herb	Lamiaceae
134	*Oldenlandia corymbosa*	Herb	Rubiaceae
135	*Ougeinia oojeinensis*	Tree	Papilionaceae
136	*Oxalis corniculata*	Herb	Oxalidaceae
137	*Phoenix sylvestris*	Tree	Arecaceae
138	*Phyllanthus nirurii*	Herb	Euphorbiaceae
139	*Plumbago zeylanica*	Herb	Plumbaginaceae
140	*Pongamia pinnata*	Tree	Papilionaceae
141	*Prosopis cineraria*	Tree	Mimosaceace
142	*Prosopis juliflora*	Tree	Papilionaceae
143	*Psoralea corylifolia*	Herb	Papilionaceae
144	*Pterocarpus marsupium*	Tree	Papilionaceae
145	*Rhynchosia minima*	Herb	Papilionaceae
146	*Rungia repens*	Herb	Acanthaceae

Sr. No.	Botanical Name of Plant	Habit	Family
147	*Schleichera oleosa*	Tree	Sapindaceae
148	*Sida acuta*	Herb	Malvaceae
149	*Sida alba*	Herb	Malvaceae
150	*Sida cordifolia*	Herb	Malvaceae
151	*Sida spinosa*	Herb	Malvaceae
152	*Sesbania aculeate*	Shrub	Papilionaceae
153	*Sesbania sesban*	Shrub	Papilionaceae
154	*Solanum xanthocarpum*	Herb	Solanaceae
155	*Soymida febrifuga*	Tree	Meliaceae
156	*Sterculia urens*	Tree	Sterculiaceae
157	*Striga angustifolia*	Herb	Scrophulariaceae
158	*Syzygium cumini*	Tree	Myrtaceae
159	*Tamarindus indica*	Tree	Caesalapiniaceae
160	*Tectona grandis*	Tree	Verbenaceae
161	*Terminalia arjuna*	Tree	Combretaceae
162	*Terminalia bellirica*	Tree	Combretaceae
163	*Terminalia crenulata*	Tree	Combretaceae
164	*Tephrosia purpurea*	Shrub	Papilionaceae
165	*Tephrosia villosa*	Shrub	Papilionaceae
166	*Thespesia lampas*	Shrub	Malvaceae
167	*Tinospora cordifolia*	Climber	Menispermaceae
168	*Tribulus terrestris*	Herb	Zygophyllaceae
169	*Trichodesma amplexicaule*	Herb	Boraginaceae
170	*Tridax procumbens*	Herb	Asteraceae
171	*Vernonia cinerea*	Herb	Asteraceae
172	*Vitex negundo*	Shrub	Verbenaceae
173	*Wrightia tinctoria*	Tree	Apocynaceae
174	*Wrightia tomentosa*	Tree	Apocynaceae
175	*Xeromphis spinosa*	Tree	Rubiaceae
176	*Zizyphus mauritiana*	Tree	Rhamnaceae
177	*Zizyphus nummularia*	Shrub	Rhamnaceae
178	*Zizyphus oenoplia*	Shrub	Rhamnaceae
179	*Zizyphus xylopyra*	Tree	Rhamnaceae
180	*Zornia gibbosa*	Herb	Papilionaceae

The Panchmahal and Dahod forest areas can be categorized into 17 different talukas and the occurrence of the collected grass species in the different talukas have been represented in Table 9.

Table 9: Occurance of species in Talukas

Sr. No.	Name of Plant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	*Chionachne koenigii*											√			√			
2.	*Coix lachryma-jobi*											√			√			
3.	*Andropogon pumilus*						√			√		√		√	√	√	√	
4.	*Apluda mutica*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
5.	*Arthraxon lanceolatus*	√			√		√	√		√		√				√		
6.	*Bothriochloa pertusa*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
7.	*Capillipedium huegelii*	√	√		√		√	√		√	√	√			√	√		√
8.	*Chrysopogon fulvus*											√	√	√	√	√	√	√
9.	*Cymbopogon martini*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
10.	*Dichanthium annulatum*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
11.	*Dichanthium caricosum*											√	√		√	√		
12.	*Hackelochloa granularis*	√	√			√	√			√						√		
13.	*Heteropogon contortus var. contortus sub var. typicus*	√				√	√					√	√	√	√	√	√	
14.	*Heteropogon contortus var. contortus sub var. genuinus*	√	√			√						√	√		√	√		√
15.	*Heteropogon ritchiei*	√				√		√				√		√	√		√	
16.	*Heteropogon triticeus*						√											
17.	*Imperata cylindrica*	√	√		√	√	√		√	√	√						√	
18.	*Ischaemum indicus*														√	√		
19.	*Ischaemum molle*						√		√			√		√	√		√	

Sr. No.	Name of Plant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
20.	*Ischaemum pilosum*						√		√			√		√	√		√	
21.	*Ischaemum rugosum*						√					√	√		√			√
22.	*Iseilema laxum*													√	√			
23.	*Ophiuros exaltatus*											√			√			
24.	*Rottboellia exaltata*											√				√		
25.	*Saccharum spontaneum*			√			√		√			√			√	√		√
26.	*Sehima ischaemoides*											√			√			
27.	*Sehima nervosum*				√	√						√	√		√	√	√	
28.	*Sehima sulcatum*				√	√						√	√		√	√	√	
29.	*Sorghum halepense*	√		√			√			√	√	√		√	√			√
30.	*Thelepogn elegans*											√			√			
31.	*Themeda cymbaria*	√					√					√		√	√			√
32.	*Themeda laxa*											√			√			
33.	*Themeda triandra*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
34.	*Themeda quadrivalvis*	√			√		√		√									
35.	*Triplopogon ramosissimus*						√											
36.	*Vetivaria zizanioides*	√					√										√	
37.	*Alloteropsis cimicina*	√		√			√					√		√		√		√
38.	*Brachiaria distachya*											√			√	√		
39.	*Brachiaria eruciformis*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
40.	*Brachiaria ramosa*														√			
41.	*Brachiaria reptans*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Sr. No.	Name of Plant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
42.	*Cenchrus biflorus*											√	√	√	√	√	√	√
43.	*Cenchrus ciliaris*	√	√	√	√	√	√	√						√				
44.	*Cenchrus setigerus*											√			√			
45.	*Digitaria ciliaris*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
46.	*Digitaria granularis*	√		√			√				√							
47.	*Digitaria longiflora*						√					√				√		√
48.	*Digitaria stricta*											√		√	√			
49.	*Echinochloa colona*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
50.	*Echinochloa crusgalli*	√											√		√		√	
51.	*Echinochloa stagnina*														√			
52.	*Eremopogon foveolatus*	√			√		√											√
53.	*Eriochloa procera*	√										√			√			
54.	*Oplismenus burmannii*						√					√		√	√	√	√	
55.	*Oplismenus composites*						√					√		√	√	√	√	
56.	*Panicum antidotale*		√									√			√			
57.	*Panicum maximum.*	√							√						√			√
58.	*Panicum miliaceum*	√							√						√			√
59.	*Panicum trypheron*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
60.	*Paspalidium flavidum*											√	√		√	√	√	√
61.	*Paspalidium geminatum*						√					√			√			
62.	*Paspalum scrobiculatum*															√		
63.	*Pennisetum setosum*											√			√			

Sr. No.	Name of Plant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
64.	*Setaria glauca*			√		√	√		√	√		√		√	√	√	√	
65.	*Setaria tomentosa*						√					√			√			√
66.	*Setaria verticillata*		√				√					√	√		√		√	
67.	*Isachne globosa*														√	√		
68.	*Aristida adscensionis*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
69.	*Aristida funiculata*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
70.	*Perotis indica*															√		
71.	*Chloris barbata*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
72.	*Choris Montana*								√			√						
73.	*Chloris virgata*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
74.	*Cynodon dactylon*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
75.	*Melanocenchris jaequemontii*	√					√	√				√			√	√	√	
76.	*Oropetium villosulum*	√																
77.	*Sachoenefeldia gracilis*	√			√										√			
78.	*Tetrapogon tenellus*											√						
79.	*Tetrapogon villosus*														√			
80.	*Acrachne racemosa*	√					√											
81.	*Dactyloctenium aegyptium*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
82.	*Dactyloctenium scindicus*						√							√	√			
83.	*Desmostachya bipinnata*	√										√			√			
84.	*Dinebra retroflexa*.											√		√	√	√		√
85.	*Eleusine indica*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Sr. No.	Name of Plant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
86.	*Eragrostiella bachyphylla*	√																
87.	*Eragrostiella bifaria*											√		√				
88.	*Eragrostis cilianensis*											√			√		√	
89.	*Eragrostis ciliaris*														√	√		
90.	*Eragrostis japonica*														√			
91.	*Eragrostis nutans*											√			√			
92.	*Eragrostis pilosa*	√					√		√			√	√		√	√		√
93.	*Eragrostis tenella*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
94.	*Eragrostis tremula*		√				√					√			√			
95.	*Eragrostis unioloides*						√					√			√		√	
96.	*Eragrostis viscosa*	√				√		√			√		√				√	
97.	*Sporobolus coromandelianus*	√						√							√			
98.	*Sporobolus diander*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
99.	*Sporobolus indicus*										√							
100.	*Tragrus biflorus*														√			

***1. Godhra, 2. Morva, 3. Shahera, 4. Lunawada, 5. Khanpur, 6. Halol, 7. Kalol, 8. Ghoghmba, 9. Satrampur, 10. Kadana, 11. Baria, 12. Limkheda, 13. Dhanpur, 14. Dahod, 15. Garbada, 16. Jhalod, 17. Fatepura**

General Morophology of Family: Poaceae (R. Brown) Barnhart

Distibution: World wide distributed, cosmopolitan
Habitat: Commonly found in all type of habitats.
Habit: Annual / Perennial
Plant Description:

Clum: Erect / Prostrate. Consists of nodes and internodes. Few grasses have stolons or rhizomes.

Leaf: Mainly it has 2 parts: leaf blade and leaf sheath. At the junction of these two parts there is a ligule is present which is either membranous or hairy or sometime absent. Rather than ligule other appendages may also be present called and auricle and the zone present at the base of leaf blade is called collar. Leaf blade lanceolate, linear, ovate or oblong. Its base is rounded, cuneate or cordate and the margin wavy. There is a distinct midrib and on holding the leaf against the light, four or five small veins come in to view. All veins run parallel from the base to the apex.

Inflorescence: It appears at the free ends of branches. Length, type, shape varies from species to species. It may be open, contracted, cylindrical or ovate. Spikelet is a unit of inflorescence and depicts variations in glumes, lemmal, palea, lodicules, stamens and pistil. It may be sessile or pedicellate. Glumes are bracts of spikelet. Shape, size, texture, nature of glumes are used in species identification. Lemma and palea length, shape, width, texture, keeled or not were noticed. Inside the lemma and palea stamens an ovary are present.

Description of studied species: Characteristic features of the studied species have been critically observed with the hand lens and steromicroscope and have been compared with the descriptions mentioned in different floras. Descriptions of the mature grasses have been described individually with supported photograps of the same.

1. ***Chionachne koenigii*(Fig.2(1))**

Distribution: Asia-tropical: India, Indo-China, and Malesia. In India: throughout, In Gujarat: throughout.
Habitat: Wetlands, grasslands
Habit: Perennial
Plant description:

Culm:long, erect, bearded node

Leaf: Leaf blade and leaf sheath have tubercle based hairs. Membranous ligule.

Inflorescence: Monoecious, raceme single, 1 fertile female spikelets on each and 4-8 male spikelets. Spikelet oblong, dorsally comprssed. Female fertile spikelets sessile, sterile spikelets pedicelled, absent or rudimentary. Male spikelets sessile and pedicelled. Female spikelets comprising 1 basal sterile florets and 1 fertile florets. Glumes dissimilar. Upper glume shiny and lower glume membranous, without keels. Lemma and palae hyline, wtihlutkeels.2lodicules.

2. ***Coix lachryma-jobi*****(Fig.2(2))**

Distribution: Europe: southwestern and southeastern.Africa. Asia-temperate: Soviet Middle Asia, western Asia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia. Pacific. America. In India: throughout, In Gujarat: throughout.

Habitat: Water logged area, moist places

Habit: Annual

Plant description:

Culm: Stout, long, spongy, surface is shiny i.e. polished

Leaf: Leaf blade is narrow towards upper side and broad cordate base, acuminate leaf tip, smooth surfaces, membranous ligule

Inflorescence: Monoecious with a male and female inflorescence in same spatholate, racemes single, spilelets 3, 2 pedicellate spikelt in cluster and 1 sessile fertile spikelet. Sterile spikelet represented by barren pedicels. Fertile spikelets dorsally compressed, ovate, falling entire, it comprising 1 basal sterile florets and 1 fertile florets. Glumes dissimilar. Lower glume lanceolate to oblong, chartaceous, without keels. Upper glume onlong, hyline, 1-keeled. Basal sterile florets barren. Lemma of lower sterile floret lacnceolate or oblong, membranous. Upper lemma lanceolate or oblong, membranous, keeled. Palea hyaline, without keels. Locdicules 2 in male flower. Stigma papillose.

3. ***Andropogon pumilus*****(Fig.3(3))**

Distribution: Asia-tropical: India and Indo-China. In India: throughout, In Gujarat: throughout.

Habitat: Grasslands, moist plains

Habit: Annual

Plant description:

Culm: Geniculately ascending, glabrous nodes

Leaf: Glabrous surfaces, acuminate leaf tip

Inflorescence: Raceme- paired, raceme bases flattened, subequal, persistant. Spikelets squeezed between internode and pedicel. Pedicelled spikelets sterile, single, well developed. Sterile spikelets containing empty lemmas, lanceolate, dorsally compressed, persistant. Companion sterile spikelet glumes chartaceous, keeled, muticous, lemmas enclosed by glumes. Fertile spikelets comprising 1 basal sterile florets and 1 fertile florets, spikelets linear, dorsally compressed, falling entire. Glumes dissimilar. Lower glume linear, coriacous, 2 keeled. Upper glume lanceolate, chartaceous, 1 keeled. Lemma of sterile floret is linear, hyaline. Fertile floret lemma linear, hyaline, without keel. Principal lemma awn from a sinus, geniculate, twisted column. Palea hyaline, without keels. Lodicules 2. Stigma long.

4. ***Apluda mutica*(Fig.3(4))**

Distribution: Africa: northeast tropical. Asia-temperate: Soviet Middle Asia, western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern and northwestern. In India: throughout, In Gujarat: throughout, verycommon.

Habitat: Very commonly grow in all type of habitat.

Habit: Perennial

Plant description:

Culm: Decumbent or prostrate, rooting from lower nodes.

Leaf: Leaf blade base tapering to the midrib, filiform.

Inflorescence: Raceme single, bearing triad of spikelet, one fertile sessile spikelet, 2 sterile pedicelled spikelets. Pedicelled spikelets rudimentary and well developed in unequal pair, barren or male, lanceolate, dorsally compressed. Glumes herbaceous, acute. Lemmas muticous. Sessile spikelets comprising1 sterile and 1 fertile florets, oblong, laterally compressed. Glumes herbaceous, acute. Glumes dissimilar. Lower glume lanceolate, coriaceous. Upper glume lanceolate, gibbous, chartaceous, 1 keeled. Lemma of lower sterile floret oblong, hyaline. Palea similar to lemma. Principal lemma awn from a sinus, geniculate. Palea hyaline, without keels. Lodicules 2. Stigma 2.

5. ***Arthraxon lanceolatus* (Fig.4(5))**

Distribution: Africa: south. Asia-tropical: India and Indo-China. In India: throughout, In Gujarat: throughout common in Saurashtra, South Gujarat.

Habitat: Water edges, little moist places, escape from gardens.

Habit: Annual

Plant description:

Culm: Decumbent, glabrous nodes

Leaf: Leaf blade base broadly rounded, lanceolate, tuberculate-ciliate margin.

Inflorescence: Raceme 2-4. Spikelets in pairs, fertile spikelets sessile, sterile spikelets pedicelled. Sessile spikelets comprising 1 basal sterile florets and 1 fertile florets. Spikelet lanceolate, laterally compressed, falling entire. Glumes dissimilar. Lower glume lanceolate, chartaceous, 2 keeled. Upper glume lanceolate, chartaceous, 1 keeled, surface scabrous. Basal sterile florets barren. Lemma of lower sterile floret lanceolate, hyaline. Upper lemma lanceolate, without keel, awned. Principal lemma awn dorsal, geniculate. Palea absent or minute. Lodicules 2. Pedicelled spikelets well developed, male, lanceolate, shorter than the fertile. Glumes keeled, membranous. Lemmas 2, hyaline.

6. ***Bothriochloa pertusa*** **(Fig.4(6))**

Distribution: Africa: western Indian ocean. Asia-temperate: China. Asia-tropical: India, Indo-China, and Malesia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, north-central. America: southeast, Mesoamericana, Caribbean, northern South America, and western South America. In India: throughout. In Gujarat: throughout.

Habitat: Grassland on clay soils and open woodland, common in all habitats.

Habit: Perennial

Plant description:

Culm: Erect, bearded nodes.

Leaf: Leaf blades glabrous, ciliolate membranous ligule.

Inflorescence: Racemes 3-12. Spikelets in pairs, fertile sessile and sterile pedicelled. Fertile spikelets comprising 1 basal sterile florets, 1 fertile florets. Sessile spikelets elliptic, dorsally compressed. Glumes dissimilar. Lower glume elliptic, cartilaginous, without keels. Upper glume lanceolate, 1 keeled. Lemma of lower sterile floret oblong, hyaline, truncate. Upper lemma linear, hyaline, without keel, apex awned. Principal lemma awned, glabrous. Palea absent or minute. Lodicules 2. Stigma 2. Pedicelled spikelets well developed, male, elliptic. Glumes pitted, glabrous, ciliate of margins. Lower lemma oblong, hyaline, truncate, without palea.

7. ***Capillipedium huegelii*** **(Fig.5(7))**

Distribution: Asia-tropical: India. In India: Central to Southwards. In Gujarat: Central to South Gujarat.

Habitat: Commons in all habitats.

Habit: Annual

Plant description:

Culm: Decumbent, bearded nodes, rooting from lower nodes.

Leaf: Leaf blades scabrous, Leaf sheath hairs ciliate, membrane ligule.

Inflorescence: Raceme, 2-3 fertile spikelets on each. Spikelets in pairs. Fertile spikelets sessile with companion pedicelled sterile spikelet. Fertile spikelets comprising l sterile floret, 1 fertile florets. Sessile spikelets oblong, dorsally compressed. Glumes dissimilar. Lower glume oblong, membranous, without keels, obtuse. Upper glume lanceolate, 1 keeled, muticose. Lemma of lower sterile floret oblong, hyaline, without vein. Upper lemma linear, hyaline, without keel, apex awned. Principal lemma awn, geniculate. Palea absent or minute. Lodicules 2. Stigmas 2. Pedicelled spikelets well developed, male, lanceolate. Lower glumes pubescent, lanceolate, cartilaginous. Upper glume elliptic, margins ciliate, apex muticous. Lemma of lower sterile floret barren or absent. Upper lemma oblong, hyaline, without keel, apex truncated. Palea absent.

8. ***Chrysopogon fulvus*****(Fig.5(8))**

Distribution: Asia-tropical: India, Indo-China, and Malesia. In India: warmer parts of India. In Gujarat: throughout, everywhere, common.

Habitat: Dry soils, occasional on rocky plateaus.

Habit: Perennial

Plant description:

Culm: Geniculately ascending, long.

Leaf: Leaves mostly basal. Leaf blades glabrous, acute apex. Ligule ciliolate membranous.

Inflorescence: Panicle with braches tipped by a raceme. Panicle open, whorled at most nodes. Raceme bearing a triad of spikelets, 1 fertile sessile spikelet, 2 sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile and 1 fertile floret. Spikelets oblong, laterally compressed, falling entire, callus hairs red-brown. Glumes dissimilar. Lower glume oblong, cartilaginous. Upper glume lanceolate, 1 keeled, awned, hispidulous. Lemma of lower sterile floret lanceolate, hyaline. Palea similar to lemma. Upper lemma oblong, hyaline, apex dentate, awned. Principal lemma awn, geniculate, pubescent. Palea hyaline, lanceolate. Locdicules 2. Stigma 2. Pedicelled spikelets well developed, male, lanceolate. Glumes chartaceous, lower glume awned. Lemmas enclosed by glumes, muticous, membranous, margin ciliate.

9. ***Cymbopogon martini*** **(Fig.6(9))**

Distribution: Africa: western Indian Ocean. Asia-temperate: China. Asia-tropical: India, Indo-China, and Malesia. Australia. In India: throughout. In Gujarat: Saurashtra, west to east Gujarat, South Gujarat.

Habitat: Common in open grasslands, occasional on drier wastelands

Habit: Perennial

Plant description:

Culm: Erect, long.

Leaf: Leaf blade base cordate, linear to lanceolate, glaucous, aromatic, filiform. Ligule membranous.

Inflorescence: Composed of dense racemes. Racemes 2, deflexed. Spikelets in pairs, fetile sessile spikelets, sterile pedicellate spikelets. Sessile spikelet comprising 1 sterile and 1 fertile florets. Spikelets onlong, dorsally compressed, falling entire. Glumes dissimilar. Lower glume lanceolate, chartaceous, 2-keeled laterally, winged on keel. Upper glume lanceolate, 1-keeled. Upper lemma lanceolate, hyaline, without keel, awned. Principal lemma awn from a sinus, geniculate, glabrous. Palea absent or minute. Lodicules 2. Pedicelled spikelets well developed, male, lanceolate. Glumes chartaceous. Lemmas enclosed glumes, membranous.

10. ***Dichanthium annulatum*****(Fig.6(10))**

Distribution:Africa: north, Macaronesia, west tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate:

western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, and north-central. North America: south-central USA and Mexico. South America: Mesoamericana, Caribbean, northern South America, and southern South America. In India: throughout. In Gujarat: throughout, common.

Habitat: Commonly found everywhere

Habit: Perennial

Plant description:

Culm: Decumbent

Leaf: Leaf blade linear, ligule membranous

Inflorescence: Raceme 2-15, digitate. Spikelets in pairs, fertile sessile and sterile pedicelled. Fertile spikelets comprising 1 sterile and fertile florets. Sessile spikelets oblong, dorsally compressed, falling entire. Glumes dissimilar. Lower glume cartilaginous, without keels. Upper glume lanceolate, 1 keeled, ciliolate. Upper lemma linear, hyaline, without keel, awned. Principal lemma awn apical, geniculate. Palea absent or minute. Lodicules 2. Stigma 2. Pedicelled spikelets well developed, male, same as sessile, lemma awnless.

11. *Dichanthium caricosum* (Fig.7(11))

Distribution:Africa: east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. North America: south-central USA and Mexico. South America: Mesoamericana, Caribbean, northern South America. In India: throughout. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Perennial

Plant description:

Culm: Decumbent

Leaf: Leaf blade linear, ligule membranous

Inflorescence: Racemes 1-10. Spikelets in pairs, fertile sessile spikelet and sterile pedicelled spikelet. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets elliptic or obovate, dorsally compressed, falling entire. Glumes dissimilar. Lower glume elliptic or obovate, chartacous, without keels. Upper glume lanceolate, 1 keeled. Upper lemma linear, hyaline, without keel, awned. Principal lemma awn apical, geniculte. Palea absent or minute. Lodicules 2. Stigma 2. Pedicelled spikelets well developed, same as sessile, lemma awnless.

12. *Hackelochloa granularis* (Fig.7(12))

Distribution: Africa: southern tropical, south, and western Indian ocean. Asia-temperate: Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China,

Malesia, and Papuasia. Australasia: Australia. North America: southwest USA, south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout. In Gujarat: throughout.

Habitat: Occasional in all habitats

Habit: Annual

Plant description:

Culm: Erect, bearded node.

Leaf: Leaf blade base cordate, linear to lanceolate, leaf sheath loose or inglated, ligule membranous.

Inflorescence: Racemes single. Spikelets appressed, in pairs, sessile and pedicelled. Pedicelled spikelets well developed, ovate, dorsally compressed. Glumes herbaceous, winged on keels, glabrous, entire, muticous. Upper lemma oblong, hyaline, without keel. Palea minute, hyaline. Lodicules 2. Sessile spikelets orbicular, dorsally compressed, falling entire. Glumes dissimilar. Lower glume orbicular, cartilaginous, without keels, surface rugose. Upper glume oblong, without keels. Upper lemma oblong, hyaline, without keel. Palea minute, hyaline. Lodicules 2.

13. ***Heteropogon contortus var. genuinus sub var. typicus*****(Fig.8(13))**

Distribution: Europe: central, southwestern, and southeastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia. Pacific. North America. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout, not common

Habitat: In open areas, grasslands

Habit: Perennial

Plant description:

Culm: Erect or decumbent, slender.

Leaf: Leaf blades linear, rigid, flat. Membranous ligule.

Inflorescence: Lower glume of pedicelled spikelet sparsely hairy with loing tubercle based deciduous hairs on the back, in the upper part and towards the margins, lower part glabrous.

14. ***Heteropogon contortus var. genuinus sub var. hispidissimus*****(Fig.8(14))**

Distribution: Europe: central, southwestern, and southeastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia.

Pacific: southwestern, south-central, northwestern, and north-central. North America: southwest USA, south-central USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout, not common

Habitat: In open areas, grasslands

Habit: Annual

Plant description:

Culm: Erect or decumbent, slender.

Leaf: Leaf blades linear, rigid, flat. Membranous ligule.

Inflorescence: Lower glume of pedicelled spikelet densely hairy with long tubercle based persistent hairs all over the back, hairs in lower part shorter than in upper.

15. ***Heteropogon ritchiei*** **(Fig.9(15))**

Distribution: Asia-tropical: India. In India: Penninsular India. In Gujarat: North to south and west Gujarat.

Habitat: Dry or moist places.

Habit: Annual

Plant description:

Culm: Long

Leaf: Leaf blades sparsely hairy on both sides, acuminate apex. Leaf sheaths keeled, glabrous, membranous ligule.

Inflorescence: Racemes single, erect. Spikelets appressed, in pairs, fertile and sterile spikelets pedicelled. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets linear, subterete, falling entire. Glumes dissimilar. Lower glume linear, coriaceous, dark brown, without keels, pubescent. Upper glume linear, coriaceous, without keels, muticous. Upper lemma linear, membranous, awned. Principal lemma awn apical, geniculate, pubescent. Palea absent or minute. Lodicules 2. Pedicelled spikelets well developed, male, lanceolate, dorsally compressed. Glumes chartaceous, acute. Lower glume tuberculate-setose on margin. Lemmas 2, membranous, lanceolate, hyaline.

16. ***Heteropogon triticeus*** **(Fig.9(16))**

Distribution: Asia-temperate: China. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. In India: throughout. In Gujarat: throughout (except Kutch)

Habitat: Moist open localities

Habit: Perennial

Plant description:

Culm: Erect, solid internode, nodes brown to black.

Leaf: Leaf blades Cauline, leaf sheaths keeled, membranous, truncate ligule.

Inflorescence: Racemes 1, bearing 5 -10 fertile spikelets on each. Spikelets appressed, in pairs, fertile sessile spikelet and sterile pedicelled spikelet. Sessile spikelet comprising 1 sterile and 1 fertile florets. Spikelets linear, subterete, falling entire. Glumes dissimilar. Lower glume linear, coriaceous, dark brown, grovved surface. Upper glume linear, symmetrical, coriaceous, without keels, winged on margins, muticous. Lemma hyaline, without lateral veing. Principal lemma linear or oblong, membranous, awned, geniculate. Palea absent or minute. Lodicules 2. Pedicelled spikelets well developed. Spikelets dorsally compressed. Glumes coriaceous, scabrous, lower glume muticous. Lemmas 2.

17. *Imperata cylindrica* (Fig.10(17))

Distribution: Europe. Africa: southern tropical, south, and western Indian ocean. Asia-temperate: Soviet Middle Asia, Caucasus, western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. North America. In India: hotter parts of India. In Gujarat: throughout, scattered, common.

Habitat: On the banks, in river beds, in damp clayey soils.

Habit: Perennial

Plant description:

Culm: Erect.

Leaf: Leaves mostly basal, leaf blades erect, flat or convolute, margin scabrous, membranous ligule.

Inflorescence: Panicle with braches tipped by raceme. Pedicels with long, fine hairs below. Spikelets in pairs, 1 flowered and 1 hermaphrodite. Fertile spikelet pedicellate. Spikelet comprising 1 fertile and 1 sterile florets, both similar. Spikelets lanceolate, subterete, falling entire. Glumes similar. Glumes oblong, membranous, without keels. Upper lemma ovate, hyaline, without keels, acute apex. Palea hyaline, without keels. Lodicules 2.

18. *Ischaemum indicus* (Fig.10(18))

Distribution: Africa: China. Asia-tropical: Indo-China, Malesia, and Papuasia. Australasia: Australia. South America: Mesoamericana, northern South America, and western South America. In India: throughout. In Gujarat: throughout.

Habitat: Common weed in all habitats

Habit: Perennial

Plant description:

Culm: Prostrate or geniculately sacending, compressed, glabrous node, ribbed internode.

Leaf: Leaf blades linear to lanceolate, flat, hairy on both sides, acuminate tip, scabrid margin. Leaf sheath compressed, loose, pilose. Membranous ligule.

Inflorescence: Racemes 2, in paird. Spikelets in pairs, fertile sessile and sterile pedicelled spikelets. Sessile spikelets elliptic. Lower glume

concave, membranous, broadly winged margin. Upper glume oblong to lanceolate, keel with hairs below the apex, awned. Lower lemma ovate to lanceolate, hyaline, ciliate. Lower palea hyaline lanceolate, glabrous. Upper lemma deeply cleft into 2, lanceolate lobes, serrate margin, hyaline, awned, geniculate, scabrid. Upper palea lanceolate with broad base, hyaline, obtuse, scabrid glabrous. Pediclellate spikelet shorter than the sessile, thick, clavate, angulr. Lower glume linear, margin incurved by a laterally expanded wing, pale greenish yellow. Upper glume oblong-lanceolate, keel with hairs below the apex, rigid, awned. Lower lemma ovate-lanceolate, acuminate, hyaline, ciliate. Lower palea hyaline, lanceolate, glabrous. Upper lemma deeply cleft into 2, serrate margin, awned–geniculate, scabrid. Upper palea lanceolate with a broad base, hyaline.

19. *Ischaemum molle* (Fig.11(19))

Distribution: Asia-temperate: Arabia. Asia-tropical: India and Indo-China. In India: Pennisular-central India. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Erect, geniculately ascending, compressed, nodes bearded, intrnodes ribbed.

Leaf: Leaf blade linear, acuminate, sparsely hairy. Leaf sheath long, compressed, loose, pilose, with tubercle based hairs. Membranous ligule.

Inflorescence: Racemes 2, paired, appressed back to back. Spikelets in pairs, fertile sessile spikelet and sterile pedicelled spikelet. Sessile spikelets elliptic. Lower glume cartilaginous, pale yellow, shiny, concave, densy villose, thinner, membranous, obtuse. Upper glume oblong-lanceolate, keel with a narrow ciliolate wing below the apex. Lower lemma ovate-lanceolate, acuminte, hyaline, ciliate. Lower palea hyaline, lanceolate, expanded by hyaline wing below the tip, glabrous. Upper lemma deeply cleft into 2, acute, lanceolate lobes, serrate margin, hyaline, keeled, awned, scabrid. Upper palea lanceolate with a broad base, hyaline, obtuse, scabrid-glabrous. Pedicellate spikelets shorter than the sessile, obliquely ovoid, thick, clavate, angular. Lower glume linear, ciliate, margin incurved by a laterally expanded wing, pale yellow, lower cartilaginous portion villose. Upper glume ovate-lanceolate, ciliate in nerve. Lower lemma ovate-lanceolate, acuminate, hyaline, ciliate, male. Lower palea hyaline, lanceolate, glabrous. Upper lemma oblong, slightly notched at the apex, scabrid, obtuse.

20. *Ischaemum pilosum*(Fig.11(20))

Distribution: Africa. Asia-tropical: India.In India: Pennisular-central India. In Gujarat: throughout.

Habitat: Common in wet soils.

Habit: Perennial

Plant description:

Culm: Tufted, rooting below, leafy, compressed, glabrous nodes, internodes ribbed.

Leaf: Leaf blades linear-lanceolate, glabrous, flat, acuminate, scabrid margin

Inflorescence: Racemes 2-5, pale yellow, spikelets in pairs, fertile sessile and sterile pedicelled spikelets. Sessile spikelets shorter than the pedicellaed, rudimentary or well developed, thick, terete, villose. Lower glume linear, ciliate, pale yellow. Upper glume ovate-lanceolate, ciliate in nerve. Lower lemma ovate-lanceolate, acuminate, hyaline, ciliate. Lower palea hyaline, lanceolate, glabrous. Upper lemma oblong, scabrid, ciliate, hyaline, awned. Principal lemma awn geniculate. Upper palea lanceolate with broad base, hyaline, scabrid to glabrous. Pedicellate spikelets shorter than the sessile, rudimentay or well developed, thick, terete, villose. Lower glume linear, ciliate, pale yellow. Upper glume ovate-lanceolate, cillate. Lower lemma ovate-lanceolate, acuminate, hyaline, ciliate. Lower palea hyaline, lanceolate, glabrous. Upper lemma oblong, scabrid, ciliate, hyaline. Upper palea lanceolate with broad base, hyaline, scabrid to glabrous.

21. *Ischaemum rugosum* (Fig.12(21))

Distribution: Africa: western Indian ocean. Asia-temperate: China and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australia. North America. South America: Mesoamericana, Caribbean, northern South America, western South America, and Brazil. In India: throughout. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Erect or geniculately ascending, leafy, compressed, glabrous nodes, ribbed internodes.

Leaf: Leaf blades linear-lanceolate, flat, hairy, acuminate, margin scabrid. Leaf sheath compressed, loose, pilose. Membranous ligule.

Inflorescence: Racemes 2, appressed back to back. Spikelets in pairs, fertile sessile and sterile pedicelled spikelets. Sessile spikelets elliptic. Lower glume cartilaginous, pale yellow, shiny, concave, thinner, membranous, obtuse, margin narrowly incurved and winged. Upper glume oblong-lancolate, acuminate, hyaline, ciliate. Lower lemma ovate-lanceolate, acuminate, hyaline, ciliate. Lower palea hyaline, lanceolate, glabrous. Upper lemma deeply cleft into 2, acute, lanceolate lobes, margin entire, hyaline,keeled, bisexual, awned. Upper palea lanceolate with a broad base, hyaline, obtuse. Pedicellate spikelets obliquely ovoid. Lower glume linear, but upper half expanded obliquely by a broad wing below the tip, ciliate, pale greenish yellow. Upper glume ovate-lanceolate, ciliate in nerve. Lower lemma ovate-lanceolate, acuminate, hyaline, ciliate. Lower palea hyaline, lanceolate,

glabrous. Upper lemma oblong, acuminate, scabrid, hyaline. Upper palea lanceolate with broad base, hyaline, obtuse, scabrid to glabrous.

22. ***Iseilema laxum*** **(Fig.12(22))**

Distribution: Asia-tropical: India and Indo-China., Sri Lanka. In India: Central to southwards India. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Perennial

Plant description:

Culm: Geniculately ascending, glabrous nodes.

Leaf: Leaf blades glaucous, apex abruptly acute. Membranous acute.

Inflorescence: Racemes single, oblong, bearing few spikelets, 1 fertile spikelet on each. Spikelets in threes, basal paired, fertile sessile spikelets, 2 sterile spikelets pedicelled. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets elliptic, dorsally compressed, falling entire. Glumes dissimilar. Lower glume elliptic, cartilaginous, without keels. Upper glume lanceolate, coriaceous, apex acuminate. Upper lemma linear, membranous, awned. Principal lemma awn geniculate, glabrous. Palea absent or minute. Lodicules 2. Pedicelled spikelets well developed, male, lanceolate. Glumes cartilaginous, glabrous, muticous. Involucral spikelets well developed, lanceolate. Glumes herbaceous, ciliate on margins, lanceolate.

23. ***Ophiuros exaltatus*** **(Fig.13(23))**

Distribution: Asia-temperate: China. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. In India: throughout. In Gujarat: throughout

Habitat: Common in all habitats

Habit: Perennial

Plant description:

Culm: Robust, lateral branches ample.

Leaf: Leaf blades elliptic, pilose, spinulose margin.

Inflorescence: Racemes single, smoothly terete. Spikelet packing abaxial, regular, 2-rowed, sunken, fertile sessile spikelet and sterile pedicelled spikelet. Sessile spikelets comprising 1 sterile and 1 fertile florets. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets oblong, dorsally compressed, falling entire. Glumes dissimilar. Lower glume oblong, coriaceous, without keels, smooth or areolate. Upper glume elliptic, membranous. Upper lemma of lower sterile floret ovate, acute, hyaline. Paleal hyaline, ovate, without keels. Lodicules 2. Pedicelled spikelets represented by barren pedicels.

24. ***Rottboellia exaltata*** **(Fig.13(24))**

Distribution: Africa: Asia-temperate: Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia. North

America. South America. In India: throughout warmer parts. In Gujarat: North to South Gujarat.

Habitat: Sandy moist places.

Habit: Annual

Plant description:

Culm: Erect, lateral braches ample.

Leaf: Leaf blades scaberulous. Leaf sheaths hispid, with tubercle-based hairs. Membranous ligule.

Inflorescence: Raceme single, erect, smoothly terete, unilateral. Spikelet arraned abaxial, regular, sunken, in pairs, fertile sessile and sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets ovate, dorsally compressed, gibbous, falling entire. Glumes dissimilar. Lower glume vate, induarate, winged on keel. Upper glume ovate, gibbous, chartaceous, winged all along. Upper lemma oblate, laterally compressed, gibbous, hyaline, lightly keeled. Palea elliptic hyaline, without keels. Lodicules 2. Pedicelled spikelets well developed, containing empty lemmas, ovate, dorsally compressed. Glumes distinctly veined, glabrous, obtuse, muticous. Lemmas enclosed by glumes, membranous, hyaline, barren.

25. ***Saccharum spontaneum*** **(Fig.14(25))**

Distribution: Europe: southeastern. Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, and western Indian ocean. Asia-temperate: Soviet Middle Asia, western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. South America: Mesoamericana. In India: throughout. In Gujarat: throughout.

Habitat: Water edges, wet lands.

Habit: Perennial.

Plant description:

Culm: Erect, robust, solid internodes.

Leaf: Leaf blades base simple or tapering to the midrib. Membrnaous ligule.

Inflorescence: Racemes. Spikelets in pairs, all fertile, sessile and pedicelled, subequal. Fertile spikelets comprising 1 sterile and 1 fertile florets. Spikelets lanceolate, dorsally compressed, falling entire. Glumes similar. Lower and upper glumes lanceolate, coriaceous, ciliate margin. Upper lemma linear, hyaline. Palea absent. Lodicules 2. Stigma 2.

26. ***Sehima ischaemoides*** **(Fig.14(26))**

Distribution: Africa: Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, and south. Asia-temperate: Arabia. Asia-tropical: India. In India: throughout. In Gujarat: Saurashtra.

Habitat: Dry soil, on slopes of river bands, on hillocks.

Habit: Annual.

Plant description:

Culm: Geniculately ascending.

Leaf: Leaf blades glucous, attenuate apex, filiform. Hairy ligule.

Inflorescence: Racemes 1, straight. Spikelets squeezed between internode and pedicel. Fertile sessile spikelets, sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelts linear, laterally compressed, falling entire. Glumes dissimilar. Lower glume linear, asymmetrical, coriaceous, surface deeply depressed. Upper glume elliptic, chartaceous, ciliate margin, awned. Upper lemma lanceolte, hyaline, without keel, ciliate margin, awned. Principal lemma awn from a sinus, geniculate. Palea without keels, hyaline. Pedicellate spikelets well developed, containing empty lemmas. Spikelets lanceolate, dorsally compressed. Glumes coriaceous, ciliate on margin, acute, muticous. Lemmas 2, muticous.

27. *Sehima nervosum* (Fig.15(27))

Distribution: Africa.Asia-temperate: Arabia and China. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australia, Sri Lanka, United States. In India: Noeth-West to Pennisular India. In Gujarat: throughout (except Kutch).

Habitat: Dry soil, on slopes of river bands, on hillocks.

Habit: Perennial.

Plant description:

Culm: Erect, wiry.

Leaf: Leaf blades glaucous, filiform. Hairy ligule.

Inflorescence: Racemes single. Spikelets squeezed between internode and pedicel, in pairs, fertile sessile and sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets elliptic, laterally compressed. Glumes dissimilar. Lower glume elliptic, asymmetrical, coriaceous, keeled dorsally below, deeply depressed. Upper glume elliptic, chartaceous, apex awned. Lower lemma oblong, hyaline, ciliate on margins. Palea hyaline, hairy, without keels. Upper lemma lanceolate, hyaline, ciliate margins, awned. Principal lemma awn from a sinus, geniculate. Palea hariy, without keels. Lodicules 2. Pedicelled spikelets well developed, containing empty lemmas, lanceolate, dorsally compressed, separately deciduous. Glumes coriaceous, ciliate on margins, acute, muticous. Lemmas 2, muticous, ciliate on margins.

28. *Sehima sulcatum*(Fig.15(28))

Distribution: Asia-tropical: India and Indo-China. In India: Noeth-West to Pennisular India. In Gujarat: throughout.

Habitat: Dry soil, on slopes of river bands, on hillocks.

Habit: Perennial

Plant description:

Culm: Long, glabrous node.

Leaf: Leaf blades glabrous, scabrous margins, acuminate apex. Hairy ligule.

Inflorescence: Racemes single. Spikelets appressed, in pairs, fertile sessile spikelets, sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile florets, 1 fertile florets. Spikelets lanceolate, dorsally compressed. Glumes dissimilar. Lower glume lanceolate, coriaceous, apex 2-fid. Upper glume lanceolate, chartaceous, keel winged, acute apex, awned. Lemma of lower sterile floret lanceolate, hyaline, ciliolate on margins. Palea of lower sterile floret similar to lemma. Upper lemma oblong, hyaline, without keel, ciliate, awned. Principal lemma awn from a sinus, geniculate. Palea hyaline. Lodicules 2. Pedicelled spikelets well developed, male, lanceolate, dorsally compressed. Ciliate pedicels. Lower glume lanceolate, coriaceous, villose margin. Upper glume lanceolate, chartaceous, acuminate apex. Upper lemma oblong, hyaline. Palea hyaline.

29. *Sorghum halepense* (Fig.16(29))

Distribution: Europe. Asia-temperate: Soviet Middle Asia, Caucasus, western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia. Pacific. America. In India: throughout. In Gujarat: throughout.

Habitat: Common near wet places, in hedges.

Habit: Perennial

Plant description:

Culm: Erect or geniculately ascending. Pubescent nodes.

Leaf: Leaf blades long, scaberulous margins. Membranous ligule.

Inflorescence: Panicle with branches tipped by a raceme. Panicle open, pyramidal. Racemes bearing few fertile spikelets. Spikelets in pairs, fertile sessile spikelets and sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile florets and 1 fertile florets. Spikelets oblong or ovate or orbuicular, dorsally compressed, persistent. Glumes dissimilar. Upper lemma gaping. Lower glume ovate, chartaceous, 2-keeled, dentate apex. Upper glume ovate, chartaceous, keeled, ciliate margins. Upper lemma obovate, hyaline, ciliate margin, awned. Principal lemma awn from a sinus, geniculate.palea hyaline, ciliated. Lodicules 2. Stigma 2. Pedicelled spikelets well developed, male, lanceolate, similar to sessile spikelet. Lower lemma awnless.

30. *Thelepogn elegans* (Fig.16(30))

Distribution: Africa: west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, and south. Asia-tropical: India, Indo-China, and Malesia. In India: throughout. In Gujarat: central to north Gujarat.

Habitat: Common in open areas

Habit: Annual

Plant description:

Culm: Erect, long

Leaf: Leaf blade base cordate or amplexicaul, lanceolate, glabrous, ciliate margin. Membranous ligule.

Inflorescence: Racemes, digitate. Spikelets in pairs, fertile sessile spikelets and sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile florets and 1 fertile florets. Spikelets dosally compressed, falling entire. Glumes dissimilar. Lower glume ovate, without keels, rugose surface, acute apex. Upper glume ovate, chartaceous, without keels, acute apex. Lemma of lower sterile floret lanceolate, hyaline. Principal lemma ovate, hyaline, without keel, apex lobed, awned, awn geniculate. Palea hyaline, without keels. Pedicellate spikelet represented by barren pedicels.

31. *Themeda cymbaria* (Fig.17(31))

Distribution: Asia-tropical: India, Sri Lanka. In India: throughout. In Gujarat: throughout.

Habitat: Common in open area, sometimes also found on hills.

Habit: Perennial

Plant description:

Culm: Long, erect.

Leaf: Leaf blade long, scabrous surface. Membranous ligule.

Inflorescence: Racemes single, bearing fertile spikelets. Spikelets in pairs, fertile sessile spikelet and sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile florets and 1 fertile florets. Spikelets elliptic, subterete, falling entire. Glumes dissimilar. Lower glume oblong, coriaceous, without keels, glabrous surface. Upper glume oblong. Upper lemma linear, hyaline, without keel, awned. Principal lemma awn apical, geniculate. Plaea absent or minute. Pedicellate spikelet well developed, male , lanceolate. Glumes smooth, glabrous. Lemmas 2, enclosed by glumes.

32. *Themeda laxa* (Fig.17(32))

Distribution: Asia-tropical: India, Burma. In India: South-Central India, Western India. In Gujarat: South-North and Central Gujarat.

Habitat: Drier rocky areas.

Habit: Perennial

Plant description:

Culm: Erect.

Leaf: Leaf blades surface pilose, sparsely hairy, scabrous margins. Membranous ligule.

Inflorescence: Racemes bearing 1 fertile spikelets on each. Spikelets in threes, basal apired, subtended by 4 involucral spikelets. Sessile spikelets comprising 1 sterile florets and 1 fertile florets. Spikelets elliptic, subterete, falling entire. Glumes dissimilar. Lower glume onlong, coriaceous, without keels, scabrous surface. Upper glume oblong, coriaceous. Upper lemma linear, hyaline, without keel, awned. Principal lemma awn apical, geniculate, hispidulous. Palea absent or minute. Lodicules 2. Pedicelledspikelets well

developed, containing empty lemmas or male, linear. Glumes herbaceous, ciliate on margins. Lemmas enclosed by glumes, lanceolate. Involucral spikelet pedicelled, 2 in the cluster, well developed, barren or male. Glumes tuberculate on margins, herbaceous, ciliate on margins, lower glume muticous and winged. Lemmas hyaline, lanceolate.

33. *Themeda triandra* (Fig.18(33))

Distribution: Africa: south, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. Pacific: southwestern. United states: Texas. In India: throughout warmer parts. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Perennial

Plant description:

Culm: Erect.

Leaf: Leaf blades long. Membranous ligule.

Inflorescence: Racemes single, bearing 1 fertile spikelets on each. Spikelets in threes, basal paired. Fertile spikelets sessile, 2 sterile spikelets pedicelled, subtended by 4 involucral spikelets. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets elliptic, subterete, falling entire, callus hairs red. Glumes dissimilar. Lower glume oblong, coriaceous, dark brown, without keels. Upper glume oblong. Upper lemma linear, hyaline, without keel, awned. Principal lemma awn apical, geniculate, hispidulous. Palea absent or minute. Lodicules 2. Pedicelled spiktlets well developed, male, elliptic. Glumes smooth, herbaceous, glabrous. Glumes smooth, herbaceous, glbrous. Lemmas 2, oblong-lanceolate, membranous, hyaline, glabrous, male. Involucral spikelets well developed, 4 in number, subsessile, equaling fertile. Lemmas 2, oblong-lanceolate, membranous, hyaline, glabrous, male.

34. *Themeda quadrivalvis* (Fig.18(34))

Distribution: Africa.. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern. America. In India: throughout. In Gujarat: throughout, common.

Habitat: Common in open areas.

Habit: Annual

Plant description:

Culm: Erect or geniculately ascending. Glabrous node.

Leaf:leaf blasdes scaberulous, glabrous or pilose, scabrous margins, acuminate apex. Leaf sheaths keeled. Membranous ligule.

Inflorescence: Racemes bearing few spikelets, 1 fertile spikelets on each. Spikelets in threes, basal paired,subtended by 4 involucral spikelets. Sessile spikelets comprising 1 sterile and 1 fertiel florets. Spikelets elliptic,

subterete, falling entire, callus hairs dark brown. Glumes dissimilar. Lower glume oblong, coriaceous,without keels, scabrous surface. Upper glume oblong, coriaceous. Upper lemma linear, hyaline, without keel, awned. Principal lemma awn apical, geniculate, hispidulous. Palea absent or minute. Lodicules 2. Pedicelled spikelets well developed, linear, shorter than fertile. Glumes herbaceous, ciliate on margins. Lemmas hyaline, lanceolate. Involucral spikelets pedicelled, 2 in cluster, well developed, 4 in number, subsessile. Glumes tuberculate on margins, herbaceous, ciliate on margins, lower glume muticous and winged. Lemmas hayaline, lanceolate.

35. ***Triplopogon ramosissimus*** **(Fig.19(35))**

Distribution: Asia-tropical: India. In India: Endemic to Penninsular India. In Gujarat: Central to South Gujarat.

Habitat: Rocky river beds, hill slopes.

Habit: Annual

Plant description:

Culm: Erect, with prop roots.

Leaf: Leaf blade base pseudo petiolate, lanceolate, flaccid, pubescent, scaberulous. Membranous ligule

Inflorescence: Racemes 1. Spikelets in pairs, fertile sessile and sterile pedicelled spikelet. Sessile spikelets comprising 1 sterile florets, 1 fertile florets. Spikelets oblong, laterally compressed, pubescent callus. Glumes dissimilar. Lower glume oblong, coriaceous, toothed apex. Upper glume oblong, coriaceous, keeled near apex. Upper lemma oblong, hyaline, awned. Palea hyaline, obtuse. Principal lemma awn from a sinus, geniculate, pubescent. Palea hyaline obtuse. Lodicules 2. Pedicelled spikelet well developed, lanceolate, separately deciduous. Glumes linear-lanceolate, coriaceous. Lemmas and paleas enclosed by glumes, membranous.

36. ***Vetivaria zinzanoides*** **(Fig.19(36))**

Distribution: Throughout Africa, India, Burma, Sri Lanka, Southeast Asia. In India: throughout. In Gujarat: throughout.

Habitat: Common along water edges.

Habit: Perennial

Plant description:

Culm: Erect, long.

Leaf: Leaf blades stiff, scabrous margins. Hairy ligule.

Inflorescence: Racemes. Spikelets appressed, in pairs, fertile sessile spikelets, sterile pedicelled spikelets. Sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets linear, laterally compressed slightly. Glumes dissimilar. Lower glume lanceolate, coriaceous, without keels, spinose veins. Upper glume lanceolate, chartaceous, spinulose vein, muticous, winged. Upper lemma oblong, hyaline, muticous. Palea hyaline, without keels. Lodicules 2. Pedicelled spikelets well developed, male, linear, dorsally compressed, smaller and similar to sessile.

37. *Alloteropsis cimicina* (Fig.20(37))

Distribution: Africa: west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: China. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. North America: southeast USA. In India: throughout. In Gujarat: throughout.

Habitat: In plains and foot hills.

Habit: Annual

Plant description:

Culm: Erect or geniculately ascending. Bearded nodes.

Leaf: Leaf blade lanceolate or ovate, amplexicaul base, ribbed surface, glabrous. Hairy ligule.

Inflorescence: Racemes 4-11, digitate, unilateral. Spikelet packing irregular, ascending. Sessile spikelets 2-4 in the cluster, comprising 1 sterile and 1 fertile florets. Spikelets ovate, dorsally compressed, falling entire. Glumes dissimilar. Lower glumes ovate, membranous, acuminate. Upper glume ovate, cartilaginous, ciliate margins, purple coloured. Upper lemma oblong or ovate, chartaceous, glabrous. Lodicules 2.

38. *Brachiaria distachya* (Fig.20(38))

Distribution: Africa: east tropical and western Indian ocean. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. In India: throughout. In Gujarat: throughout.

Habitat: Moist shaded places in plains.

Habit: Annual

Plant description:

Culm: Prostrate

Leaf: Leaf blades lanceolate. Hairy ligule.

Inflorescence: Racemes 2-3, unilateral. Spikelet packing adaxial, regular, 2-rowed, solitary, sessile, comprising 1 sterile florets, 1 fertile florets. Spikelets elliptic, dorsally compressed, falling entire. Glumes dissimilar. Lower glume ovate, clasping, membranous. Lemma of lower sterile floret similar to upper glume, oblong, membranous. Lower palea membranous, obtuse. Upper lemma elliptic, indurate, rugulose, involute margins. Palea involute, indurate, rugose.

39. *Brachiaria eruciformis* (Fig.21(39))

Distribution: Europe: southwestern and southeastern. Africa: north, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: Soviet Middle Asia, Caucasus, western Asia, Arabia, and China. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern and northwestern. South America: Caribbean and southern South America. In India: throughout. In Gujarat: throughout.

Habitat: Common everywhere.
Habit: Annual
Plant description:

Culm: Decumbent.

Leaf: Leaf blades linear or lanceolate, glabrous or pubescent.

Inflorescence: Racemes 3-14, unilateral. Spikelet packing adaxial, regulare 2-rowed, solitary. Fertile sessile spikelets comprising 1 sterile and 1 fertile florets. Spikelets elliptic, slightly dorsally compressed, falling entire. Glumes dissimilar. Lower glume oblong, membranous, without keels, veinless, glabrous. Upper glume oblong, membranous. Lemma of lower sterile floret similar to upper glume oblong, membranous. Lower palea, membranous, toothed. Upper lemma elliptic, indurate, shiny, smooth, involute margins. Palea involute, without keels. Lodicules 2.

40. *Brachiaria ramose* (Fig.21(40))

Distribution: Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, and western Indian ocean. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India, Indo-China, and Malesia. Australasia: Australia. North America: southeast USA. In India: throughout. In Gujarat: throughout.
Habitat: Common in all habitats.
Habit: Annual
Plant description:

Culm: Erect

Leaf:leaf blades long, filiform. Hairy ligule.

Inflorescence: Racemes 3-15, unilateral. Spikelet packing adaxial, irregular, 2-rowed, appressed, in pairs, elliptic, slightly dorsally compressed, acute, falling entire, pedicelled. Fertile spikelets comprising 1 sterile and 1 fertile florets. Glumes dissimilar. Lower glume ovate, clasping, membranous. Upper glume ovate, membranous, glabrous. Lemma of lower sterile floret similar to upper glume, ovate, membranous, glabrous,acute. Lower palea membranous. Upper lemma ovate, indurate, dark brown, rugose, involute margins. Palea involute, indurate, 2 veined. Lodicules 2.

41. *Brachiaria reptans* (Fig.22(41))

Distribution: Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. America.. In India: throughout. In Gujarat: throughout.
Habitat: Common in all habitats.
Habit: Annual
Plant description:

Culm: Decumbent, rooting from lower nodes.

Leaf: Leaf blades lanceolate. Hairy ligule.

Inflorescence:racemes 5-10, unilateral. Spikelet packing crowded, regular, elliptic, slightly dorsally compressed, acute, falling entire, 2-rowed, inpairs, sessile and pedicelled. Fertile spikelets comprising 1 sterile and 1 fertile florets. Glumes dissimilar. Lower glume orbicular clasping, hyaline. Upper glume ovate, membranous, glabrous. Lemma of lower sterile floret similar to upper glume, ovate, membranous, glabrous. Lower palea mimbrnaous, 2-veined. Upper lemma elliptic, indurate, dark brown, rugolse, involute margins. Palea involute, indurate. Lodicules 2.

42. *Cenchrus biflorus* (Fig.22(42))

Distribution: Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia and Arabia. Asia-tropical: India. Australasia: Australia. In India: throughout hotter parts. In Gujarat: throughout.

Habitat: In sandy soil.

Habit: Annual

Plant description:

Culm: Geniculately ascending. Unequal internodes, the upper longer, channeled; nodes constricted, glabrous.

Leaf: Leaf blades linear or lanceolate, scaberulous, base broadly rounded or cordate. Leaf heaths loose, keeled, scaberulous, glabrous. Hairy ligule.

Inflorescence: Panicle spiciform, linear. Primary panicle braches accrescent to a central axis with sessile scars on axis. Spikelets subtended by an involucres, composed of bristles, deciduous with the fertile spikelets, in tow with and outer whorl of thinner bristle, inner bristle longer than outer, flattened, grooved on the face, rigid, retrorsely scaberulous, ciliate, spinose. Fertile spikelets sessile, 1-3 in the cluster comprising 1 sterile and 1 fertile florets. Spikelets ovate, dorsally compressed, falling entire. Glumes shorter than the spikelet, thinner than upper lemma. Lower glume lanceolate, membranous. Lemma of lower sterile floret similar to upper glume, ovate, membranous. Upper lemma ovate, coriaceous, flat magins. Palea coriaceous, apex toothed, membranous.

43. *Cenchrus ciliaris*(Fig.23(43))

Distribution: Europe. Asia-temperate: western Asia, Arabia, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australia. North America: Mexico. South America: Mesoamericana, Caribbean, western South America, Brazil, and southern South America. In India: throughout. In Gujarat: throughout, common.

Habitat: Common in dry and sandy habitats, even drier parts of hills.

Habit: Perennial

Plant description:

Culm: Geniculately ascending.

Leaf:leaf blade vernation distinct, conspicuous midrib, scaberulous, sparsely hairy with tubercle based hairs, margins unthickened, glabrous or ciliate. Leaf sheaths loose, with flat margins, outer margin hairy. Hairy ligule.

Infloroscece: Panicle spiciform, linear to oblong. Primary braches accrescent to central axis. Spikelets subtended by an involucres, composed of bristles connate into a disc below, with an outer whorl of thinner bristles, inner bristles longer than outer, with one conspicuously longer bristle, flattened, without grooves, flexible, antrorsely sscaberulous. Fertile sessile spikelets, 1-4 in the cluster, comprising 1 sterile and 1 fertile florets. Spikelets lanceolate, dorsally compressed. Glumes similar, subequal, shorter than spikelet. Lower and Upper glume ovate, hyaline. Sterile florets barren, with or without palea, if it present ovate, chartaceous. Lemma of lower sterile floret ovate, membranous. Upper lemma ovate, dorsally compressed, lanceolate, chartaceous, pallid. Palea ovate, chartaceous. Lodicules 2.

44. *Cenchrus setigerus* (Fig.23(44))

Distribution: Africa: north, west tropical, northeast tropical, and east tropical. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India and Indo-China. Australasia: Australia. Pacific: north-central. South America: Brazil. In India: throughout hotter parts. In Gujarat: throughout very common weed.

Habitat: In dry shady areas and in fellow fields.

Habit: Perennial

Plant description:

Culm: Geniculately ascending.

Leaf: Leaf blades long. Hairy ligule.

Inflorescence: Panicle spiciform, linear. Primary braches accrescent to central axis. Spikelets subtended by an involucres, composed of bristles connate into a cup below, bristle deciduous with the fertile spikelets, in one whorl or an outer whorl of thinner bristles, inner bristles longer than outer, with one conspicuously longer bristle, flattened, without grooves, flexible, antrorsely sscaberulous. Fertile sessile spikelets, 1-3 in the cluster, comprising 1 sterile and 1 fertile florets. Spikelets ovate, dorsally compressed. Glumes shorter than the spikelet. Lower and upper glume ovate, hyaline. Lemma of lower sterile floret oblong, membranous, emarginated. Palea toothed, memnranous, coriaceous. Upper lemma ovate, coriaceous, flat margins. Palea toothed, membranous, coriaceous. Lodicules absent.

45. *Digitaria ciliaris* (Fig.24(45))

Distribution: Europe: southeastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south,

middle Atlantic ocean, and western Indian ocean. Asia-temperate: Soviet far east, Caucasus, western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. Pacific: southwestern, south-central, northwestern, and north-central. North America. In India: throughout. In Gujarat: throughout.

Habitat: Common in forest undergrowth, wastelands, road sides, moist places.

Habit: Annual

Plant description:

Culm: Decumbent

Leaf: Leaf blades long. Membranous ligule.

Inflorescence: Racemes, digitate, unilateral. Spikelet packing contiguous, appressed, in pairs, pedicelled, all alike, comprising 1 sterile and 1 fertile florets. Spikelets elliptic, dorsally compressed, falling entire. Glumes dissimilar. Lower glume if present membranous, truncate, ovate. Upper glume lanceolate. Upper lemma elliptic, cartilaginous, dark brown, covering most of palea, ciliate. Palea cartilaginous. Lodicules 2.

46. *Digitaria granularis* (Fig.24(46))

Distribution: Asia-temperate: China. Asia-tropical: India, Indo-China, Malesia, and Papuasia. In India: throughout. In Gujarat: throughout except Kutch.

Habitat: In open fallow fields, in open grasslands.

Habit: Annual

Plant description:

Culm: Decumbent, rooting from lower nodes.

Leaf: Leaf blades linear, flaccid, scaberulous, filiform. Leaf sheaths pilose with tubercle based hairs. Membranous ligule.

Inflorescence: Racemes 3-7, digitate, unilateral. Spikelet packing lax, spreading, in pairs or in threes, pedicelled. Spikelets fertile, elliptic, dorsally compressed, falling entire, comprising 1 sterile and 1 fertile florets. Lower glumes absent or obscure. Upper glume lanceolate, membranous. Upper lemma elliptic, cartilaginous, dark brown, striate, flat margins, covering most of palea. Palea cartilaginous. Lodicules 2.

47. *Digitaria longiflora* (Fig.25(47))

Distribution: Africa. Asia-temperate: China and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern and northwestern. America. In India: throughout. In Gujarat: North to South Gujarat.

Habitat: In dry areas, in forest undergrowth of rocky habitats.

Habit: Annual

Plant description:

Culm: Rambling

Leaf: Leaf blades glabrous. Leaf sheaths glabrous. Membranous ligule.

Inflorescence: Racemes 2-4, paired or digitate, unilateral. Spikelets 3 in the cluster, pedicelled, ellotic, dorsally compressed, falling entire, comprising 1 sterile and 1 fertile florets. Lower glumes absent. Upper glume elliptic, membranous, pubescent with verruculose hairs. Upper lemma elliptic, cartilaginous, light brown, flat margins, covering most of palea. Palea cartilaginous, elliptic. Lodicules 2.

48. ***Digitaria stricta*** **(Fig.25(48))**

Distribution: Asia-temperate: Arabia, China, and eastern Asia. Asia-tropical: India and Indo-China. In India: throughout. In Gujarat: throughout.

Habitat: In open wastelands in rocky gravelly habitats.

Habit: Annual

Plant description:

Culm: Geniculately ascending

Leaf: Leaf blades and leaf sheath hirsute with tubercle based hairs. Membranous ligule.

Inflorescence: Racemes 3-12, digitate, unilateral. Spikelets 3 in the cluster, pedicelled. Spikelets oblong, dorsally co,pressed, obtuse, falling entire, comprising 1 sterile and 1 fertile florets. Lower glumes absent. Upper glume elliptic, membranous, pubescent with capitate hairs. Upper lemma elliptic, cartilaginous, covering most of palea. Palea cartilaginous, apiculate. Lodicules 2.

49. ***Echinochloa colona*** **(Fig.26(49))**

Distribution: Europe. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. North America: northwest USA, north-central USA, northeast USA, southwest USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent.

Leaf: Leaf blades and sheaths glabrous. Ligule absent.

Inflorescence: Racemes unilateral. Spikelet packing crowded, regular, 4 rowed. Fertile sessile-subsessile spikelets 2-4 in cluster, subequal, comprising 1 sterile and 1 fertile florets. Spikelets orbicular, dorsally compressed, gibbous, acuminate. Glumes dissimilar. Lowr glume ovate, membranous, scabrous. Upper glume ovate, membranous, pubescent. Lemma

of lower sterile floret similar to upper glume. Lower palea membranous, toothed. Upper lemma ovate, gibbous, indurate, shiny, involute margins, laterally pinched. Palea reflexed at apex, indurate. Lodicules 2.

50. *Echinochloa crusgalli*(Fig.26(50))

Distribution: Europe: northern, central, southwestern, southeastern, and eastern. Africa: north, Macaronesia, west tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: Siberia, Soviet far east, Soviet Middle Asia, Caucasus, western Asia, Arabia, China, Mongolia, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. Pacific: southwestern, south-central, northwestern, and north-central. America. In India: throughout. In Gujarat: throughout.

Habitat: In moist places, water margin, damp places.

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent

Leaf: Leaf blades and sheaths glabrous. Ligule absent.

Inflorescence: Racemes 5-15, unilateral. Fertile sessile and pedicelled spikelets, crowded, irregular, 2-4 rowed, subequal. Fertile spikelets comprising 1 sterile and 1 fertile florets, dorsally compressed, gibbous, falling entire. Glumes dissimilar. Lower glume oblate, without keels, scabrous. Upper glume ovate, membranous, without keels, hispid, awned. Lemma of lower sterile floret similar to upper glume. Lower palea membranous, toothed. Upper lemma ovate, gibbous, indurate, shiny, involute margins, acute, laterally pintched. Palea reflexed at apex, indurate. Lodicules 2.

51. *Echinochloa stagnina* (Fig.27(51))

Distribution: Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-tropical: India, Indo-China, Malesia, and Papuasia. In India: throughout. In Gujarat: throughout.

Habitat: In moist damp places

Habit: Perennial

Plant description:

Culm: Decumbent, long, spongy, rooting from lower nodes.

Leaf: Leaf blades and sheaths glabrous. Hairy ligule.

Inflorescence: Racemes simply spaced, flexuous, unilateral. Spikelet packing irretular, 4-rowed, comprising 1 sterile and 1 fertile florets, dorsally compressed, gibbous, acuminate, falling entire. Glumes dissimilar. Lower glume oblate, without keels, scabrous. Upper glume ovate, membranous, without keels, hispid, awned. Lemma of lower sterile floret similar to upper glume. Lowr palea membranous, toothed. Upper lemma ovate, gibbous, indurate, laterally pinched. Palea reflexed at apex, indurate. Lodicules 2.

52. ***Eremopogon foveolatus*** **(Fig.27(52))**

Distribution: Africa: north, Macaronesia, west tropical, northeast tropical, and east tropical. Asia-temperate: western Asia and Arabia. Asia-tropical: India and Indo-China. In India: throughout. In Gujarat: throughout, common.

Habitat: Grassy hills and open dry habitats.

Habit: Perennial

Plant description:

Culm: Geniculately ascending

Leaf: Leaf blades flat or convolute. Membranous ligule.

Inflorescence: Racemes single. Spikelts in pairs, fertile sessile and sterile pedicelled. Fertile spikelets comprising 1 sterile and 1 fertile florets. Sessile spikelets elliptic, dorsally compressed. Glumes dissimilar. Lower glume elliptic, cartilaginous, without keels, ciliate margins. Upper glume lanceolate, 1 keeled. Lemma of lower sterile floret oblong, hyaline, truncate. Upper lemma linear, hyaline, without keel, apex awned. Principal lemma awn apical, geniculate, glabrous. Palea absent or minute. Lodicules 2. Pedicelled spikelets well developed, male , ellipitic. Glumes pitted, glabrous, ciliate margin. Lower lemma oblong, hyaline, truncate, without palea. Upper floret lacking.

53. ***Eriochloa procera*** **(Fig.28(53))**

Distribution: Africa: northeast tropical, east tropical, southern tropical, middle Atlantic ocean, and western Indian ocean. Asia-temperate: China and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, northwestern, and north-central. South America: northern South America and western South America. In India: throughout. In Gujarat: throughout

Habitat: Water edges, margin of agricultural fields, waste lands.

Habit: Annual

Plant description:

Culm: Erect or geniculately ascending

Leaf: Leaf blades long. Hairy ligule.

Inflorescence: Racemes 3-10, unilateral. Spikelet packing regular, 2-rowed, in pairs, pedicelled, pedicels free, oblong, glabrous. Fertile spikelets comprising 1 sterile and 1 fertile florets. Spikelets lanceolate, dorsally compressed, falling entire,glbrous. Glumes one the lower absent or obscure. Upper glume elliptic, membranous, pubescent, acuminate apex. Basal sterile florets barren, without significant palea. Lemma of lower sterile floret similar to upper glume elliptic, pubescent, acute. Upper lemma elliptic, indurate, without keel, granulose surface, involute margins, mucronate. Palea involute, indurate. Lodicules 2.

54. ***Oplismenus burmannii*** **(Fig.28(54))**

Distribution: Africa:Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: Caucasus and Arabia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern and north-central. North America: Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, and Brazil. In India: throughout.In Gujarat: throughout.

Habitat: Common in all the shady spots of various habitats.

Habit: Annual

Plant description:

Culm: Prostrate, rooting from lower nodes.

Leaf: Leaf blade lanceolate or ovate, asymmetrical base, glabrous surface. Membranous ligule.

Inflorescence: Racemes 3-8, unilateral. Spikelets packing contiguous, in pairs, sessile and pedicelled, 2 in the cluster, subequal, oblong pedicels. Fertile spikeltets comprising 1 sterile and 1 fertile florets. Spikelets lanceolate, laterally compressed, falling entire, in pairs. Glumes similar, shorter than spikelet. Lower glume ovate, herbaceous, 1 keeled, awned, scaberulous. Upper glume ovate, herbaceous, 1 keeled, pubescent, awned. Basal sterile florets barren without significant palea. Lemma of lower sterile floret ovate, membranous, 1-keeled, pubescent, without emarginated. Upper lemma oblong, dorsally compressed, coriaceous, shiny. Palea involute, coriaceous. Lodicules 2.

55. *Oplismenus composites* (Fig.29(55))

Distribution: Africa: northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. North America: Mexico. South America: Mesoamericana, northern South America, and western South America. In India: throughout. In Gujarat: throughout but not common, occasional.

Habitat: In forest undergrowth.

Habit: Perennial

Plant description:

Culm: Prostrate, rooting from lower nodes.

Leaf: Leaf blade base asymmetrical, lanceolate or ovate. Leaf sheaths pilose. Membranous ligule.

Inflorescence: Racemes 4-12, unilateral. Spikelet packing lax, regular, 2 rowed, in pairs. Fertile spikelets sessile and pedicelled, subequal, pedicels oblong. Fertile spikelets comprising 1 sterile and 1 fertile florets, lanceolate, laterally compressed, falling entire. Glumes dissimilar, shorter than spikelet. Lower glume ovate, herbaceous, 1 keeled, glabrous, 1 awned. Upper glume ovate, herbaceous, 1 keeled, pubescent, apex awned. Basal sterile florets

barren, without significant palea. Lemma of lower sterile floret ovate, membranous, keeled, glabrous. Upper lemma oblong, dorsally compressed, coriaceous, shiny, involute. Palea involute, coriaceous. Lodicules 2.

56. *Panicum antidotale* (Fig.29(56))

Distribution: Africa: west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. In India: South to Gangetic plains, North West India. In Gujarat: throughout, not common.

Habitat: Common in wet places, grows under bushes and trees and in hedges.

Habit: Perennial

Plant description:

Culm: Erect or geniuculately ascending, woody, swollen nodes.

Leaf: Leaf blades midrib conspicuous, attenuate apex. Hairy ligule.

Inflorescence: Panicle open, oblong, contracted about primary branches. Spikelets solitary, pedicelled. Fertile spikelets comprising 1 sterile and 1 fertile florets. Spikelets elliptic, dorsally compressed, acute, falling entire. Lower glume ovate, membranous. Upper glume ovate, membranous, with hyaline margins. Lemma of lower sterile floret similar to upper glume. Palea of lower sterile floret membranous, hyaline acute. Upper lemma oblong, dorsally compressed, indurate, pallid, shiny. Palea involute, indurate. Lodicules 2.

57. *Panicum maximum* (Fig.30(57))

Distribution: Europe: southeastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. Pacific: southwestern, south-central, northwestern, and north-central. North America: south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout, In Gujarat: cultivated.

Habitat: Generally grows on hilly areas

Habit: Perennial

Plant description:

Culm: Erect or geniculately ascending, slender, without nodal roots. Node and internode glabrous. Bearded node.

Leaf: Leaf blades linear or lanceolate, glabrous. Leaf sheaths wider than blade at the collar. Membranous ligule.

Inflorescence: Pancile open. Spikelet solitary. Fertile spikelets pedicelled. Spikelet comprising 1 sterile and 1 fertile florets. Spikelets oblong, dorsally compressed, obtuse, falling entire. Glumes dissimilar. Lower and

upper glume ovate, membranous, without keels, glabrous. Lemma of lower sterile floret similar to upper glume, ovate, membranous, without grooves, glabrous. Fertile lemma oblong, dorsally compressed, indurate, pallid, without keel, surface rugose, involute. Palea involute, indurate, rugose.

58. *Panicum miliaceum* (Fig.30(58))

Distribution: Europe: central, southwestern, southeastern, and eastern. Africa: north, Macaronesia, west-central tropical, southern tropical, and western Indian ocean. Asia-temperate: Siberia, Soviet far east, Soviet Middle Asia, Caucasus, western Asia, Arabia, China, Mongolia, and eastern Asia. Asia-tropical: India, Indo-China, and Malesia. Australasia. Pacific: northwestern and north-central. North America. South America.In India: throughout, In Gujarat: cultivated.

Habitat: Generally grows on hilly areas

Habit: Annual.

Plant description:

Culm: Erect or geniculately ascending, nodes and internodes glabrous, bearded node.

Leaf: Leaf blade glabrous, hispid. Leaf sheath hispid. Membranous ligule.

Inflorescence: Panicle contracted, obovate. Spikelet solitary. Fertile spikelets pedicelled. Spikelets comprising 1 sterile florets and 1 fertile florets. Spikelets elliptic, dorsally compressed, persistant. Glumes similar. Lower glume ovate, membranous, without keels. Lower glume acuminate. Upper glume ovate, membranous, without keels, acuminate. Basal sterile florets barren, with palea. Lemma of lower sterile floret similar to upper glume, ovate, membranous. Fertile lemma oblong, dorsally compressed, indurate, dark brown, shiny, without keel. Palea involute, indurate.

59. *Panicum trypheron* (Fig.31(59))

Distribution: Asia-temperate: China and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. In India: Southwards to Gangetic plains. In Gujarat: North to South Gujarat.

Habitat: In wet lands, in sandy waste land, near cultivated fields.

Habit: Annual

Plant description:

Culm: Erect or geniculately ascending, long, glabrous node.

Leaf: Leaf blades linear-lanceolate, surface hispid with tubercle based hairs. Leaf sheaths hairy margin. Hairy margin.

Inflorescence: Panicle open, ovate, effuse. Spikelet solitary, pedicelled. Fertile spikelets comprising 1 sterile and 1 fertile florets. Spikelets elliptic or oblong, dorsally compressed, acuminate, falling entire. Lower glume ovate, membranous. Upper glume lanceolate, membranous. Basal sterile florets barren, with palea. Lemma of lower sterile floret similar to upper

glume, ovate, membranous. Palea membranous, hyaline. Upper oblong, dorsally compressed, indurate, pallid. Palea involute, indurate. Lodicules 2.

60. ***Paspalidium flavidum*** **(Fig.31(60))**

Distribution: Africa: western Indian ocean. Asia-temperate: Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: northwestern. In India: throughout the plains. In Gujarat: throughout.

Habitat: Common in wet places.

Habit: Perennial

Plant description:

Culm: Erect or geniculately ascending.

Leaf: Leaf blades long. Hairy ligule.

Inflorescence: Racemes 4-12. Spikelet packing abaxial, regular, 2 rowed, spreading, solitary. Fertile spikelets sessile, comprising 1 sterile and 1 fertile florets. Spikelts ovate, laterally compressed, gibbous, falling entire. Glumes similar, shorter than spikelet. Lower glume orbicular, membranous. Upper glume orbicular, cartilaginous. Lemma of lower sterile floret ovate, cartilaginous. Palea membranous, hyaline, toothed. Upper lemma ovate, laterally compressed, gibbous. Lodicules 2.

61. ***Paspalidium geminatum*** **(Fig.32(61))**

Distribution: Africa. Asia-temperate: western Asia and Arabia. Asia-tropical: India, Indo-China, and Malesia. North America: north-central USA, south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: cultivated throughout. In Gujarat: throughout.

Habitat: Water edges, river beds, seasonal water bodies.

Habit: Perennial

Plant description:

Culm: Prostrate, spongy, rooting from lower nodes.

Leaf: Leaf blades flat. Hairy ligule.

Inflorescence: Racemes unilateral. Spikelet packing abaxial, regular, 2-rowed, appressed, ovate, dorsally compressed, solitary or in pairs, sessile, falling entire. Fertile spikelets comprising 1 sterile and 1 fertile florets. Glumes dissimilar. Lower glume orbicular, membranous, pallid. Upper glume elliptic, membranous. Lemma of lower sterile floret similar to upper glume, elliptic, membranous. Palea membranous, hyaline, toothed. Upper lemma elliptic, indurate, shiny, granulose, unwrinkled or rugulose, involute margin. palea indurate. Lodicules 2.

62. ***Paspalum scrobiculatum*** **(Fig.32(62))**

Distribution: Africa. Asia-temperate: Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and

New Zealand. Pacific: southwestern, south-central, northwestern, and north-central. North America: northeast USA, south-central USA, and southeast USA. South America: Mesoamericana, Caribbean, northern South America, western South America, and Brazil. In India: throughout. In Gujarat: Cultivated generally.

Habitat: Water edges.

Habit: Annual.

Plant description:

Culm: Erect or geniculately ascending, rooting from lower nodes.

Leaf: Leaf blade base simple, filiform. Leaf sheaths mostly shorter than internode. Membranous ligule.

Inflorescence: Racemes 1-2, digitate, unilateral. Spikelet packing abaxial, regular, 2-rowed, solitary, pedicelled. Fertile spikelet comprising 1 sterile and 1 fertile florets, obovate or orbicular, dorsally compressed, falling entire. Lower glumes absent or obscure. Upper glume ovate, chartaceous, puberlous. Lemma of lower sterile floret similar to upper glume, ovate, chartaceous, glabrous, obtuse. Upper lemma elliptic or obovate, gibbous, indurate, dark brown, involute margin. palea involute, indurate. Lodicules 2.

63. *Pennisetum setosum*(Fig.33(63))

Distribution: Asia-temperate: Caucasus, China, and eastern Asia. Asia-tropical: India, Indo-China, and Malesia. Australasia: Australia and New Zealand. In India: throughout. In Guajrat: Kutch, North and South Guajrat.

Habitat: In Open waste lands and fallow fields.

Habit: Annual or perennial

Plant description:

Culm: Geniculately ascending.

Leaf: Leaf blades long. Ciliate membranous ligule.

Inflorescence: Panicle spiciform, linear. Spikelet subtended by and involucres, composed of bristles, with and outer whorl of thinner bristle. Fertile spikelets lanceolate, dorsally compressed, sessile or pedicelled, comprising 1 sterile and 1 fertile florets, falling entire. Lower glumes absent or obscure. Upper glume shorter than spikelet, ovate, membranous. Lemma of lower sterile floret lanceolate, chartaceous, acuminate. Palea lanceolate, membranous. Upper lemma lanceolate, coriaceous, flat margins, eciliate. Palea lanceolate, membranous, coriaceous. Lodicules absent.

64. *Setaria glauca* (Fig.33(64))

Distribution: Europe: eastern. Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India and Indo-China. Australasia: Australia. South America: Caribbean. In India: throughout. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Geniculately ascending. Glabrous node.

Leaf: Leaf blades filiform. Membranous ligule.

Inflorescence: Panicle spiciform, linear. Spikelets subtended by and involucres, composed of bristles, free throughout, persistant, few in one whorl, 6-8 in principal whorl, flexible, antrorsely scaberulous. Fertile spikelets ovate, dorsally compressed, gibbous, falling entire. Fertile spikelets comprising 1 sterile and 1 fertile florets. Flumes shorter than spikelet. Lower glume orbicular, membranous. Upper glume ovate, membranous. Lemma of lower sterile floret ovate, membranous. Palea membranous, toothed. Upper lemma ovate, dorsally compressed, gibbous, indurate, rugose, involute. Palea involute, indurate. Lodicules 2.

65. ***Setaria tomentosa*** **(Fig.34(65))**

Distribution: Africa: northeast tropical, east tropical, and western Indian ocean. Asia-temperate: Caucasus, Arabia, and China. Asia-tropical: India and Indo-China. In India: throughout. In Gujarat: throughout.

Habitat: In hedges, forest undergrowth.

Habit: Annual

Plant description:

Culm: Erect

Leaf:leaf blades sprading, plicate, flaccid. Membranous ligule.

Inflorescence: Panicle open, pyramidal. Spikelet subtended by and involucres, composed of bristles, persistant, flexible, glabrous. Fertile spikelets sessile, comprising 1 sterile and 1 fertile florets. Spikelts elliptic, slightly dorsally compressed, falling entire. Glumes reaching apex of florets. Lower glume orbicular, hyaline. Upper glume elliptic, membranous. Lemma of lower sterile floret elloptic, membranous, toothed. Upper lemma ovate, dorsally compressed, gibbous, indurate, rugose, margins involute. Palea involute, indurate, rugose. Lodicules 2.

66. ***Setaria verticillata*** **(Fig.34(66))**

Distribution: Europe: central, southwestern, southeastern, and eastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: Soviet Middle Asia, Caucasus, western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, and Malesia. Australasia. Pacific. America. Western South America, Brazil, and southern South America. In India: throughout. In Gujarat: throughout.

Habitat: In hedges and shady grounds

Habit: Annual

Plant description:

Culm: Decumbent.

Leaf: Leaf blades flaccid, pilose. Leaf sheaths outer margin hairy. Membranous ligule.

Inflorescence: Panicle spiciform, linear. Spikelets subtended by and involucres, involucres composed of bristles, persistant bristles, 1-4 in principal whorl. Fertile spikelets 1-3 in cluster, comprising 1 sterile and 1 florets. Spikelets elliptic, dorsally compressed, falling entire. Glumes reaching apex of florets. Lower glume ovate, hyaline. Upper glume ovate, membranous. Lemma of lower sterile floret ovate, membranous. Upper lemma ovate, dorsally compressed, gibbous, indurate, rugose, involute. Palea involute, indurate. Lodicules 2.

67. ***Isachne globosa*** **(Fig.35(67))**

Distribution: Asia-temperate: Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. Pacific: southwestern, south-central, and northwestern. In India: throughout hotter parts. In Guajrat: throughout.

Habitat: In wet and marshy habitats along the streams, moist grounds.

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent, rooting from lower nodes.

Leaf: Leaf blades linear or lanceolate, cartilaginous margins. Leaf sheath glabrous. Hairy ligule.

Inflorescence: Panicle open. Spikelets solitary, pedicelled, comprising 1 sterile and 1 fertile florets. Glumes deciduous, similar. Lower glume elliptic to orbicular, membranous, puberulous. Upper glume ovate, membranous, puberulous. Lemma of lower sterile floret elliptic to ovate, chartaceous, glabrous. Palea coriaceous, obtuse. Upper lemma orbicular. Palea coriaceous, obtuse. Lodicules 2.

68. ***Aristida adscensionis*** **(Fig.35(68))**

Distribution: Europe: southwestern and southeastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: Soviet Middle Asia, Caucasus, western Asia, Arabia, China, and Mongolia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Pacific: south-central and north-central. North America: northwest USA, north-central USA, southwest USA, south-central USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout the drier parts. In Gujarat: throughut.

Habitat: Common in all habitats

Habit: Annual or Perennial

Plant description:

Culm: Erect or geniculately ascending or decumbent. Internodes distally glabrous.

Leaf: Leaf blades flat or conduplicate. Hairy ligule

Inflorescence: Panicle open or contracted, elliptic. Spikelet solitary, fertile, pedicelled, comprising 1 fertile florets. Spikelets lanceolate, subterete, breaking up at maturity. Glumes persistent, similar, shorter than spikelet. Lower glume lanceolate,scariious. Upper glume lanceolate, scarious, 1 keeled. Upper lemma elliptic, laterally compressed, coriaceous, awned. Principal lemma awn, persistant. Lateral lemma awns, shorter than principal. Palea without keels.

69. *Aristida funiculata* (Fig.36(69))

Distribution: Africa: north, Macaronesia, west tropical, northeast tropical, and east tropical. Asia-temperate: western Asia and Arabia. Asia-tropical: India and Indo-China. In India: Peninsular and NW India. In Gujarat: throughout.

Habitat: Common on drier and rocky grounds and hills.

Habit: Annual

Plant description:

Culm: Long. Glabrous internodes.

Leaf: Leaf blades flat or conduplicate. Hairy ligule.

Inflorescence: Panicle open, linear. Spikelets solitary, fertile, pedicelled, comprising 1 fertile florets. Spikelets lanceolate, subterete, breaking up at maturity. Glumes persistant. Lower glume linear, membranous, 1 keeled. Upper glume linear, membranous, 1 keeled. Upper lemma elliptic, subterete, coraceous, without keel,scabrous, rough above, convolute margin, apex awned, 3 awned. Principal lemma awn 3 branched. Lateral lemma awns shorter than principal awn. Palea without keels.

70. *Perotis indica* (Fig.36(70))

Distribution: Africa: west tropical, west-central tropical, east tropical, and western Indian ocean. Asia-temperate: China and eastern Asia. Asia-tropical: India, Indo-China, and Malesia. Australasia: Australia. In India: throughout in planis. In Gujarat: North to South Gujarat.

Habitat: On dry sandy soil, weedy places.

Habit: Annual

Plant description:

Culm: Clums geniculately ascending.

Leaf: Leaf blades lanceolate or ovate. Membranous ligule.

Inflorescence: Racemes 1, single, multilateral. Spikelet packing crowded or contiguous, irregular. Spikelets ascending, soliatary, pedicelled,comprising 1 fertile florets. Spikelets linear, subterete, falling

entire. Glumes similar. Lower glume lanceolate, membranous, hispidulous, awned apex. Upper glume lanceolate, membranous, hispidulous, awned apex. Upper lemma lanceolate, hyaline. Palea hyaline. Lodicules 2.

71. *Chloris barbata* (Fig.37(71))

Distribution: Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, middle Atlantic ocean, and western Indian ocean. Asia-temperate: western Asia, Arabia, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. North America: Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout in plains. In Gujarat: throughout.

Habitat: Common in plains.

Habit: Perennial

Plant description:

Culm: Geniculately ascending, sparse branches.

Leaf: Leaf blades surface scaberulous, filiform. Leaf sheaths keeled. Memebranous ligule.

Inflorescence: Racemes 5-20, digitate, unilateral. Spikelet packing broadside to rachis, solitary, sessile, comprising 1 fertile florets, laterally compressed. Glumes persistent, similar. Lower glume lanceolate, membranous, 1 keeled. Upper glume lanceolate, membranous, 1 keeled, setaceously attenuate. Upper lemma obovate, laterally compressed, elliptic, cartilaginous, pallid, keeled, pubescent margin, awned. Apical sterile florets 2 in number, barren, oblong. Apical sterile lemmas glabrous awned, 1 per spikelet in number. Lodicules 2.

72. *Choris Montana* (Fig.37(72))

Distribution: Asia-tropical: India and Indo-China. In India: throughout in dry open area.

Habitat: Dry areas.

Habit: Perennial

Plant description:

Culm: Erect, long

Leaf: Leaf blade surface smooth abaxially and rough adaxially. Membranous ligule.

Inflorescence: Racemes 2-5, digitate, erect, unilateral. Spikelet packing broadside to rhachis, regular. Spikelet solitary, fertile spikelets sessile. Spikelets comprising 1 fertile florets, cuneate, laterally compressed. Glumes persistent, similar. Lower glume lanceolate, membranous, 1 keeled. Upper glume lanceolate, membranous, 1 keeled, lateral veins absent. Fertile lemma elliptic, laterally compressed, cartilaginous, keeled, awned. Principal lemma

awn. Apical sterile florets 3 in number, barren, in a clump, cuneate. Apical sterile lemmas awned. Apical sterile lemma awn, 3 per spikelet in number. Lodicules 2.

73. *Chloris virgata* (Fig.38(73))

Distribution: Africa. Asia-temperate: Soviet far east, Soviet Middle Asia, Caucasus, western Asia, Arabia, China, Mongolia, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. North America: northwest USA, north-central USA, northeast USA, southwest USA, south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout hotter parts. In Gujarat: throughout.

Habitat: Common on grassy hills.

Habit: Annual.

Plant description:

Culm: Geniculately ascending or decumbent, rooting from lower nodes.

Leaf: Leaf blades attenuate apex. Leaf sheaths keeled. Membranous ligule.

Inflorescence: Racemes 4-12, digitate, spreading, unilateral. Spikelet packing broadside to rachis, solitary, sessile, comprising 1 fertile florets, laterally compressed. Glumes persistent. Lower glume lanceolate, membranous, 1 keeled. Upper glume lanceolate, membranous, 1 keeled, setaceously attenuate or awned. Upper lemma obovate, laterally compressed, elliptic, cartilaginous, pallid, keeled, pubescent margin, awned. Apical sterile florets 2 in number, barren, oblong. Apical sterile lemmas glabrous awned, awn subapical, 1 per spikelet in number. Lodicules 2.

74. *Cynodon dactylon* (Fig.38(74))

Distribution: Europe: northern, central, southwestern, southeastern, and eastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: Siberia, Soviet Middle Asia, Caucasus, western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. Pacific: southwestern, south-central, northwestern, and north-central. North America: western Canada, eastern Canada, northwest USA, north-central USA, northeast USA. South America: Mesoamericana, Caribbean, Brazil, and southern South America. Antarctic. In India: throughout. In Guajart: throughout.

Habitat: Common everywhere.

Habit: Perennial

Plant description:

Culm: Geniculately ascending.

Leaf: Leaf blades flat or conduplicate. Membranous ligule.

Inflorescence: Racemes 4-6, digitate, unilateral. Spikelet packing broadside to rachis, regular, 2-rowed, appressed, solitary, sessile, comprising 1 fertile florets, laterally compressed. Glumes deciduous, similar. Lower glume oblong, membranous, 1 keeled. Upper glume oblong, membrabous, 1 keeled, veined. Upper lemma ovate, laterally compressed, cartilaginous, keeled. Palea keels ciliolate. Lodicules 2.

75. *Melanocenchris jaequemontii* (Fig.39(75))

Distribution: Africa: northeast tropical. Asia-temperate: western Asia. Asia-tropical: India. In India: throughout in drier parts, In Gujarat: throughout.

Habitat: Common on rocky soil.

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent.

Leaf: Leaf blades filiform. Hairy ligule.

Inflorescence: Racemes 4-10, spreading, cuneate, unilateral, bearing gew fertile spikelets. Spikelets appressed, solitary, sessile. Apical sterile spikelets barren 2-4 in number, cuneate, dorsally compressed, falling entire. Fertile spikelets comprising 1 fertile florets. Glumes collateral, similar, shorter than spikelt. Lower glume linear, coriaceous, villous, 1 awned. Upper glume oblong, coriaceous, with hyaline margins, ciliolate margins, awned. Fertile lemma elliptic, membranous, keeled, apex 3 fid, awned. Pr Palea apex 2-fid. Principal lemma awn. Lateral lemma arising on apex of lobes, shorter than principal. Apical sterile florets 2-4 in number, dissimilar. First apical floret male, ovate, muticous. Apical sterile florets barren, cuneate. Apical sterile lemmas truncate. Lodicules 2.

76. *Oropetium villosulum* (Fig.39(76))

Distribution: Asia-tropical: India. In India: occasionally seen. In Gujarat: North Gujarat, rare.

Habitat: On rocky soil

Habit: Annual

Plant description:

Culm: Erect. Glabrous nodes.

Leaf: Leaf blade involute, surface pubescent. Membranous ligule.

Inflorescence: Racemes 1, smoothly terete, bilateral, deciduous as a whole. Spikelet packing adaxial, regular, 2 rowed, sunken, solitary. Fertile spikelets sessile. Spikelets comprising 1 fertile florets. Spikelets elliptic, dorsally compressed, breaking up at maturity. Glumes two or one the lower absent or obscure, deciduous, dissimilar. Lower glume orbicular, hyaline, without keels, lateral veins absent. Upper glume elliptic, coriaceous, with hyaline margins, without keels, lateral veins ribbed. Fertile lemma elliptic,

membranous, without keel, pilose surface, truncate apex. Palea hyaline, 2 veined, pilose surface.

77. *Schoenefeldia gracilis* (Fig.40(77))

Distribution: Africa: north, west tropical, west-central tropical, northeast tropical, and western Indian ocean. Asia-temperate: Arabia. Asia-tropical: India. In India: throughout. In Gujarat: North to central Gujarat, Saurashtra.

Habitat: In open dry sandy areas.

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent

Leaf: Leaf blade convolute, attenuate apex, filiform. Membranous ligule.

Inflorescence: Racemes 1-4, digitate, unilateral. Spikelet packing broadside to rachis, crowded, regular, 2 rowed. Spikelet solitary, fertile spikelets sessile. Spikelets comprising 1 fertile florets, cuneate, laterally compressed. Glumes persistent, similar. Lower glume lanceolate, membranous, 1 keeled, lateral vein absent, awned. Upper glume lanceolate, membranous, 1 keeled, lateral vein absent, awned. Fertile lemma elliptic, membranous, keeled, lateral veins close to margins, 2 fid, awned. Principal lemma awn from a sinus, flexuous. Palea hyaline, 2 veined.

78. *Tetrapogon tenellus* (Fig.40(78))

Distribution: Africa: northeast tropical, east tropical, southern tropical, and south. Asia-temperate: Arabia. Asia-tropical: India. In India: Peninsular and NW India. In Gujarat: North to South to Central Gujarat.

Habitat: In open dry areas

Habit: Perennial

Plant description:

Culm: Erect or geniculately ascending

Leaf: Leaf blades attenuate apex. Membranous ligule.

Inflorescence: Racemes single, ascending, unilateral. Spikelet packing broadside to rachis, regular, 2 rowed, ascending, solitary. Fertile spikelets sessile, comprising 3-4 fertile florets. Spikelets cuneate, laterally compressed. Glumes persistent, similar, shorter than spikelet. Lower glume lanceolate, membranous, 1 keeled, 1 veined. Upper glume lanceolate, membranous, 1 keeled, 1 veined. Upper glume lanceolate, coriaceous, keeled, 3 veined, awned. Palea 2 veined, keels ciliolate. Apical sterile florets 1-2 in number, barren in a clump, cuneate. Apical lemmas muticous awned. Lodicules 2.

79. *Tetrapogon villosus* (Fig.41(79))

Distribution: Africa: north, Macaronesia, west tropical, northeast tropical, and east tropical. Asia-temperate: Soviet Middle Asia, western Asia, and Arabia.

Asia-tropical: India. In India:throughout. In Gujarat: throughout except Kutch but not common.

Habitat: In open dry areas.

Habit: Perennial

Plant description:

Culm: Erect, black node

Leaf: Apex obtuse or acute. Membranous ligule.

Inflorescence: Racemes 2, paired, appressed back to back, unilateral. Spikelet packing broadside to rhachis, regular, 2 rowed. Spikelets ascending, solitary. Fertile spikelets sessile, comprising 1-3 fertile florets, cuneate, laterally compressed. Glumes persistent, dissimilar. Lower glume lanceolate, membranous, 1 keeled, lateral vein absent. Upper glume ovate, membranous, lateral veins absent. Fertile lemma ovate, coriaceous, keeled, ciliate midvein, awned. Principal lemma awn subapical. Palea 2 veined, keels ciliolate. Apical sterile florets 3 in number, barren, in a clump, cunete. Apical sterile lemmas awned.

80. ***Acrachne racemosa*** **(Fig.41(80))**

Distribution: Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, and south. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India and Indo-China. Australasia: Australia. South America: Caribbean. In India: throughout the plains. In Gujarat: throughout.

Habitat: Common in all habitats

Habit: Annual

Plant description:

Culm: Geniculately ascending

Leaf: Leaf blades glabrous sparsely hairy, cartilaginous margins, filiform. Membranous ligule.

Inflorescence: Racemes 3-25, in several whorls, unilateral. Spikelet packing broadside to rachis, appressed, in pairs, sessile. Apical sterile spikelets rudimentary, 1 in number. Fertile spikelets comprising 6-14 fertile florets, laterally compressed. Glumes deciduous, similar. Lower glume lanceolate, membranous, keeled, scabrous. Fertile florets recurved at tip. Upper lemma ovate, laterally compressed, ovate, membranous, keeled, scaberulous,awned. Principal lemma awn. Palea ovate, keels scabrous. Apical sterile florets resembling fertile though under developed. Lodicules 2.

81. ***Dactyloctenium aegyptium*** **(Fig.42(81))**

Distribution: Europe: southeastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-

central, northwestern, and north-central. North America: northwest USA, north-central USA, northeast USA, southwest USA, south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout. In Gujarat: throughout.

Habitat: In open plains, water edges, escape from gardens

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent, rooting from lower nodes.

Leaf: Leaf blades tuberculate ciliate. Membranous ligule.

Inflorescence: Racemes 3-9, digitate, spreading, unilateral. Spikelet packing broadside to rachis, crowded, regular, 2 rowed, solitary, sessile, comprising 3-4 fertile florets. Spikelets ovate, laterally compressed. Glumes persistent, dissimilar. Lower glume ovate, 1 keeled, 1 veined. Upper glume oblong, membranous, 1 keeled, awned. Upper lemmas gibbous, ovate, membranous, keeled. Palea keels narrowly winged. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

82. ***Dactyloctenium scindicus*** **(Fig.42(82))**

Distribution: Africa: north, northeast tropical, and east tropical. Asia-temperate: Arabia. Asia-tropical: India. In India: N. W. India. In Gujarat: South to Central Gujarat.

Habitat: Near sea coast, sandy soils.

Habit: Perennial

Plant description:

Culm: Decumbent

Leaf: Leaf blade flat or conduplicate. Membranous ligule.

Inflorescence: Racemes 3-6, digitate, incurved, unilateral. Spikelet packing broadside to rachis, crowded, regular, 2 rowed, solitary, sessile, comprising 2-3 fertile florets. Spikelets ovate, laterally compressed, breaking up at maturity. Glumes persistant, dissimilar. Lower glume ovate, 1 keeled. Upper glume oblong, membranous, 1 keeled, awned. Upper lemmas gibbous, ovate, membranous, keeled. Paleas 2 veined, keels narrowly winged. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

83. ***Desmostachya bipinnata*** **(Fig.43(83))**

Distribution: Africa: north, west tropical, and northeast tropical. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India, Indo-China, and Malesia. In India: throughout. In Gujarat: throughout

Habitat: Common in all habitats

Habit: Perennial

Plant description:

Culm: Erect

Leaf: Leaf blades convolute, coriaceous, stiff, glaucous, filiform, ribbed surface. Leaf sheaths as wide as blade at the collar, smooth. Membranous ligule.

Inflorescence: Racemes numerous, closely spaces in a multilateral false spike, spreading, solitary, sessile, 2 seriate, deflexed, comprising up to 30 fertile florets. Spikelets oblong, laterally compressed, falling entire. Glumes similar. Lower glume ovate, membranous, keeled, 1 veined. Upper glume ovate, membranous, keeled, lateral veins obscure. Palea oblong, 2 veined, keels scaberulous. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

84. ***Dinebra retroflexa*** **(Fig.43(84))**

Distribution: Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India, Indo-China, and Malesia. Australasia: Australia. In India: throughout. In Guajrat: throughout.

Habitat: Common in all habitats

Habit: Annual

Plant description:

Culm: Erect

Leaf: Leaf blades glabrous, acuminate. Membranous ligule.

Inflorescence: Racemes numerous, deflexed, spreading, linear, unilateral, bearing 2-20 fertile spikelets, simple. Spikelet packing broadside to rachis, appressed, solitaru, sessile, comprising 2-3 fertile florets. Spikelets laterally compressed. Glumes persistent, similar, recurved at apex. Lower glume elliptic, coriaceous, 1 keeled, caudate apex. Upper glume elliptic, coriaceous, 1 keeled, 1 veined, caudate apex. Upper lemma ovate, membranous, lightly keeled, pubescent margin. Palea 2 veined, keels pubescent. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

85. ***Eleusine indica*** **(Fig.44(85))**

Distribution: Europe: northern, southwestern, and southeastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: Soviet Middle Asia, Caucasus, western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. Pacific. North America and South America: In India: throughout. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent, slender.

Leaf: Leaves mostly basal. Leaf blades conduplicate. Leaf sheaths keeled, outer margin hairy. Membranous ligule.

Inflorescence: Racemes 1-12, digitate, unilateral. Spikelet packing broadside to rachis, 2 rowed, appressed, sessile, comprising 3-9 fertile florets. Spikelets elliptic, laterally compressed. Glumes persistent, similar. Lower glume lanceolate, membranous, 1-keeled, winged on keel. Upper glume elliptic, membranous, 1 keeled, winged on keel. Upper lemma lanceolate, membranous. Palea veined, apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

86. *Eragrostiella bachyphylla* (Fig.44(86))

Distribution: Asia-tropical: India, Bangladesh. In India: E. W. and S. India. In Gujarat: Saurashtra, North to South Guajrat.

Habitat: In Sandy-rocky soils.

Habit: Perennial

Plant description:

Culm: Erect, glabrous nodes.

Leaf: Leaf blades flat or conduplicate, coriaceous, glaucous, glabrous, cartilaginous, scabrous. Racemes 1, single, unilateral.

Inflorescence: Spikelets elliptic or oblong, laterally compressed. Glumes lower persistent, upper deciduous, similar. Lower glume lanceolate or ovate, membranous, 1 keeled, scaberulous. Upper glume oblong or ovate, membranous, 1 keeled, obtuse. Upper lemma ovate, dorsally straight along back, cartilaginous, pallid, keeled. Palea ovate, keels winged, ciliolate, glabrous. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

87. *Eragrostiella bifaria* (Fig.(87))

Distribution: Africa: northeast tropical and east tropical. Asia-tropical: India and Indo-China. Australasia: Australia. In India: throughout. In Gujarat: North to Central Gujarat.

Habitat: Open rocky areas.

Habit: Perennial

Plant description:

Culm: Erect

Leaf: Leaf blades filiform, convolute, pilose, regular, 2 rowed. Membranous ligule.

Inflorescence: Racemes 1, single, erect, unilateral. Spikelets ascending, solitary, fertile spikelets sessile. Spikelets comprising 9-50 fertile florets. Spikelets elliptic or oblong, straight or curved, laterally compressed. Glumes deciduous, similar. Lower glume lanceolate or ovate, cartilaginous, 1 keeled. Upper glume oblong or ovate, cartilaginous, without keels. Fertile florets imbricate to tip. Fertile lemma ovate, cartilaginous, keeled. Palea ovate keels winged, ciliolate. Apical steriles florets resembling fertile though underdeveloped. Lodicules 2.

88. *Eragrostis cilianensis* (Fig.45(88))

Distribution: Europe: central, southwestern, southeastern, and eastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: Soviet Middle Asia, Caucasus, western Asia, Arabia, China, Mongolia, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia and New Zealand. Pacific: southwestern and north-central. North America: western Canada, eastern Canada, northwest USA, north-central USA, northeast USA, southwest USA, south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout. In Gujarat: throughout.

Habitat: Along margins of water courses.

Habit: Annual

Plant description:

Culm: Erect or geniculately ascending.

Leaf: Leaf blades margins glandular. Hairy ligule.

Inflorescence: Panicle open or contracted, ovate, dense or loose. Spikelets solitary. Fertile spikelets pedicelled. Pedicels oblong, glandular. Spikelets comprising 5-60 fertile florets, oblong or ovate, laterally compressed. Glumes deciduous, similar. Lower glume ovate, eglandular, 1 keeled. Lower glume acute apex. Upper glume ovate, eglandular of glandular, 1 keeled. Fertile lemma ovate or orbicular, chartaceous, glandular on veins, keeled. Palea keels scabrous. Apical sterile florets resembling fertile though underdeveloped.

89. *Eragrostis ciliaris* (Fig.46(89))

Distribution: Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, and eastern Asia. Asia-tropical: India and Indo-China. Pacific: southwestern, northwestern, and north-central. North America: south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout plains. In Gujarat: thtoughout.

Habitat: Common in all habitats.

Habit: Annual.

Plant description:

Culm: Erect

Leaf: Leaf blades long.

Inflorescence: Panicle spiciform, linear or oblong, continuous or interrupted. Spikelets solitary, pedicelled, comprising 6-12 fertile florets, ovate, laterally compressed. Glumes deciduous, similar. Lower glume

lanceolate, 1 keeled. Upper glume lanceolate, 1 keeled, 1 veined. Upper lemma elliptic or oblong, membranous, keeled, 3 veined. Palea keels tuberculate ciliate. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

90. ***Eragrostis japonica*** **(Fig.46(90))**

Distribution: Europe: eastern. Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. North America: north-central USA, south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America.In India: throughout. In Gujarat: thtoughout.

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Erect

Leaf: Leaf blade filiform. Membranous ligule.

Inflorescence: Panicle open, linear or ovate. Spikelets solitary, pedicelled, comprising 6-12 fertile florets, oblong, laterally compressed. Glumes persistent, similar. Lower glume ovate, 1 keeled. Upper glume ovate, 1 keeled. Upper lemma ovate, membrnos keeled. Palea 2 veined, keels scaberulous. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

91. ***Eragrostis nutans*** **(Fig.47(91))**

Distribution: Asia-temperate: China and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. North America: southeast USA. In India: W. E. and S. India. In Gujarat: Central to South Gujarat.

Habitat: Common in sandy soils.

Habit: Perennial

Plant description:

Culm: Erect or geniculately ascending. Glabrous nodes.

Leaf: Leaf blades lsacberulous. Leaf sheaths oral hairs bearded. Hairy ligule.

Inflorescence: Panicle spiciform, lanceolate, scabrous. Spikelets solitary, pedicelled. Fertile spikelets comprising 10-20 fertile florets, linear, laterally compressed. Glumes deciduous, similar. Lower glume ovate, 1 keeled, 1 veined. Upper glume ovate, 1 keeled. Palea keels scaberulous, ciliolate. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

92. ***Eragrostis pilosa*** **(Fig.47(92))**

Distribution: Europe: central, southwestern, southeastern, and eastern. Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: Siberia, Soviet far east, Soviet Middle Asia, Caucasus, western Asia, Arabia, China, Mongolia, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. North America: northwest USA, north-central USA, northeast USA, southwest USA, south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout. In Gujarat: throughout.

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Erect or geniculately ascending

Leaf: Leaf blades filiform. Hairy ligule.

Inflorescence: Panicle open, eglandular. Spikelets solitary, pedicelled, comprising 4-14 fertile florets. Spikelets linear, laterally compressed. Glumes deciduous, dissimilar. Lower glume ovate, hyaline, without keels. Upper glume ovate, hyaline, 1 keeled. Upper lemma ovate, membranous, keeled. Palea keels scaberulous. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

93. ***Eragrostis tenella*** **(Fig.48(93))**

Distribution: Africa: north, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, middle Atlantic ocean, and western Indian ocean. Asia-temperate: western Asia, Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, south-central, northwestern, and north-central. North America: south-central USA, southeast USA, and Mexico. South America: Mesoamericana, Caribbean, northern South America, western South America, Brazil, and southern South America. In India: throughout. In Gujarat: throughut.

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent.

Leaf: Leaf blades filiform. Hairy ligule.

Inflorescence: Panicle open, linear or elliptic. Spikelets solitary, fertile spikelets pedecelled. Spikelets comprising 4-8 fertile florets, ovate or obovate, laterally compressed. Glumes deciduous, similar. Lower glume ovate, 1 keeled, lateral veins absent. Upper glume ovate, 1 keeled. Fertile lemma oblong or ovate, membranous, keeled, scaberulous. Palea keels ciliate. Apical sterile florets resembling fertile though underdeveloped.

94. ***Eragrostis tremula*** **(Fig.48(94))**

Distribution: Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, and southern tropical. Asia-temperate: western Asia and Arabia. Asia-tropical: India and Indo-China. In India: throughout. In Gujarat: throughout, common

Habitat: Common in all habitats.

Habit: Annual

Plant description:

Culm: Erect or geniculately ascending

Leaf: Leaf blades attenuate apex. Hairy ligule.

Inflorescence: Panicle open, ovate, effuse, braches flexuous, eglandular, bearded in axils. Spikelets solitary, pedicelled, comprising 20-60 fertile florets, linear, laterally compressed. Glumes persistent, similar. Lower glume ovate, membranous, 1 keeled. Upper glume ovate, membranous, 1 keeled. Upper lemma ovate, membranous, keeled, purple. Palea 2 veined, keels scabrous. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

95. *Eragrostis unioloides* (Fig.49(95))

Distribution: Africa: west tropical, west-central tropical, and western Indian ocean. Asia-temperate: Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. Pacific: southwestern, northwestern, and north-central. North America: southeast USA. South America: Mesoamericana, Caribbean, northern South America, and western South America. In India: throughout. In Gujarat: throughout.

Habitat: Common in all habitats

Habit: Annual

Plant description:

Culm: Geniculately ascending or decumbent, rooting from lower nodes.

Leaf: Leaf blades long. Hiary ligule.

Inflorescence: Panicle open, elliptic. Spikelets solitary, pedicelled, ovate, laterally compressed.glumes deciduous, similar. Lower glume lanceolate, 1 keeled. Upper glume ovate, keeled. Upper lemma ovate, membranous, keeled. Palea keels scaberulous. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

96. *Eragrostis viscosa* (Fig.49(96))

Distribution: Africa: west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, south, and middle Atlantic ocean. Asia-temperate: Arabia. Asia-tropical: India, Indo-China, and Malesia. North America: Mexico. South America: Mesoamericana, northern South America, and western South America. In India: throughout. In Gujarat: throughout, not common.

Habitat: Common in sandy soils

Habit: Annual

Plant description:

Culm: Erect

Leaf: Leaf blades and leaf sheaths viscid. Hairy ligule.

Inflorescence: Panicle open, oblong. Spikelets solitary, pedicelled, comprising 4-8 fertile florets, ovate or obovate, laterally compressed. Glumes deciduous, similar. Lower glume ovate, 1 keeled. Upper glume ovate, 1 keeled. Upper lemma ovate, membranous, keeled. Palea keels ciliate. Apical sterile florets resembling fertile though underdeveloped. Lodicules 2.

97. *Sporobolus coromandelianus* (Fig.50(97))

Distribution: Africa: northeast tropical, east tropical, southern tropical, south, and western Indian ocean. Asia-temperate: western Asia, Arabia, and China. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Australasia: Australia. In India: throughout in plains and In Gujarat: throughout, common

Habitat: In shady areas, moist soil, waste lands.

Habit: Annual

Plant description:

Culm: Geniculately ascending

Leaf: Leaf blades ciliate margins, hairy at base. Hairy ligule.

Inflorescence: Panicle open, ovate. Spikelets solitary, pedicelled, comprising 1 fertile florets, lanceolate, subterete. Glumes deciduous, dissimilar. Lower flume ovate, hyaline. Upper glume oblong, membranous,smooth. Upper lemma oblong, membranous, without keel, scaberulous. Palea keeled. Lodicules 2.

98. *Sporobolus diander*(Fig.50(98))

Distribution: Africa: Macaronesia, northeast tropical, and western Indian ocean. Asia-temperate: Arabia, China, and eastern Asia. Asia-tropical: India, Indo-China, Malesia, and Papuasia. Pacific: southwestern, south-central, northwestern, and north-central. South America: Mesoamericana. In India: throughout. In Gujarat: throughout.

Habitat: In open grass lands

Habit: Perennial

Plant description:

Culm: Erect

Leaf: Leaf blades convolute. Hairy ligule.

Inflorescence: Panicle open, lanceolate. Spikelets solitary, pedicelled. Fertile spikelets comprising 1 fertile florets, lanceolate, subterete. Glumes deciduous, similar. Lower glume oblong, 0 veined, obtuse apex. Upper glume oblong, hyaline, acute apex. Upper lemma ovate, membranous. Palea 2 veined. Lodicules 2.

99. *Sporobolus indicus* (Fig.51(99))

Distribution: Europe: southwestern and southeastern. Africa: Macaronesia and western Indian ocean. Pacific: southwestern and north-central. North America: southeast USA and Mexico. South America: Mesoamericana, Caribbean,

northern South America, western South America, Brazil, and southern South America. Antarctic: Subantarctic islands. In India: Maharashtra, south India, Madhyaparadesh. In Gujarat: Saurashtra, Panchmahal.

Habitat: Agricultural areas, coastland, shrublands, urban areas.

Habit: Perennial

Plant description:

Culm: Erect, lateral branches lacking.

Leaf: Basal and cauline. Ligule a fringe of hair. Leaf blades flat or involute, filiform.

Inflorescence: Panicle, contracted or spiciform. spikelets solitary, fertile spikelet pedicelled. Fertile spikelet comprising 1 fertile florets, disarticulation below each fertile floret. Glumes deciduous, shorter than spikelet. Lower glume ovate, membranous, without keels. Upper glume ovate, membranous, without keels, apex acute. Fertile lemma ovate, 1-veined, membranous, without keel. Palea 2-veined, keels approximate.

100.*Tragrus biflorus* (Fig.51(100))

Distribution: Europe: central, southwestern, southeastern, and eastern. Africa: north, Macaronesia, west tropical, west-central tropical, northeast tropical, east tropical, southern tropical, and south. Asia-temperate: Soviet Middle Asia, Caucasus, western Asia, Arabia, and China. North America: northeast USA, southwest USA, south-central USA, and southeast USA. South America: western South America and southern South America. In India: throughout in drier plains. In Gujarat: throughout, not common

Habitat: In open dry places

Habit: Annual

Plant description:

Culm: Prostrate

Leaf: Leaf blades tough. Hairy ligule.

Inflorescence: Racemes numerous, closely spaced, spreading, cuneate, bearing 2 fertile spikelets on each. Spikelets solitary, sessile. Apical sterile spikelets rudimentary. Fertile spikelets comprising 1 fertile floretrs. Spikelets lanceolate, dorsally compressed, falling entire, deciduous. Glumes dissimilar. Lower glume ovate, hyaline, veinless. Upper glume elliptic, membranous, surface with hooked spines. Upper lemma elliptic, dorsally compressed, membranous. Palea ovate, 2 veined. Lodicules 2.

Figs. 1 – 51 Represents the following parts mentioned

A: Habit

B: Inflorescence

C: Magnified view of Inflorescence

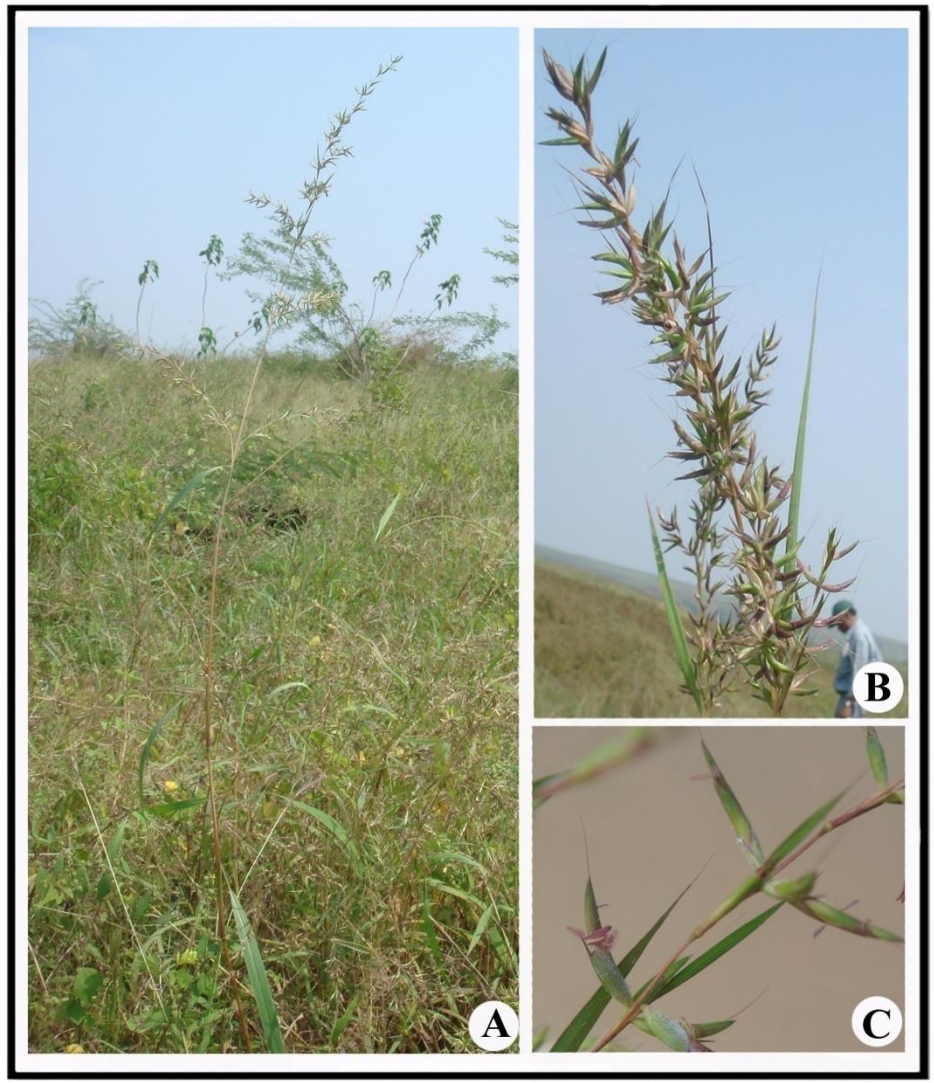
Fig. 1

1. *Chionachne koenigii*

Fig. 2

2. *Coix lachryma-jobi*

3. *Andropogon pumilus*



4. *Apluda mutica*

Fig. 3

5. *Arthraxon lanceolatus*

Fig. 4

6. *Bothriochloa pertusa*

7. *Capillipedium hugelii*

Fig. 5

8. *Chrysopogon fulvus*

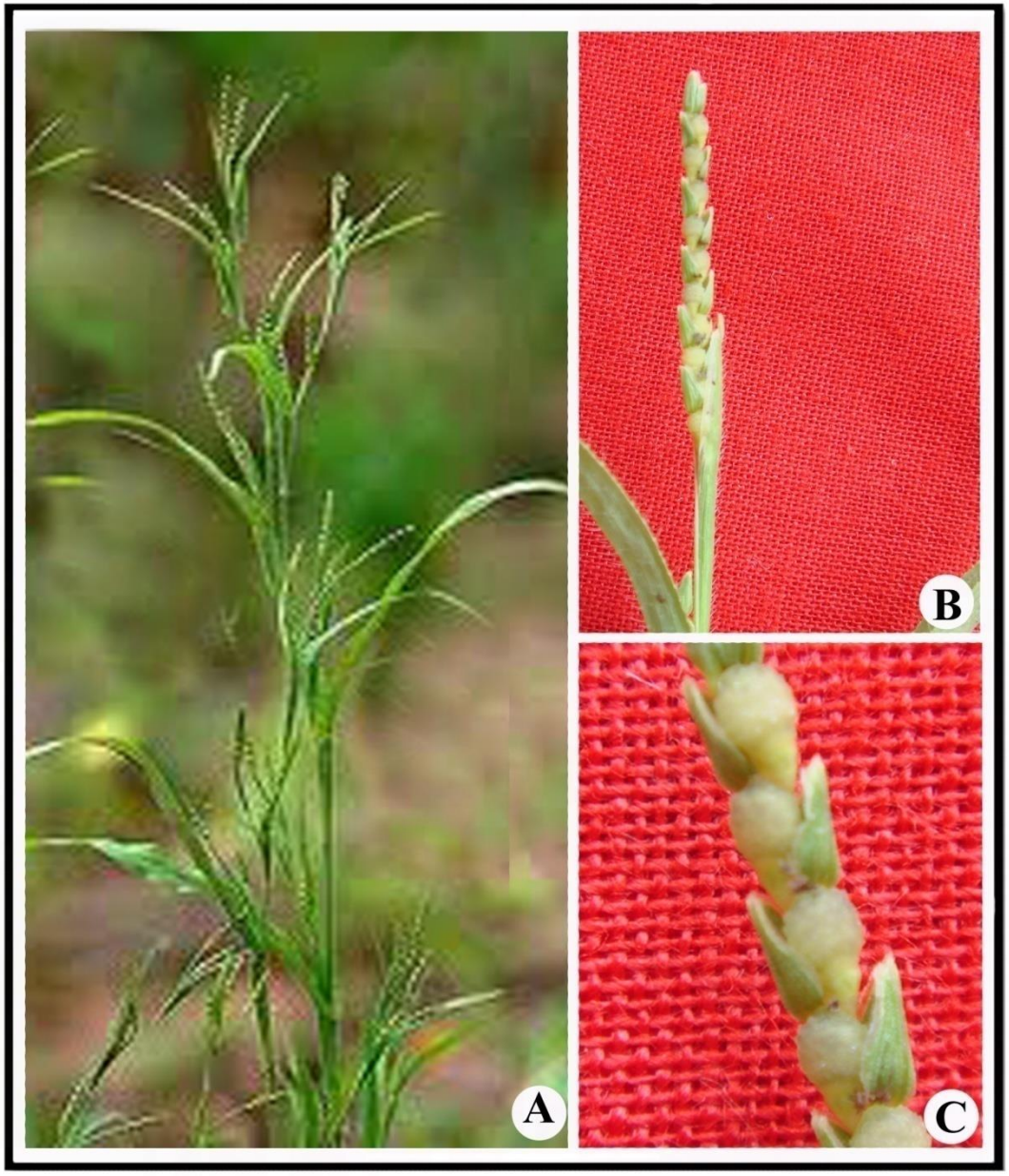
9. *Cymbopogon martinii*

Fig. 6

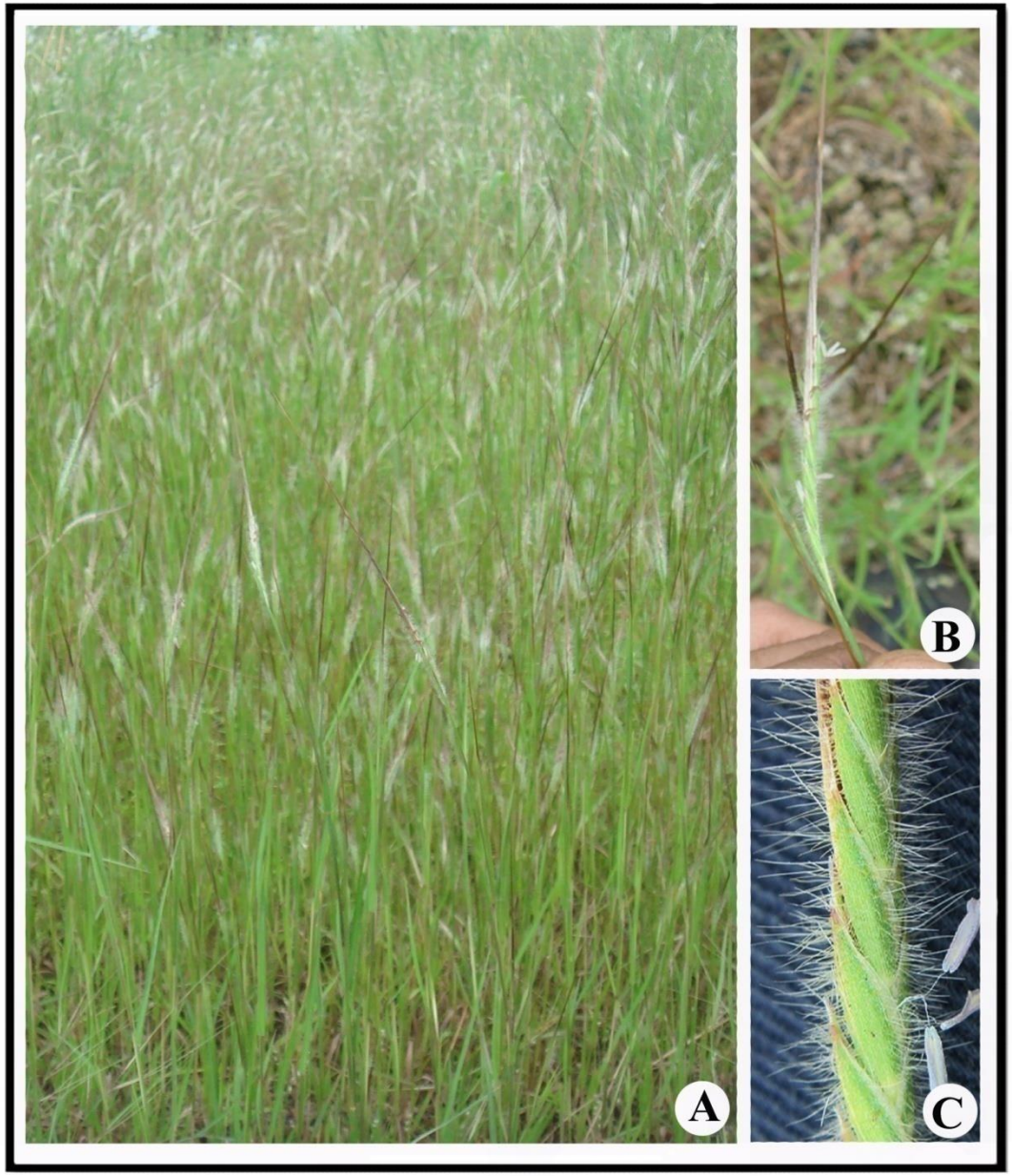
10. *Dicanthium annulatum*

11. ***Dicanthium caricosum***

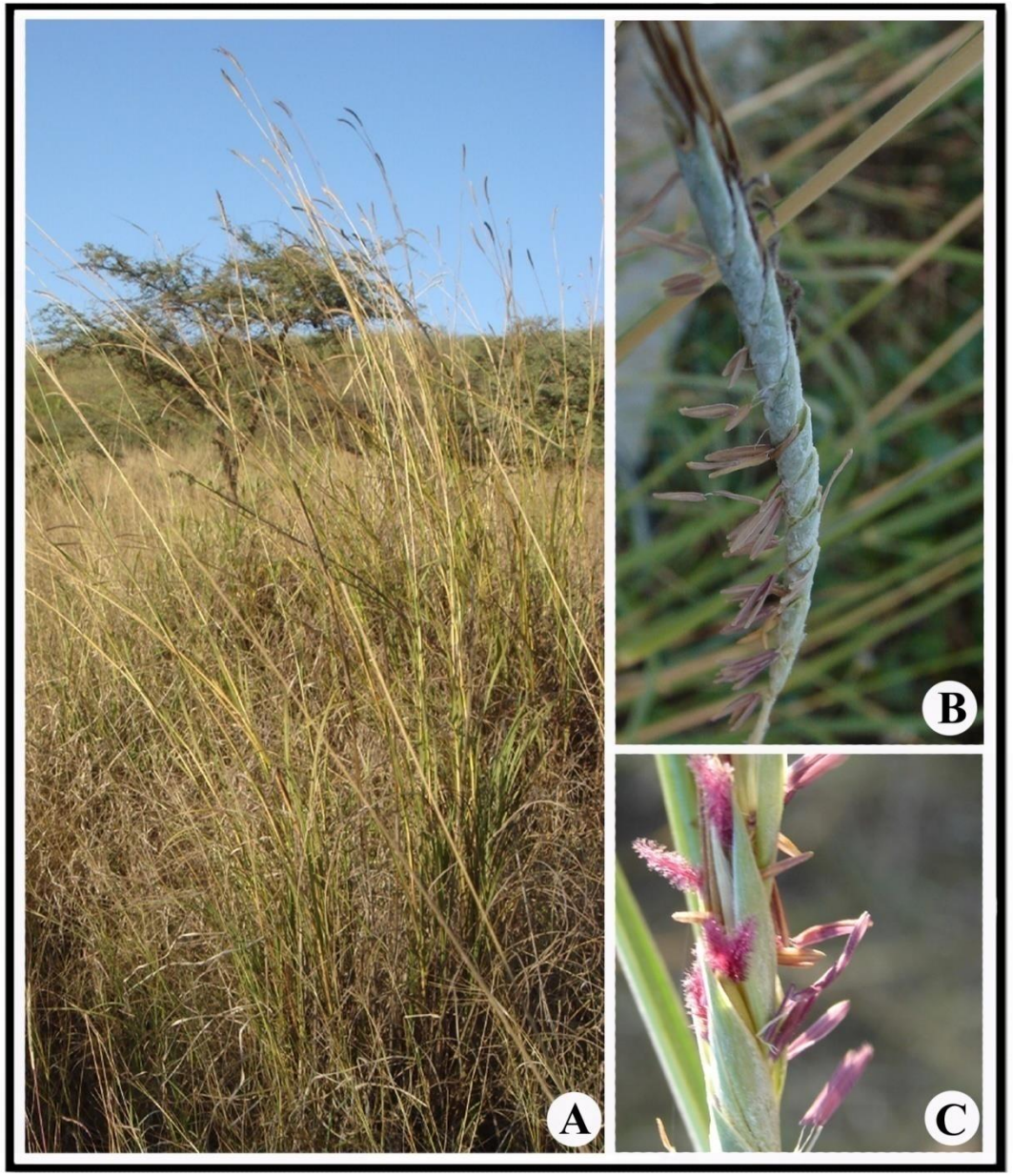
Fig. 7



12. ***Hackelochloa granularis***



13. *Heteropogon contortus var. genuinus sub var. typicus*Fig. 8 14. *Heteropogon contortus var. genuinus sub var. hispidissimus*



15. *Heteropogon ritchiei* **Fig. 9** 16. *Heteropogon triticeus*

17. *Imperata cylindrica* **Fig. 10** 18. *Ischaemum indicum*

19. *Ischaemum molle*

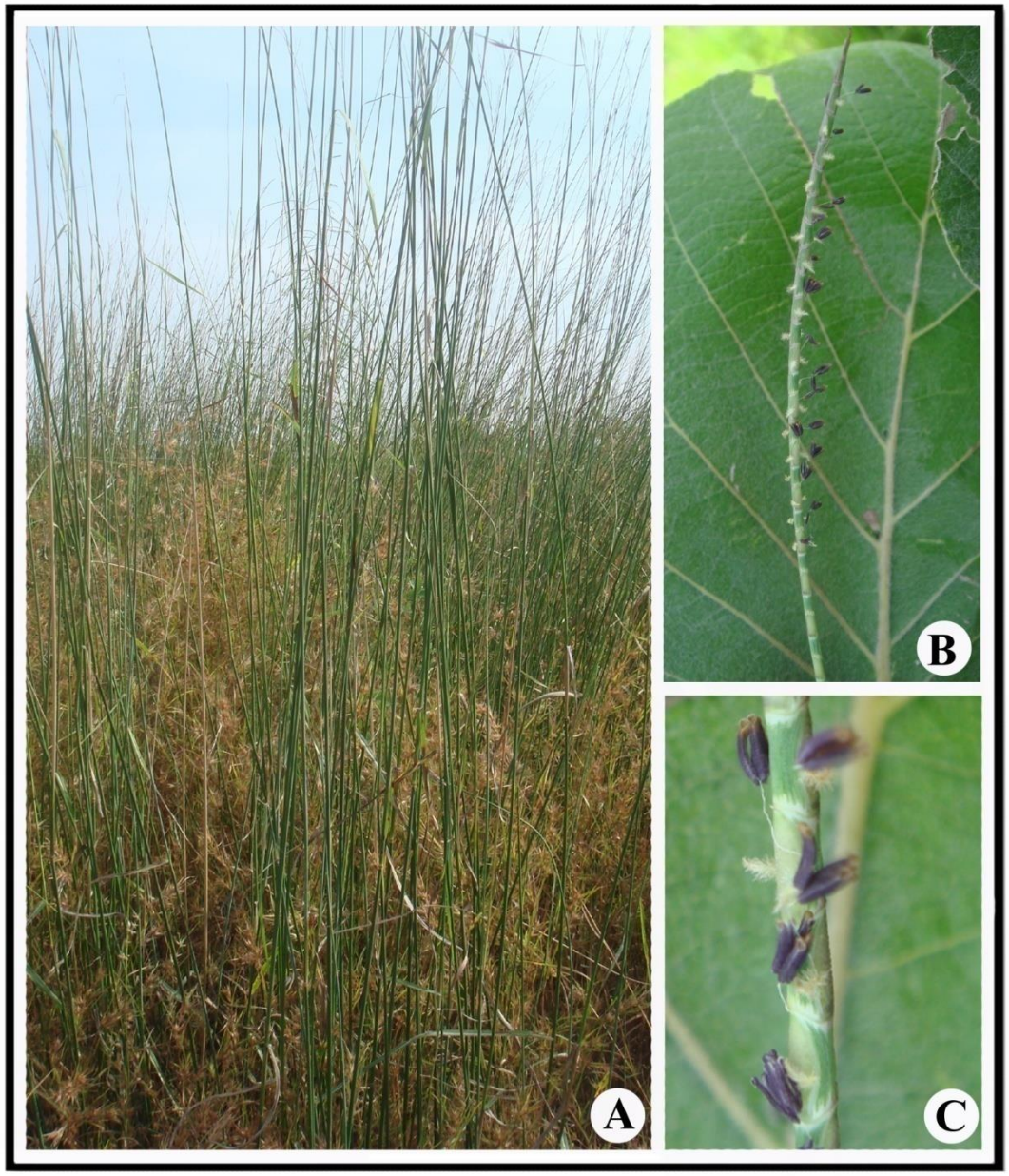
Fig. 11

20. *Ischaemum pilosum*

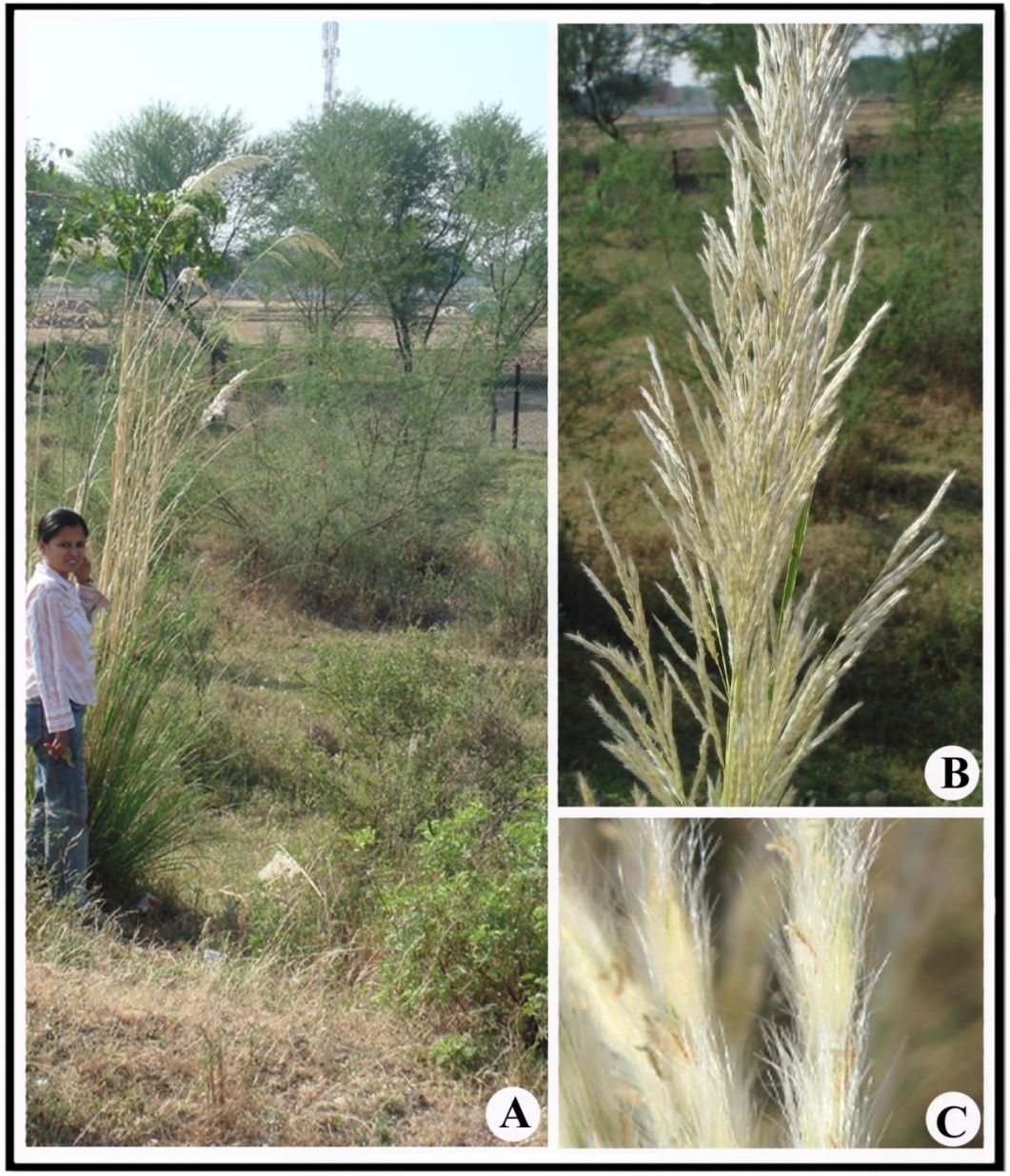
21. *Ischaemum rugosum*

Fig. 12

22. *Iseilema laxum*



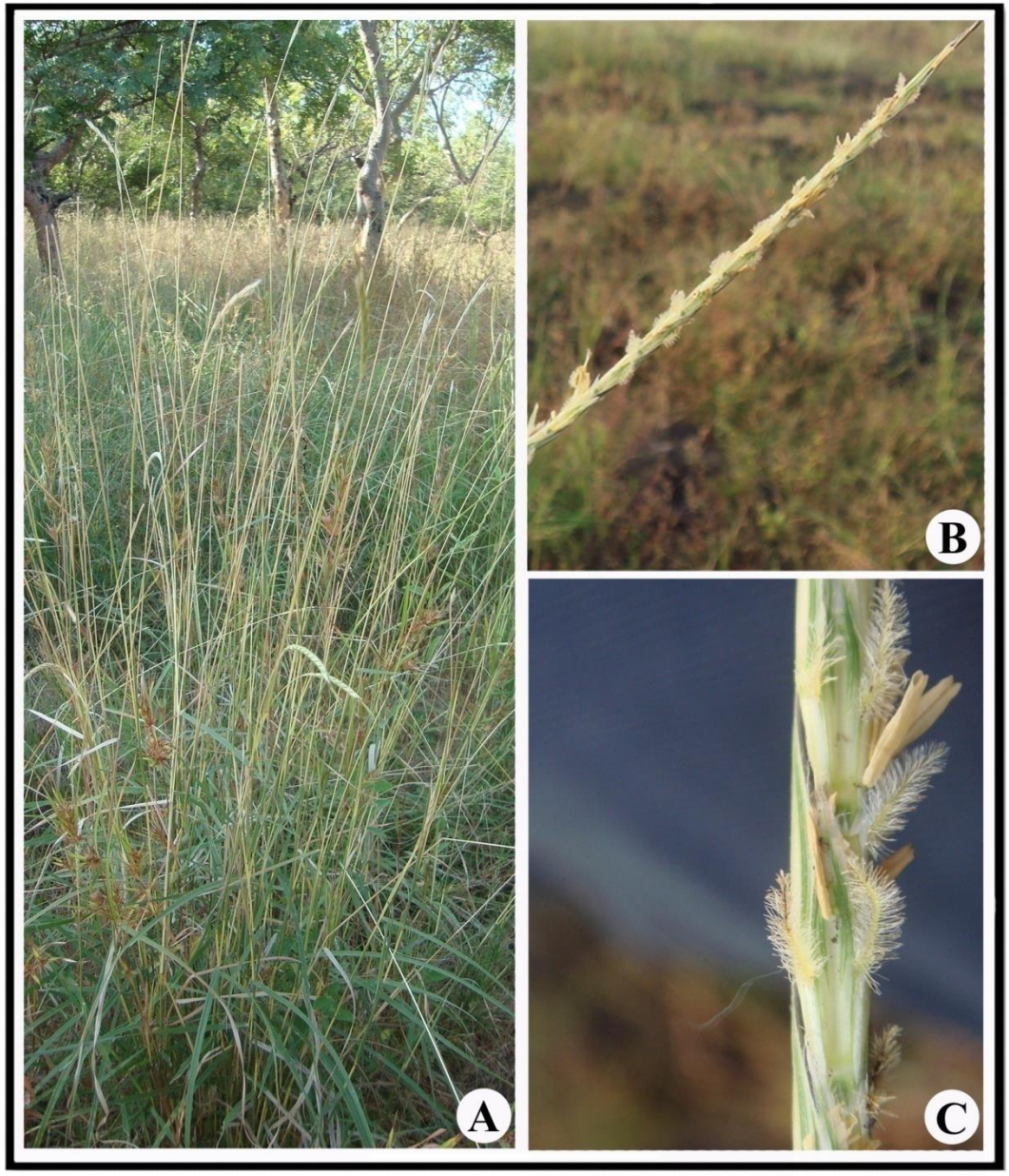
23. *Ophiuros exaltatus* **Fig. 13** **24. *Rottboellia exaltata***



25. *Saccharum spontaneum*

26. *Sehima ischaemoides*

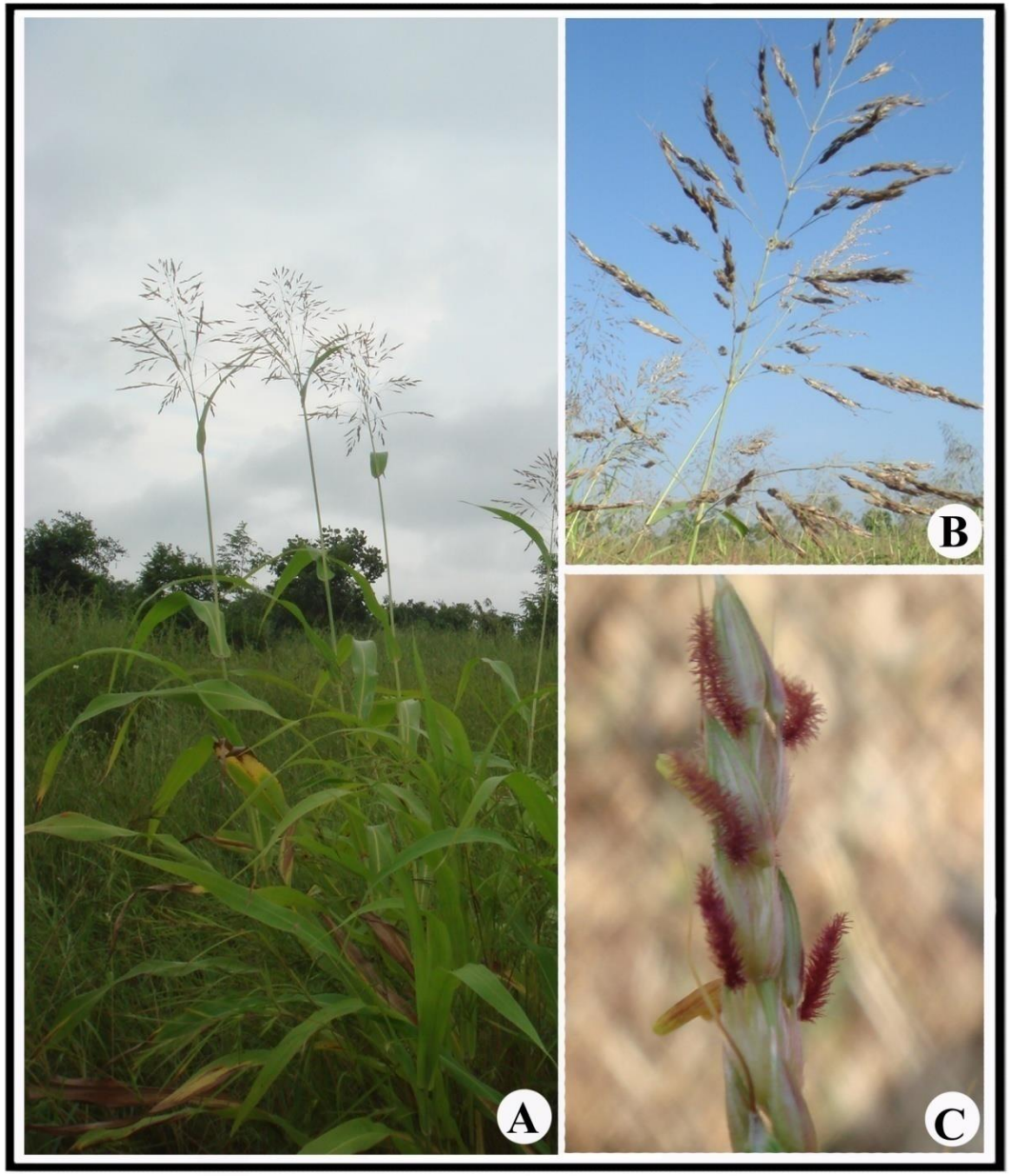
Fig. 14

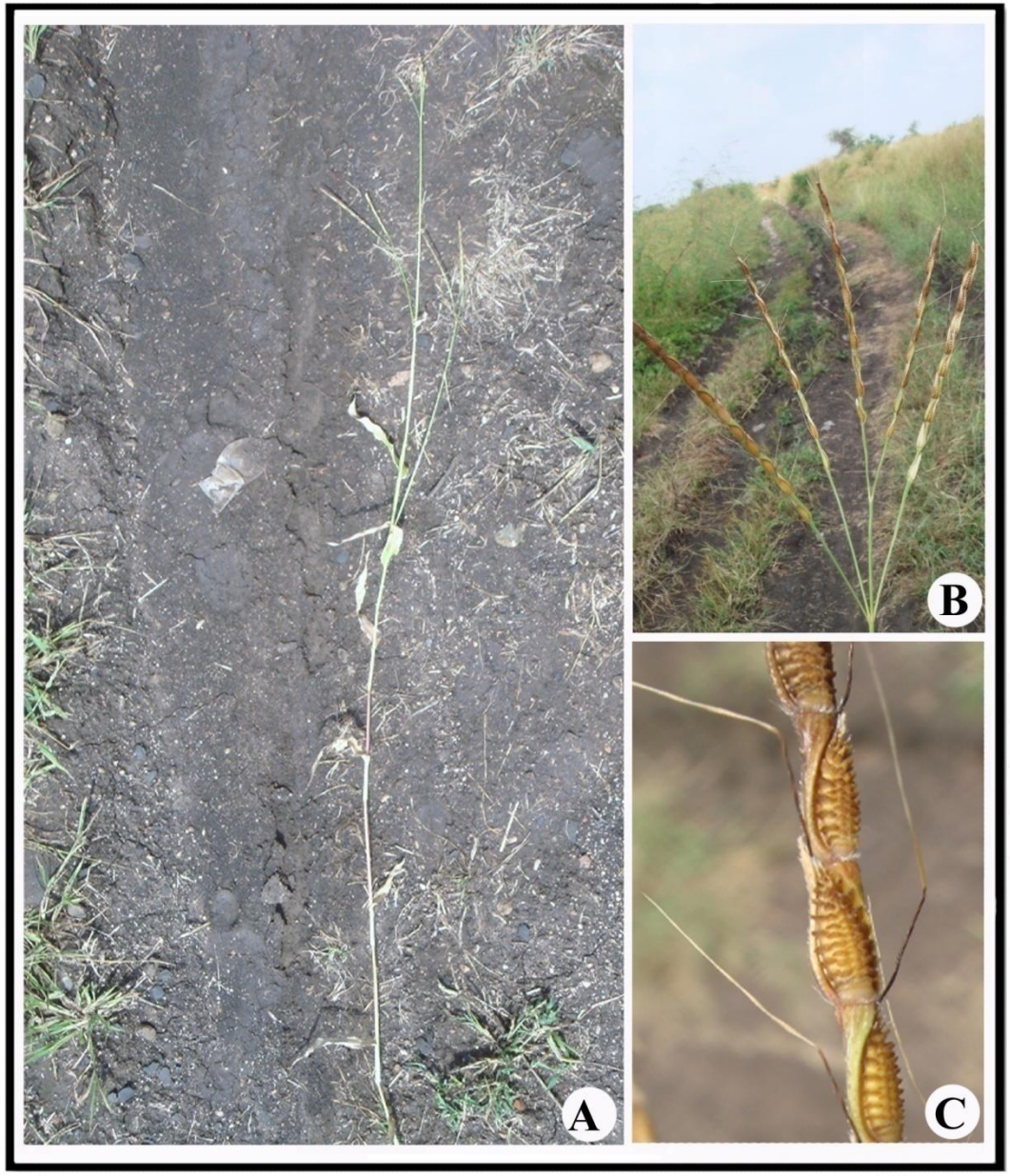


27. *Sehima nervosum*

Fig. 15

28. *Sehima sulcatum*





29. ***Sorghum halepense***

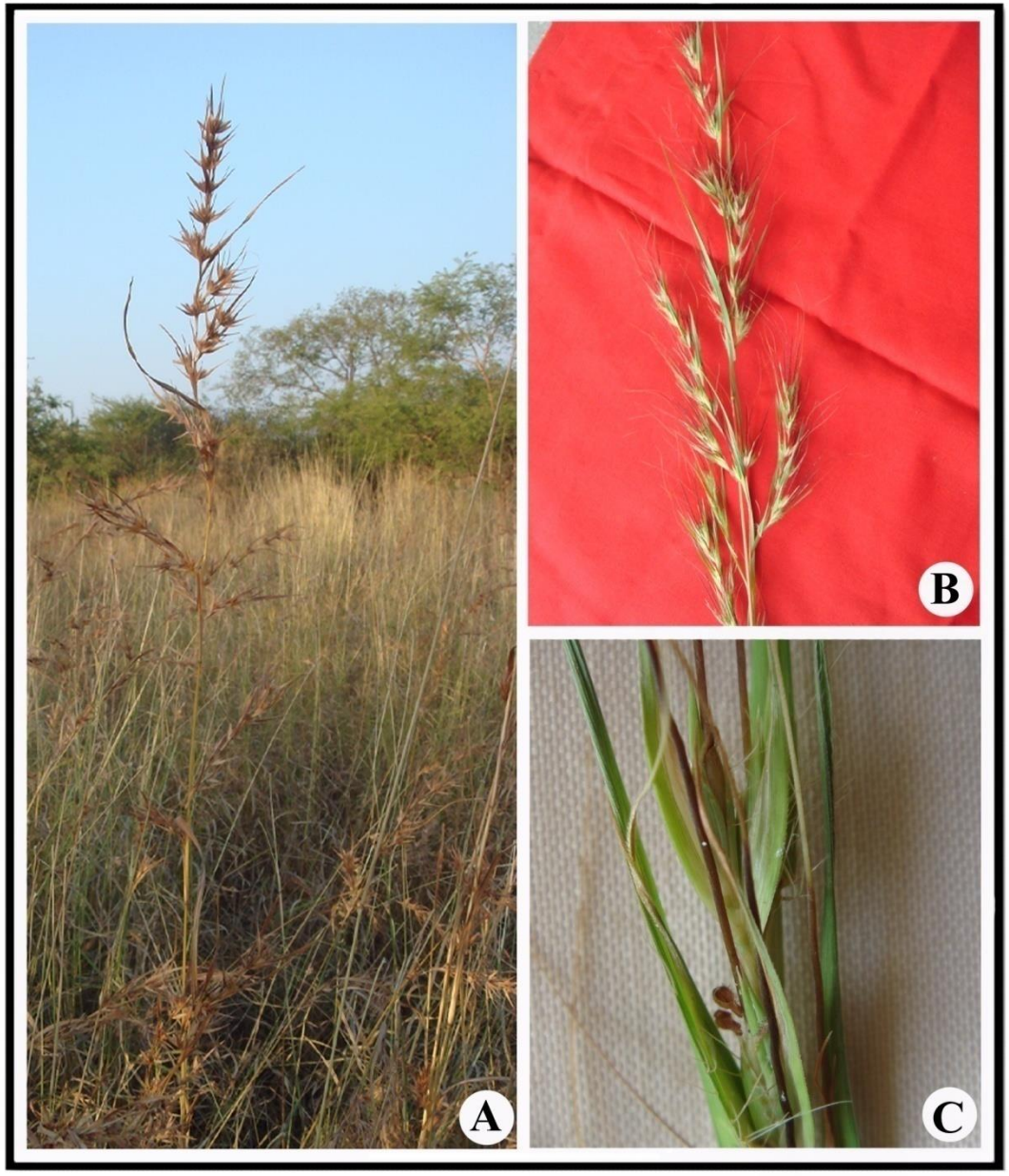
Fig. 16

30. ***Thelepogn elegans***

31. *Themeda cymbaria*

Fig. 17

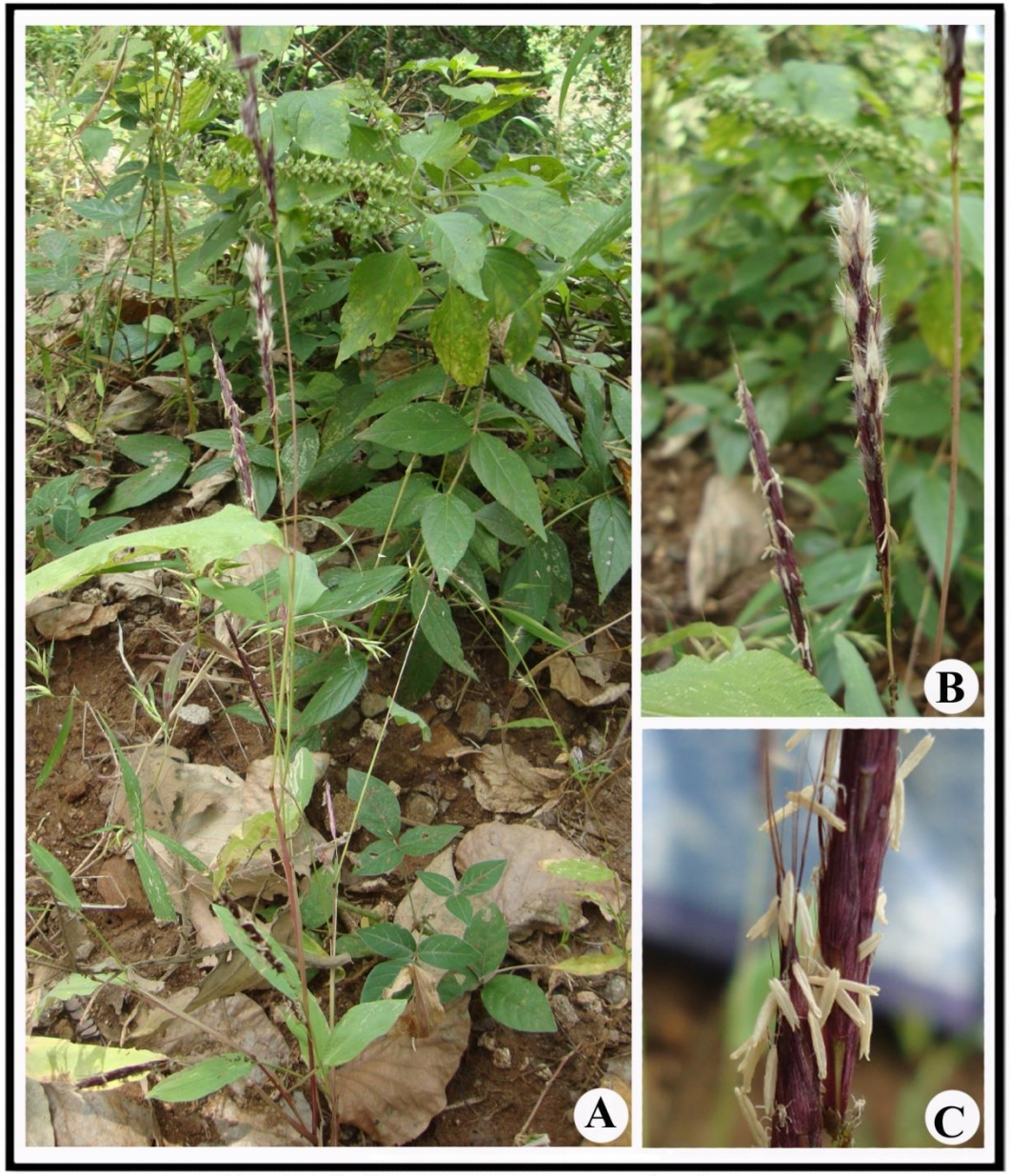
32. *Themeda laxa*



33. *Themeda triandra*

Fig. 18

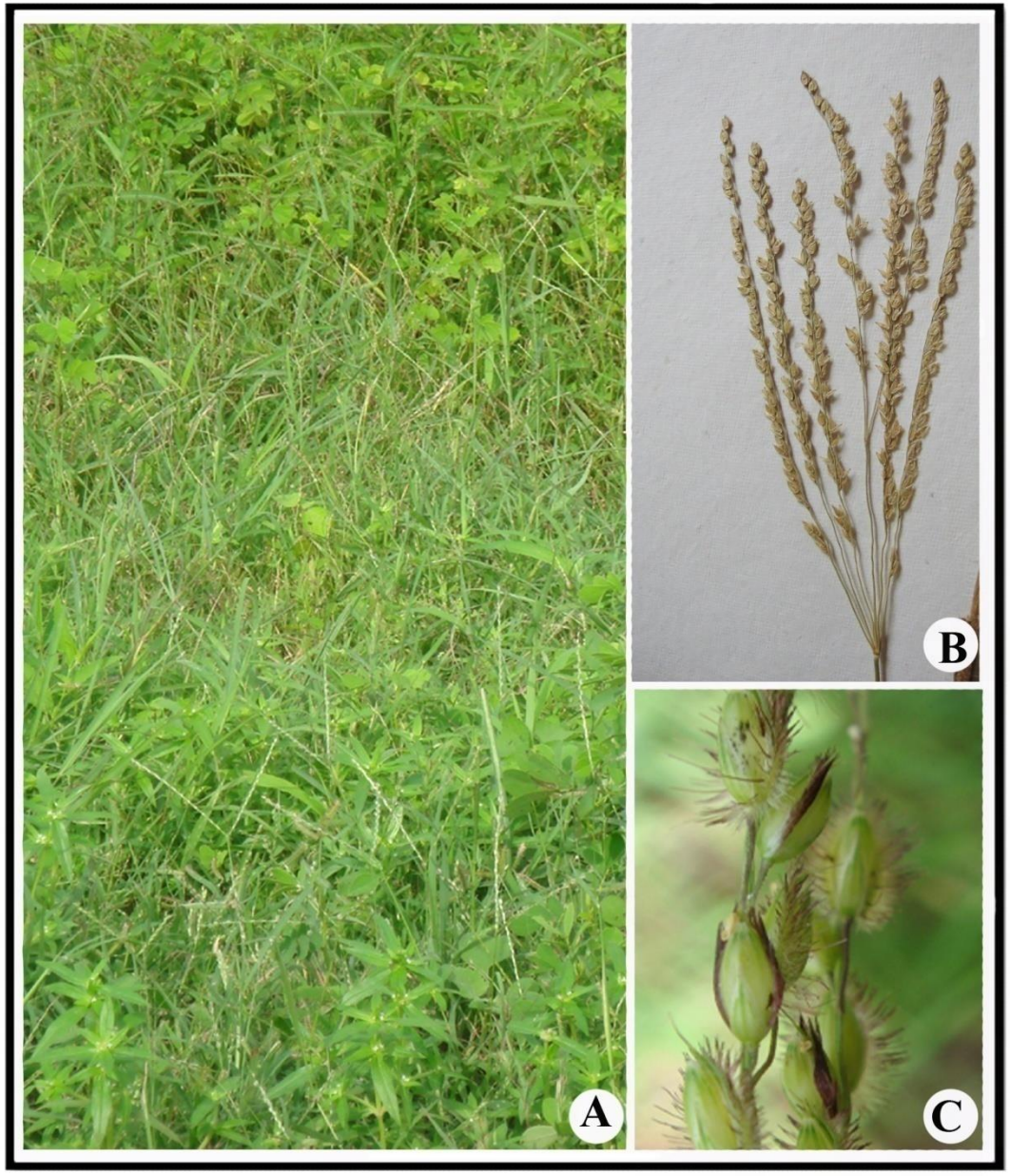
34. *Themeda quadrivalvis*



35. *Triplopogon ramosissimus*

36. *Vetivaria zizanioides*

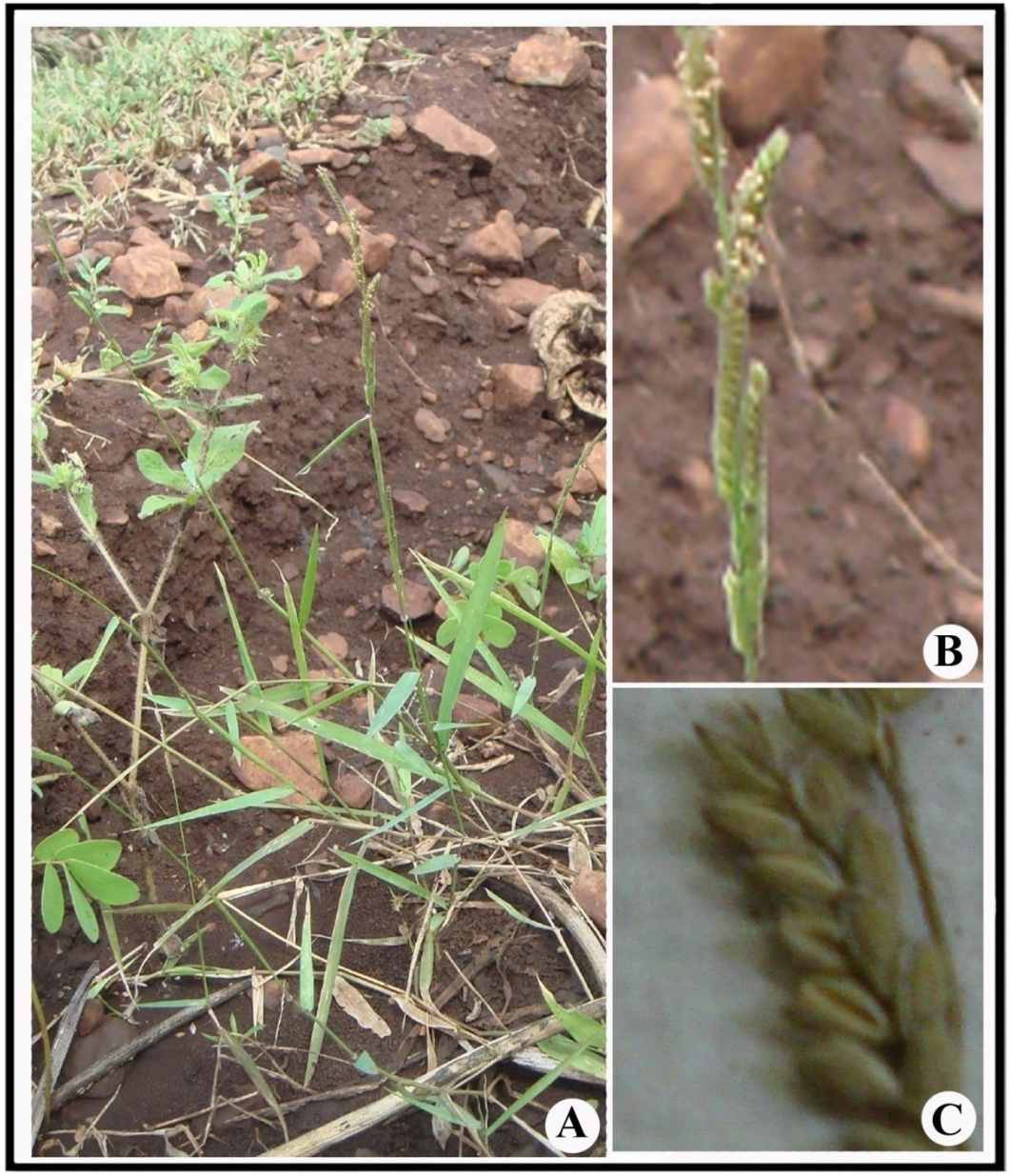
Fig. 19



37. *Alloteropsis cimicina*

Fig. 20

38. *Brachiaria distachya*



39. ***Brachiaria eruciformis***

Fig. 21

40. ***Brachiaria ramosa***

41. *Brachiaria reptans*

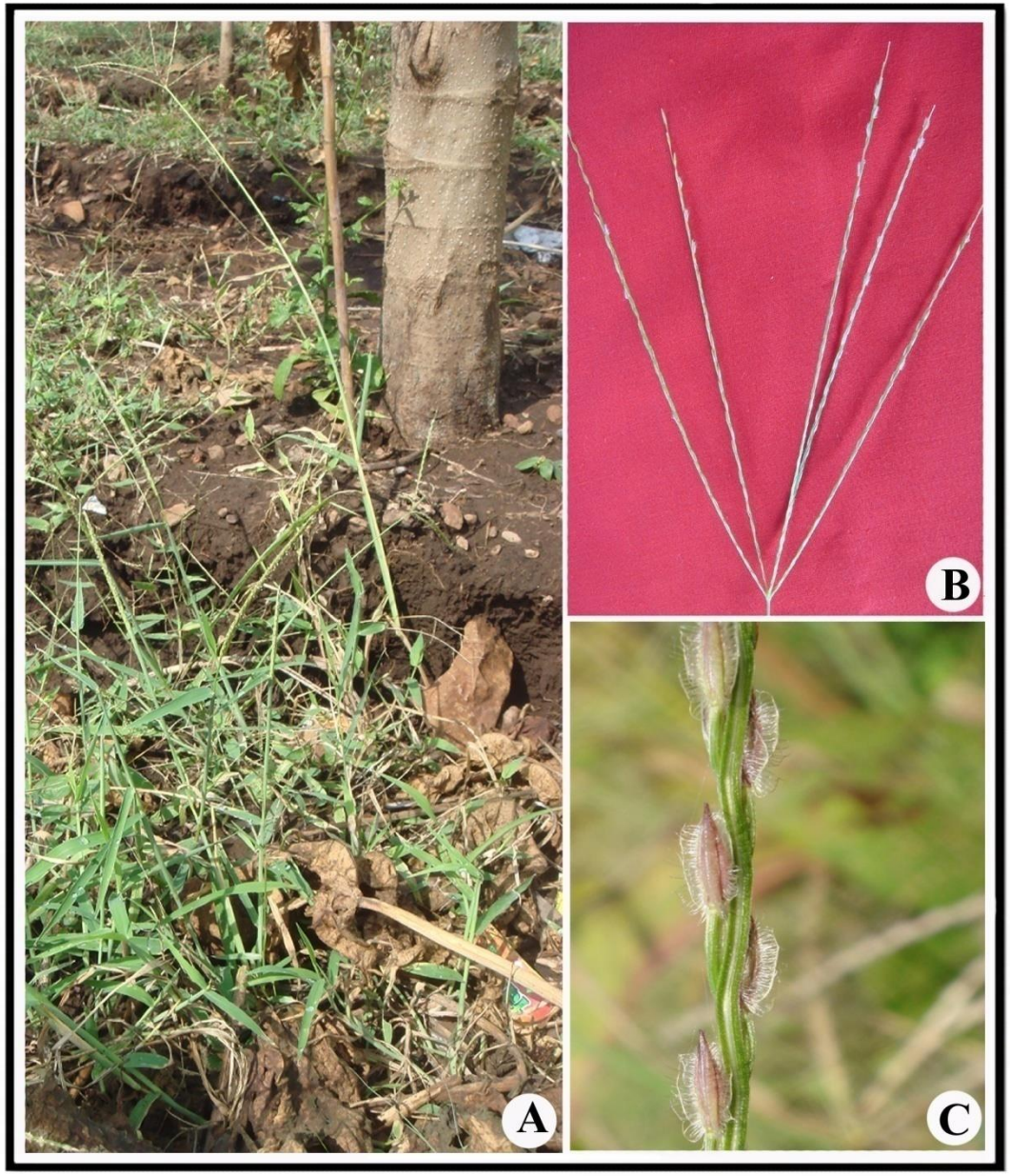
Fig. 22

42. *Cenchrus biflorus*

43. *Cenchrus ciliaris*

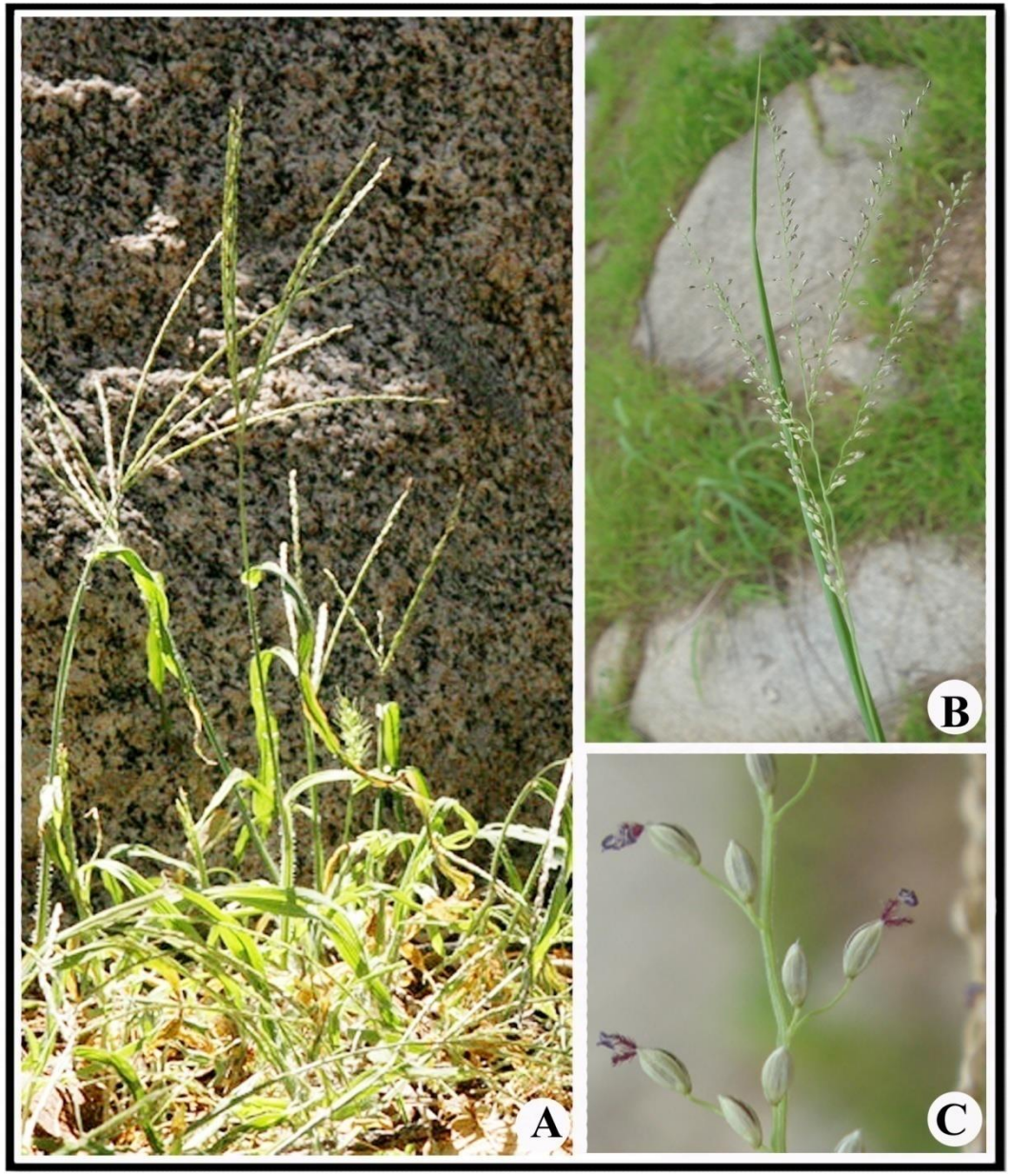
Fig. 23

44. *Cenchrus setigerus*



45. *Digitaria ciliaris*

Fig. 24



46. *Digitaria granularis*

47. *Digitaria longiflora*

Fig. 25

48. *Digitaria stricta*

49. *Echinochloa colona* **Fig. 26** **50. *Echinochloa crusgalli***

51. *Echinochloa stagnina*

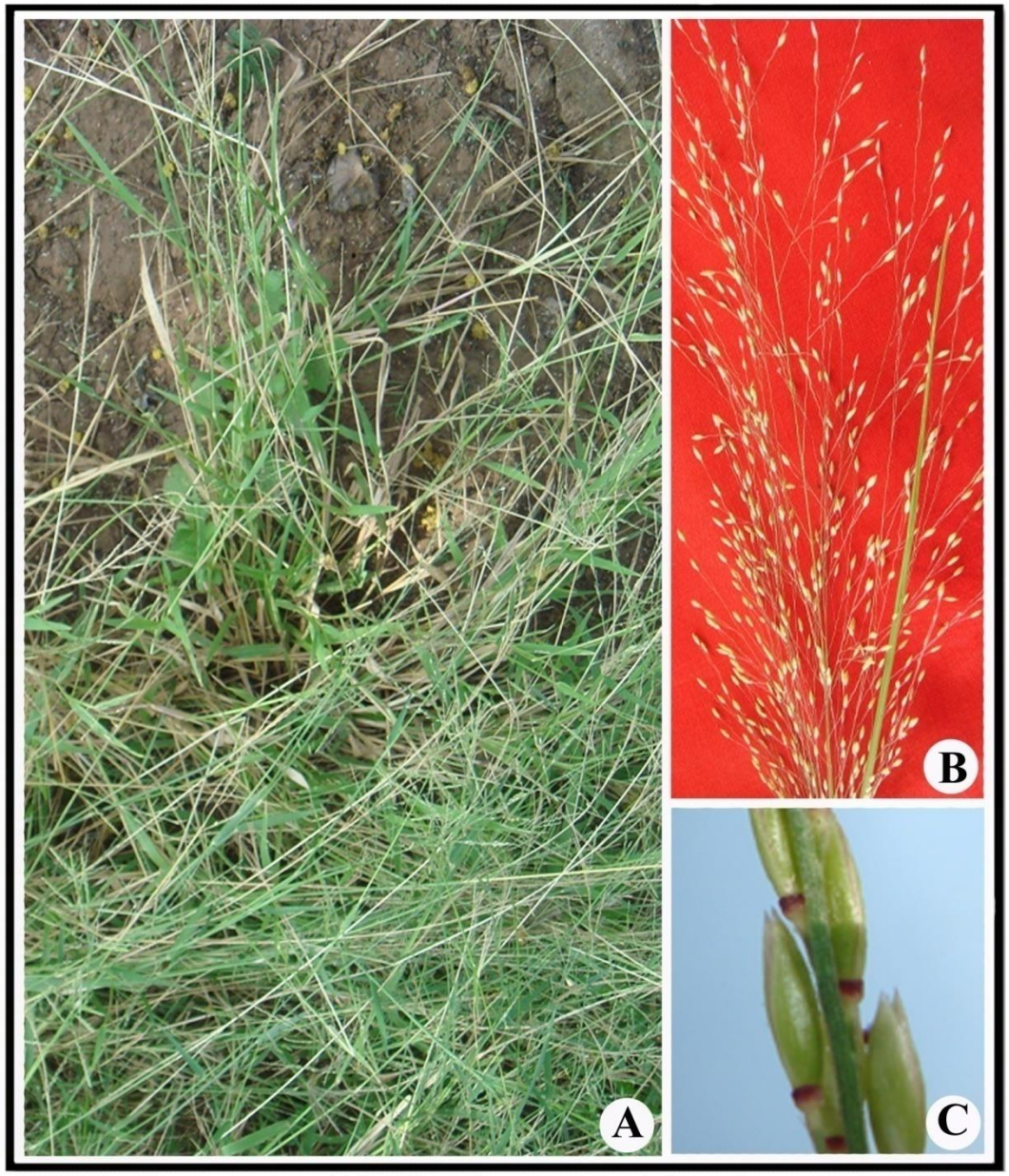
Fig. 27

52. *Eremopogon foveolatus*

53. *Eriochloa procera*

Fig. 28

54. *Oplismenus burmannii*



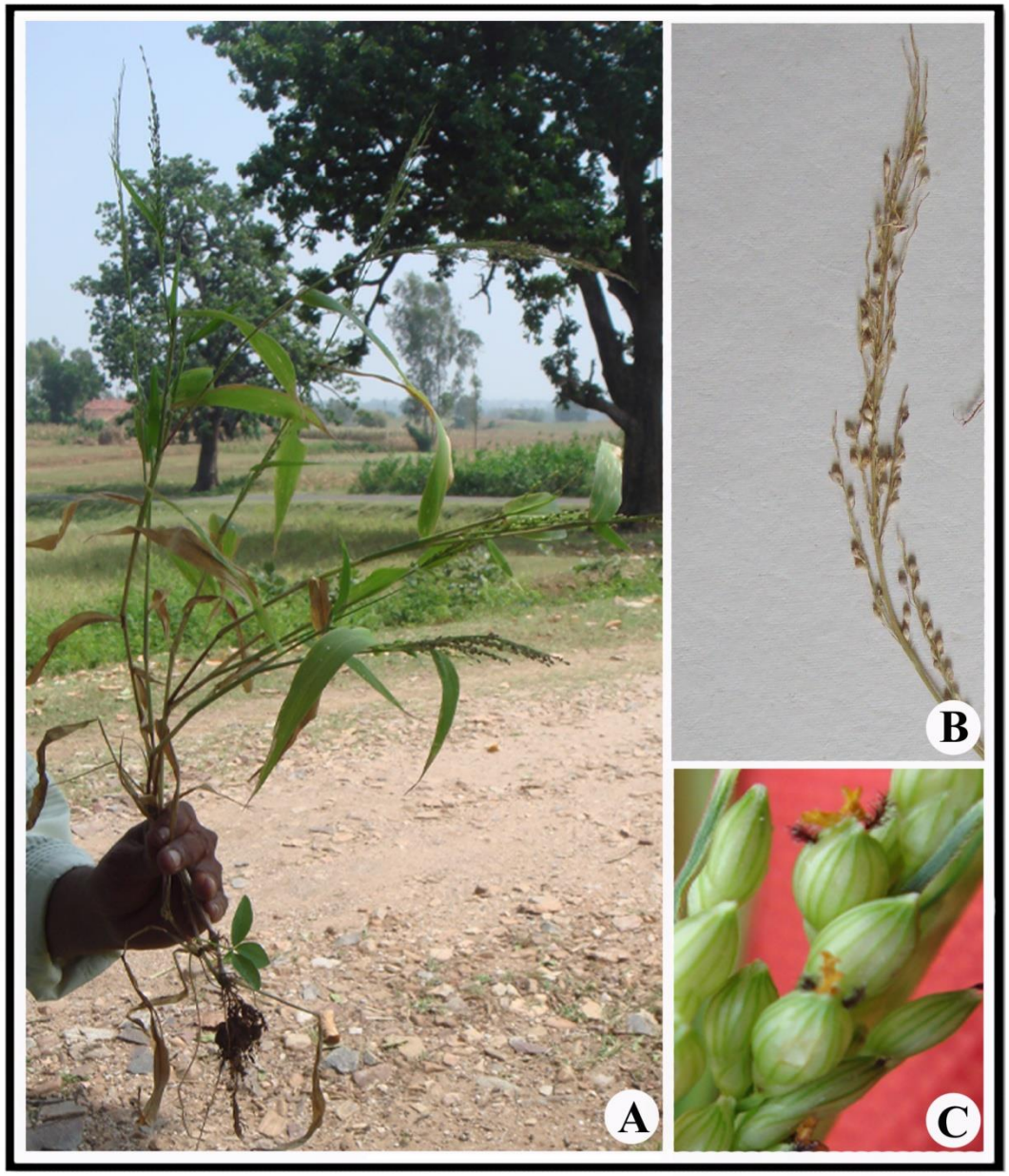
55. *Oplismenus composites*

Fig. 29

56. *Panicum antidotale*

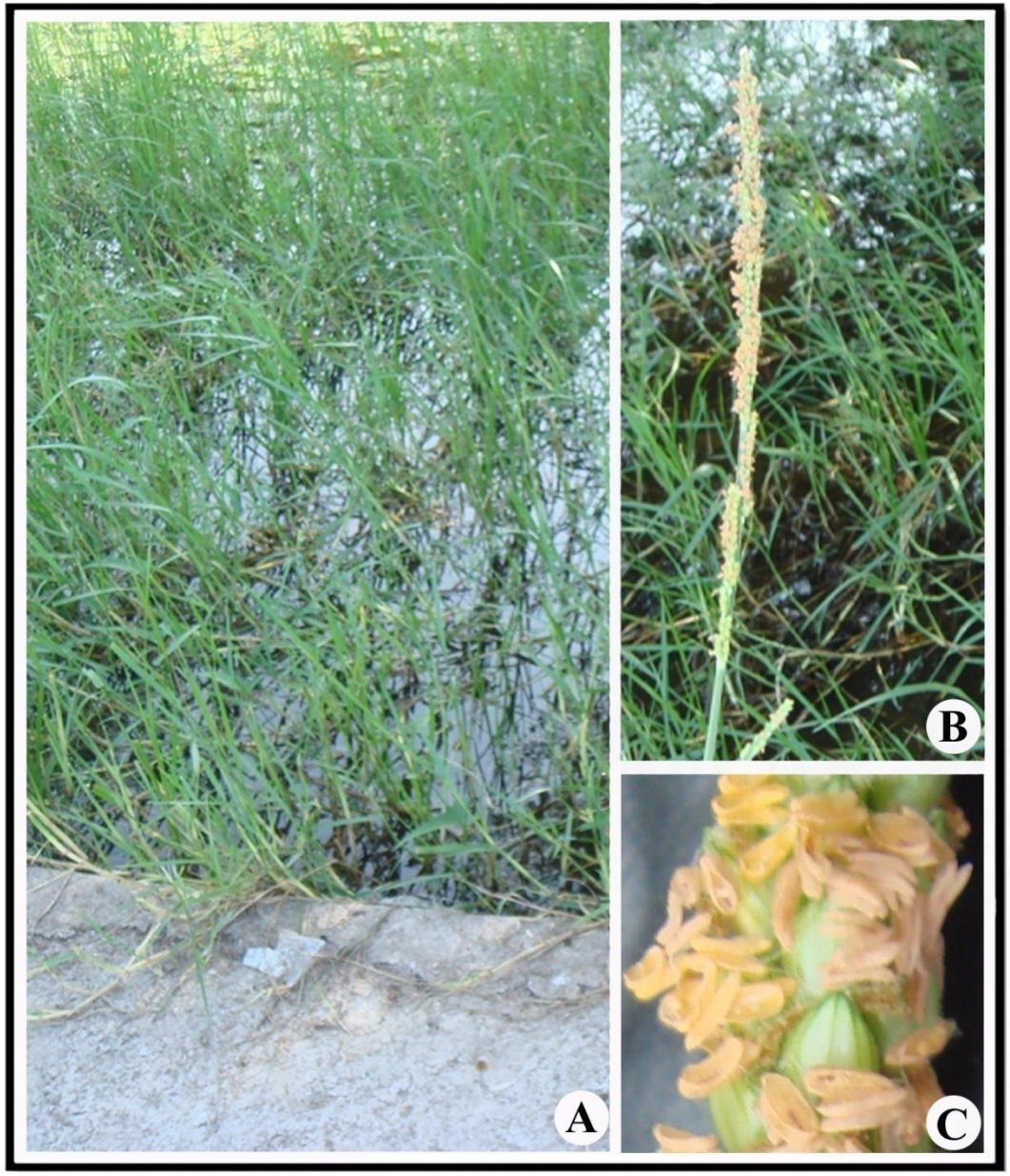
57. *Panicum maximum*

Fig. 30

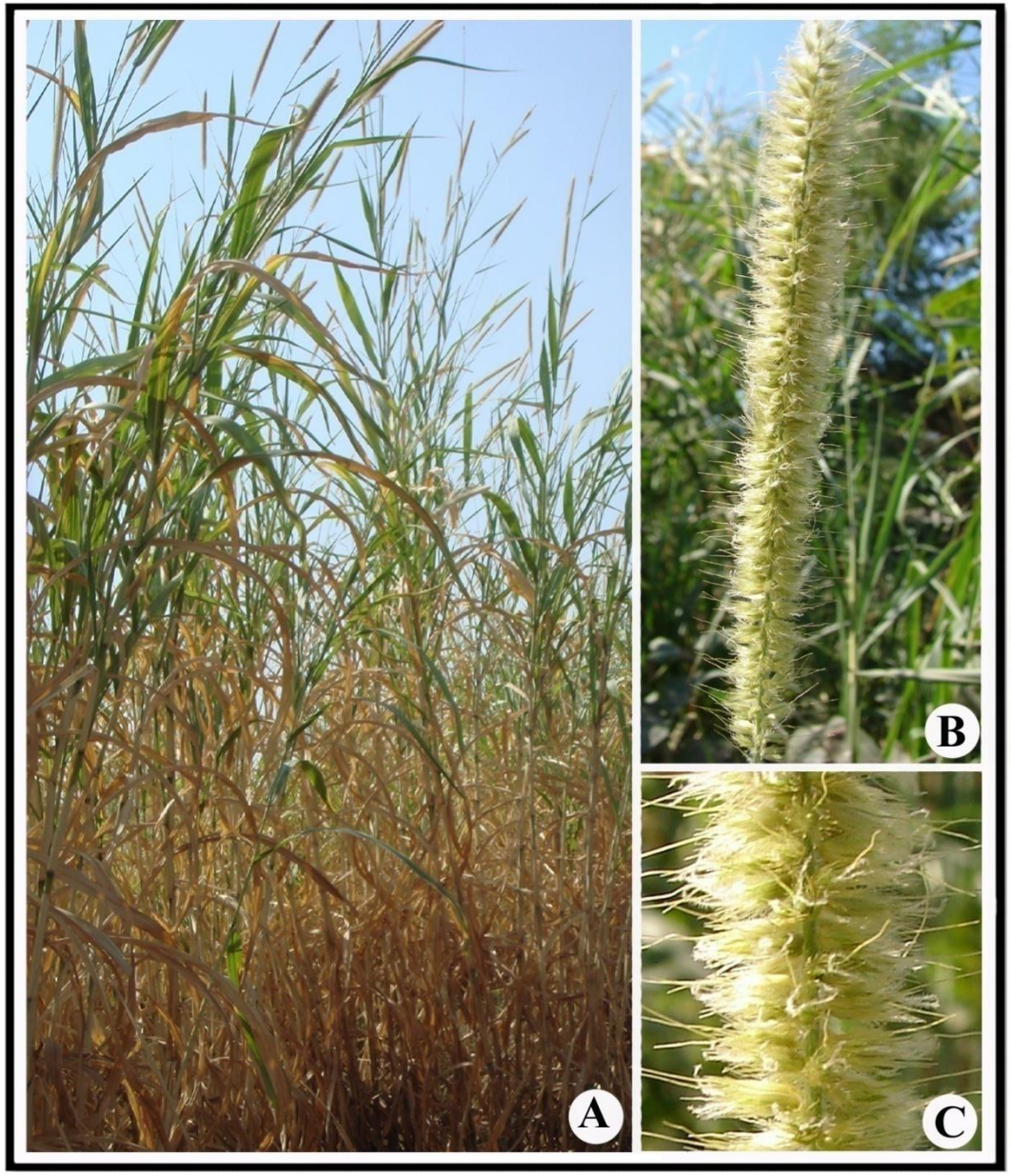


58. *Panicum miliaceum*

59. ***Panicum trypheron*** **Fig. 31** **60. *Paspalidium flavidum***

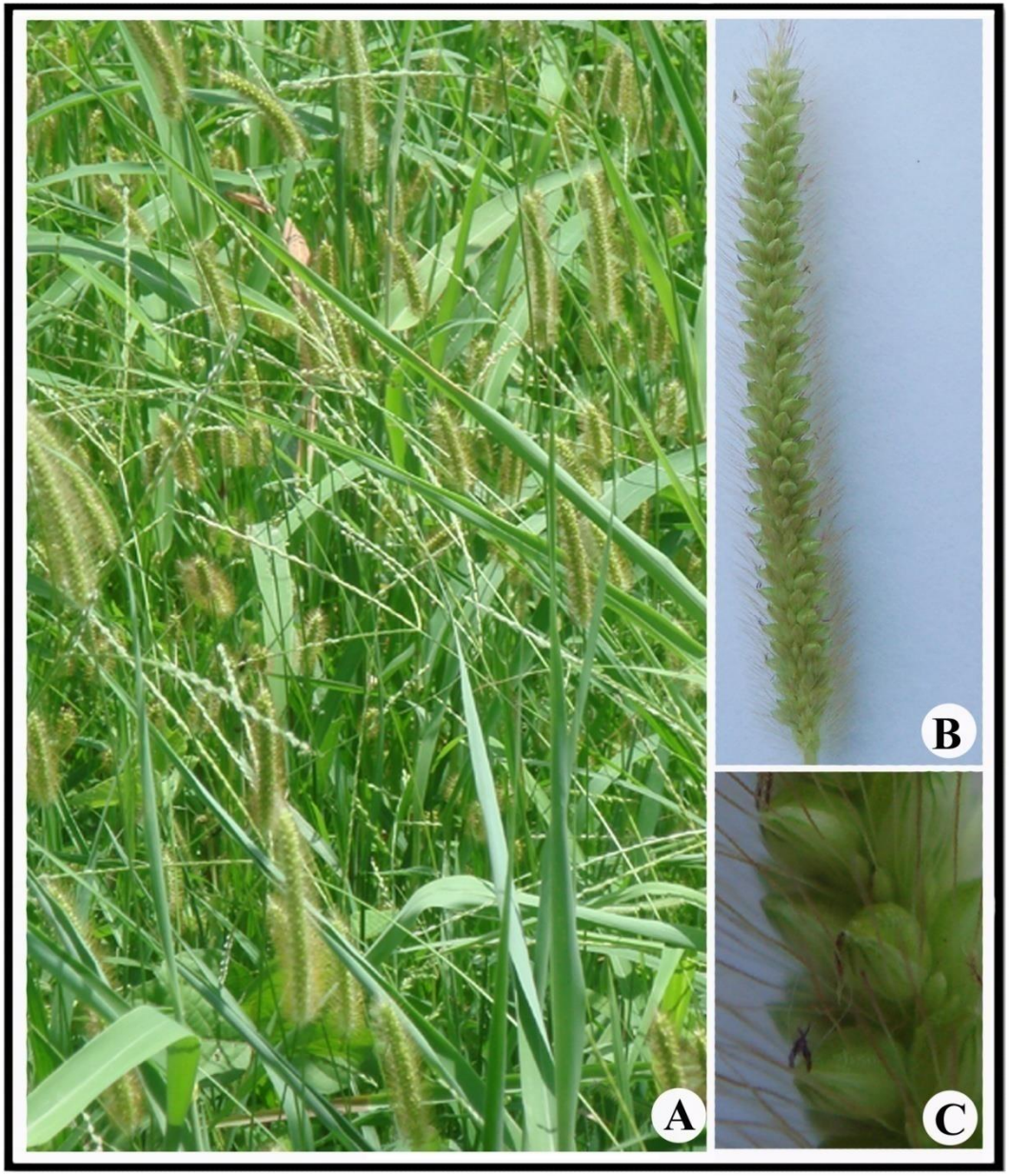


61. ***Paspalidium geminatum*** **Fig. 32** **62. *Paspalum scrobiculatum***



63. *Pennisetum setosum*

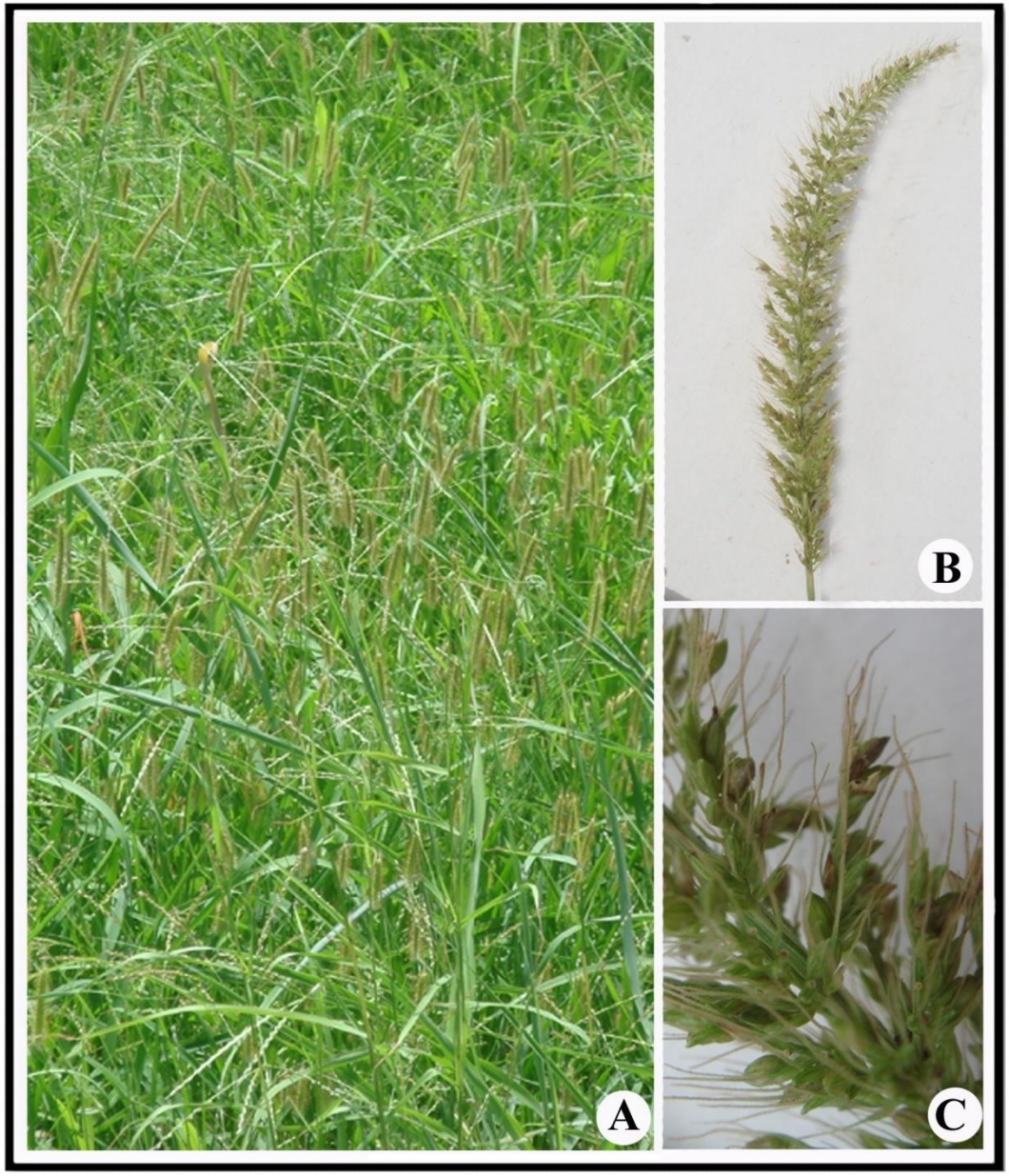
Fig. 33



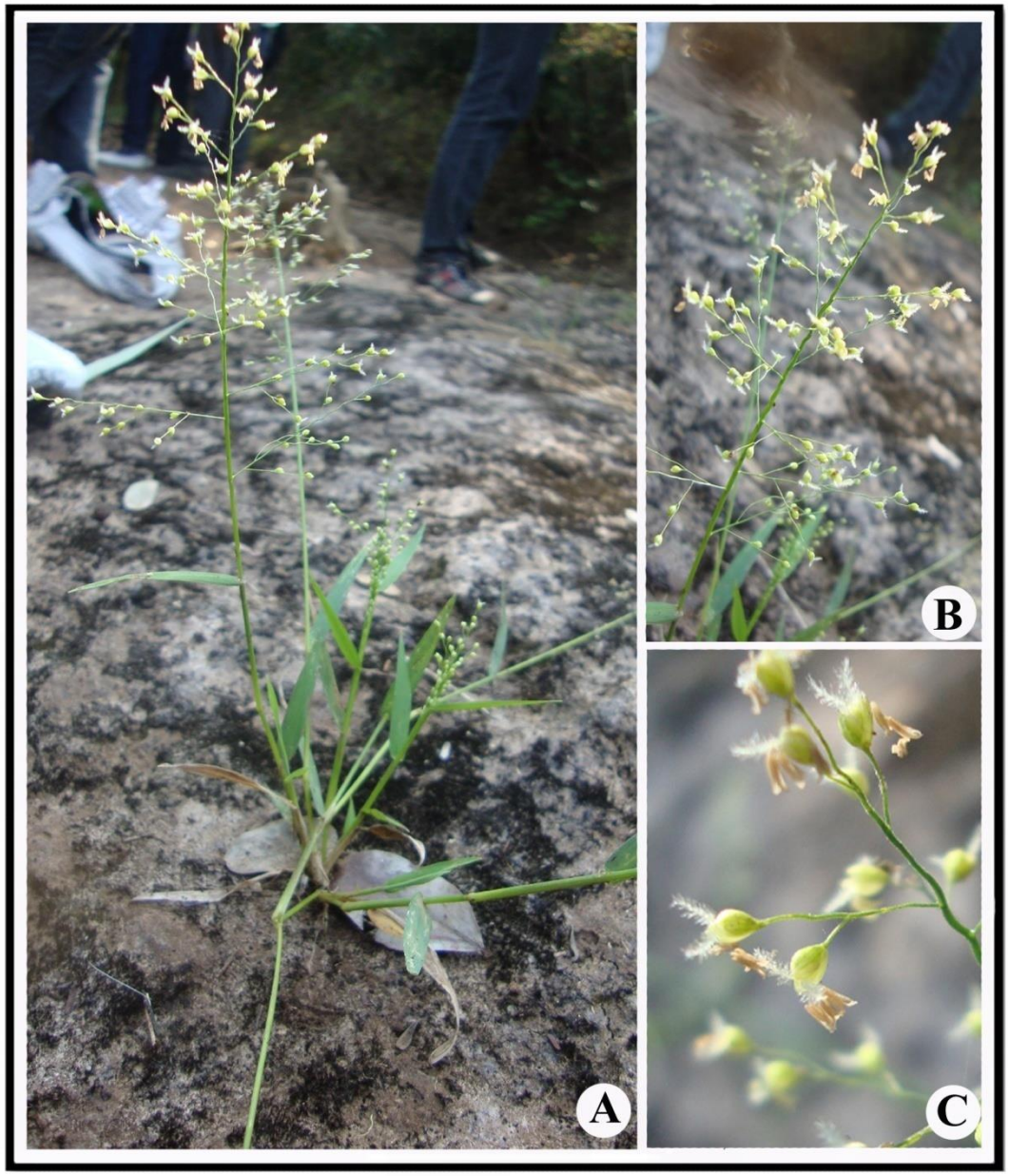
64. *Setaria glauca*

65. *Setaria tomentosa*

Fig. 34



66. *Setaria verticillata*



67. *Isachne globosa*

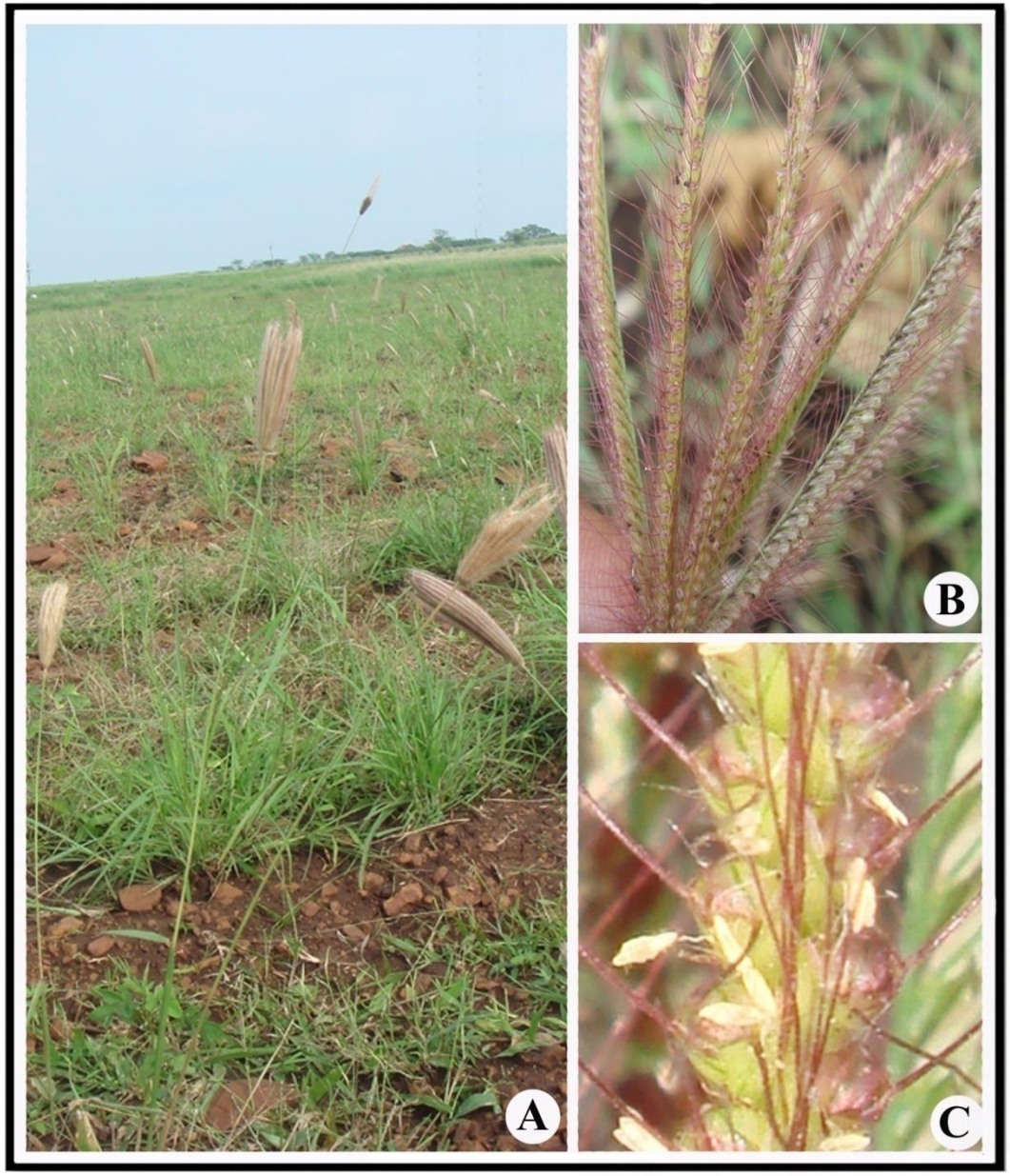
Fig. 35

68. *Aristida adscensionis*

69. *Aristida funiculata*

Fig. 36

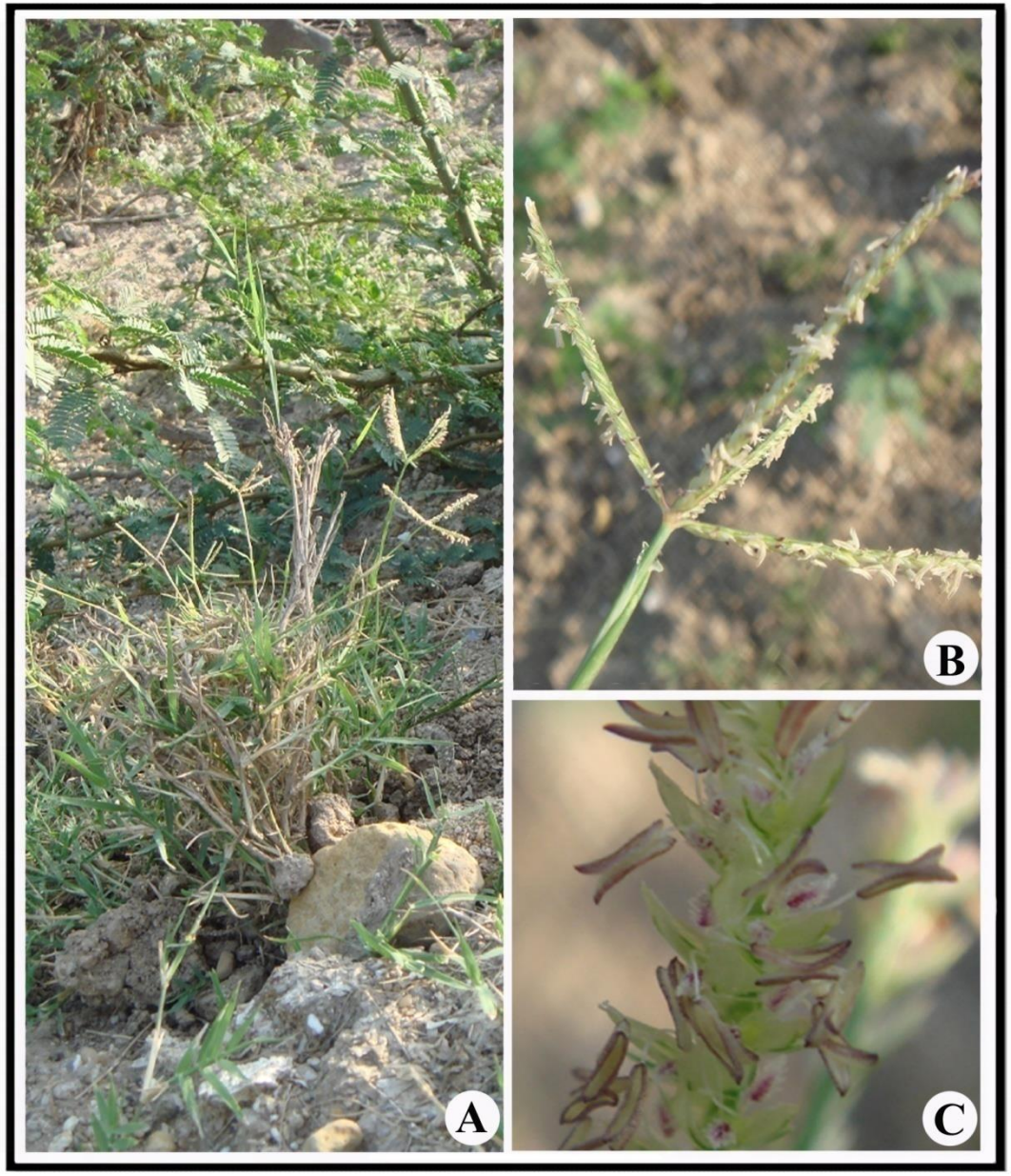
70. *Perotis indica*



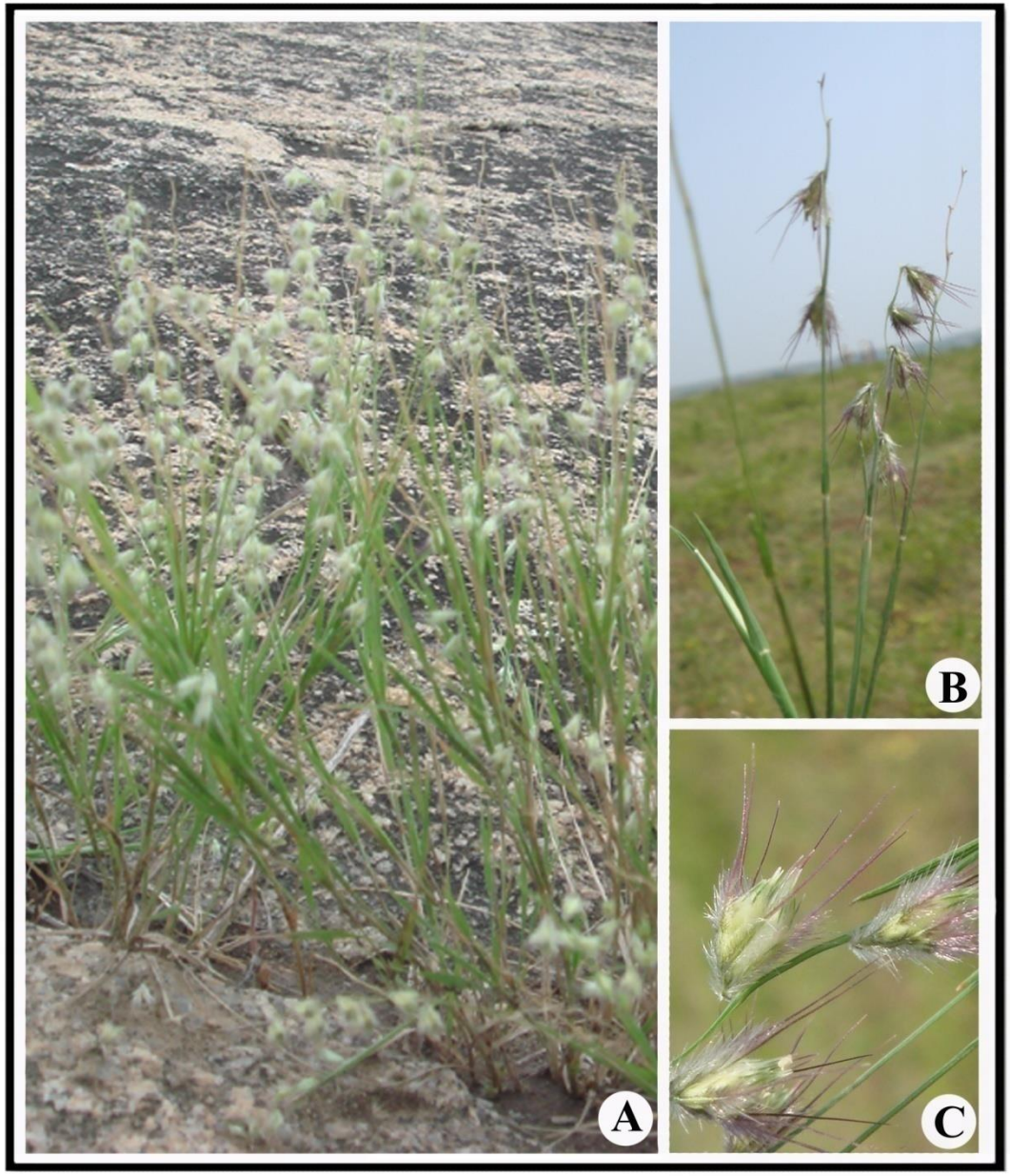
71. *Chloris barbata*

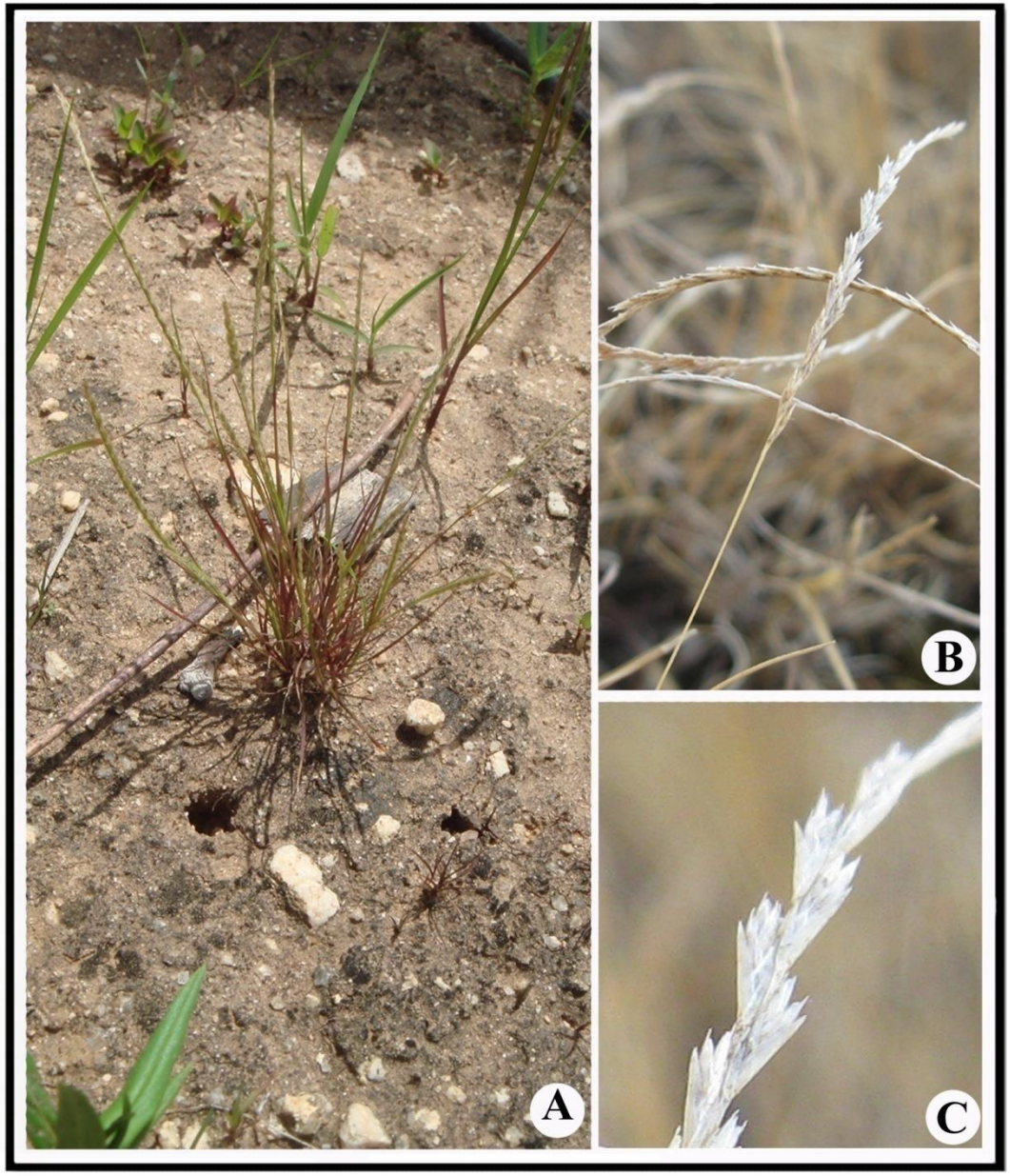
Fig. 37

72. *Chloris montana*

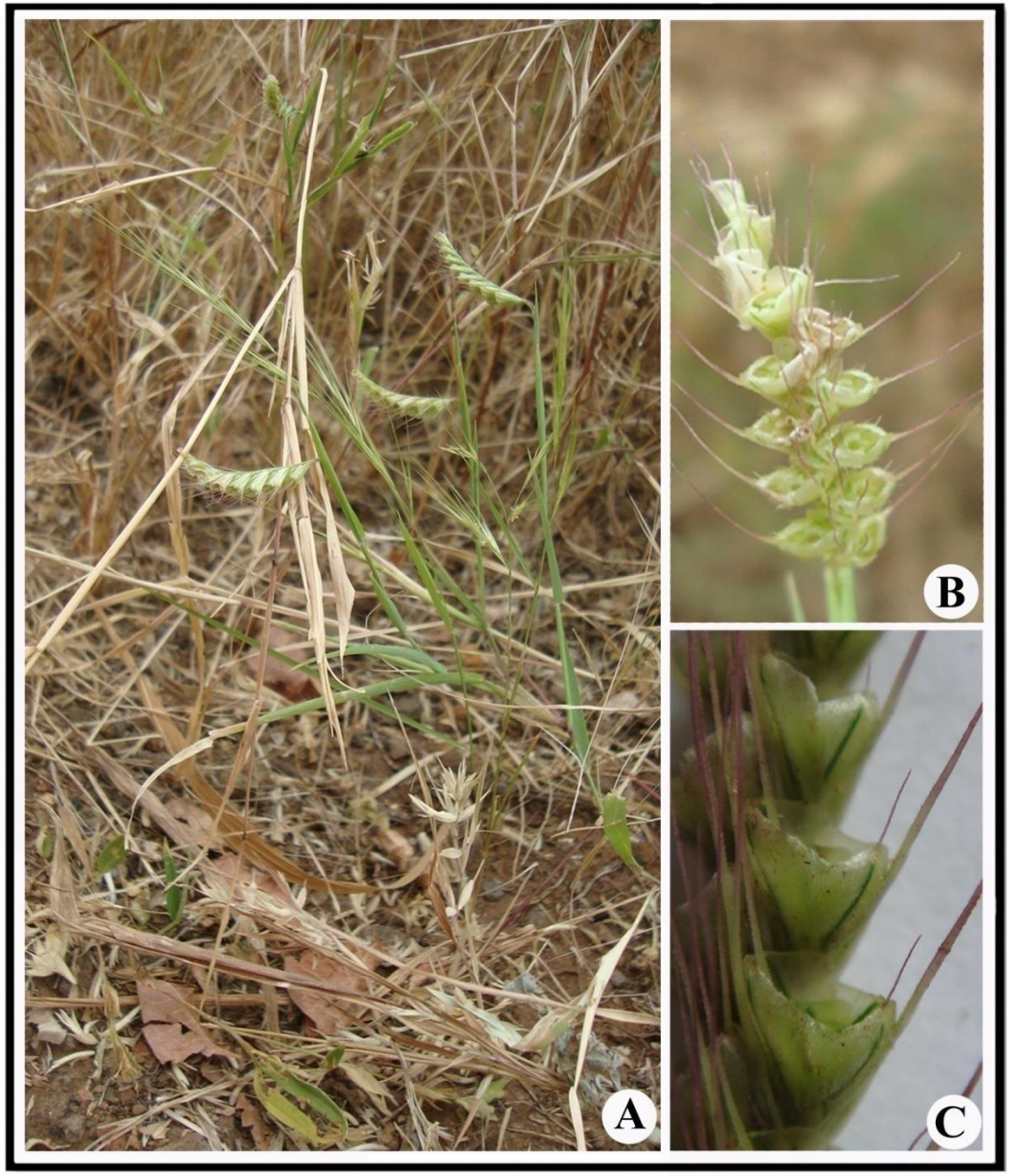


73. *Choris virgata* **Fig. 38** **74. *Cynadon dactylon***

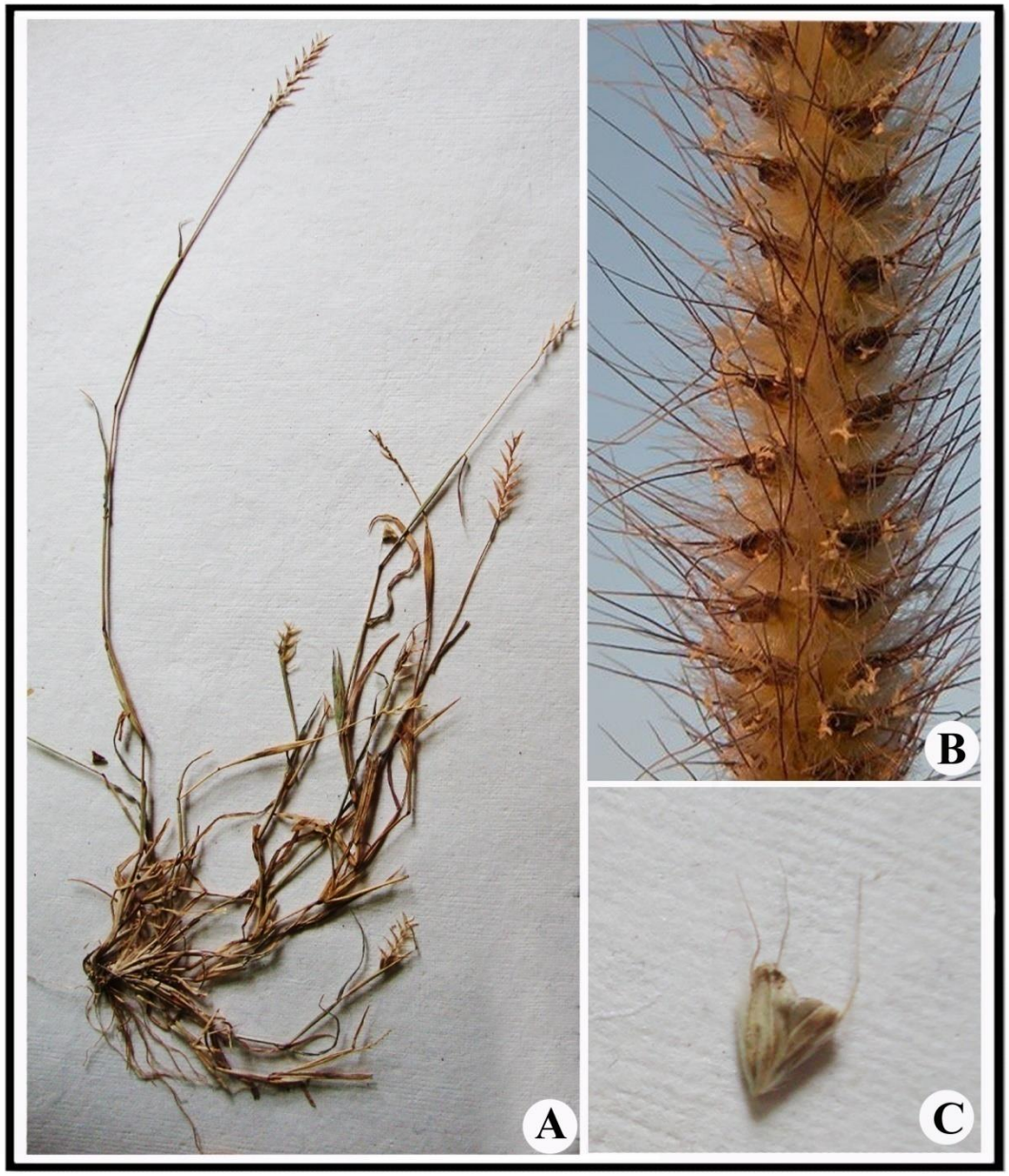




75. *Melanocenchris jaequemontii* **Fig. 39** **76. *Oropetium villosulum***



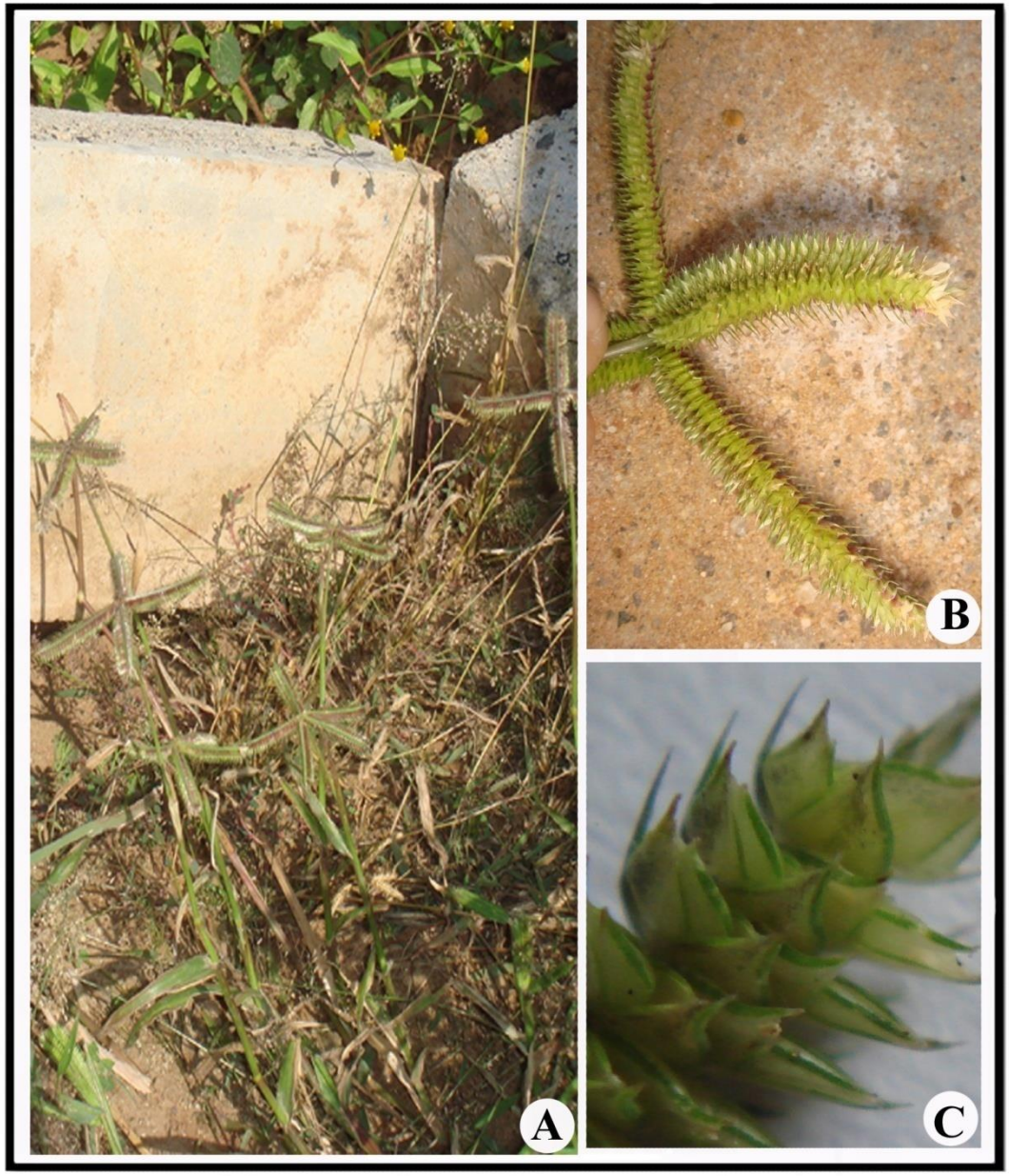
77. *Sachoenefeldia gracilis* **Fig. 40** **78. *Tetrapogon tenellus***



79. *Tetrapogon villosus*

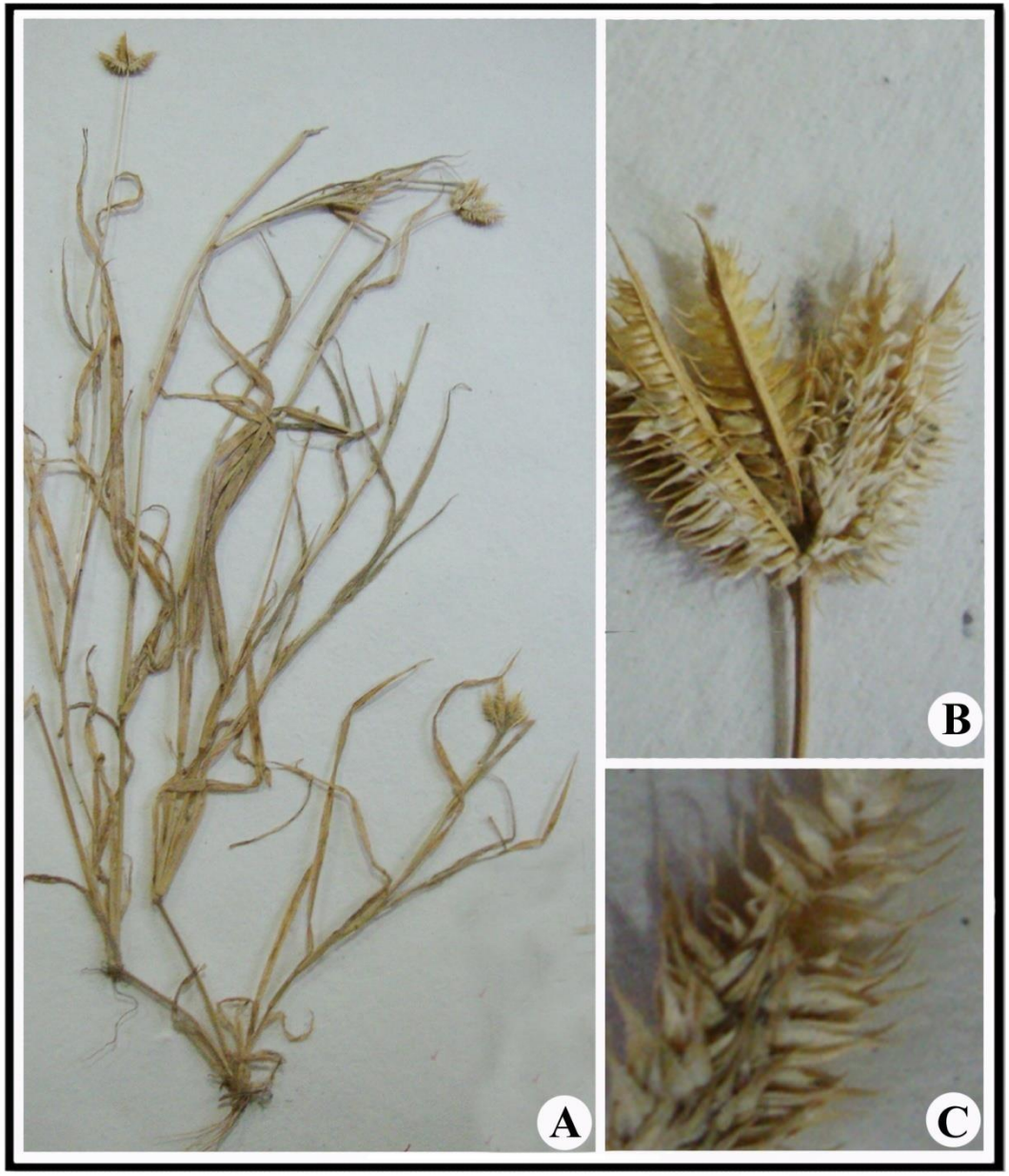
Fig. 41

80. *Acrachne racemosa*

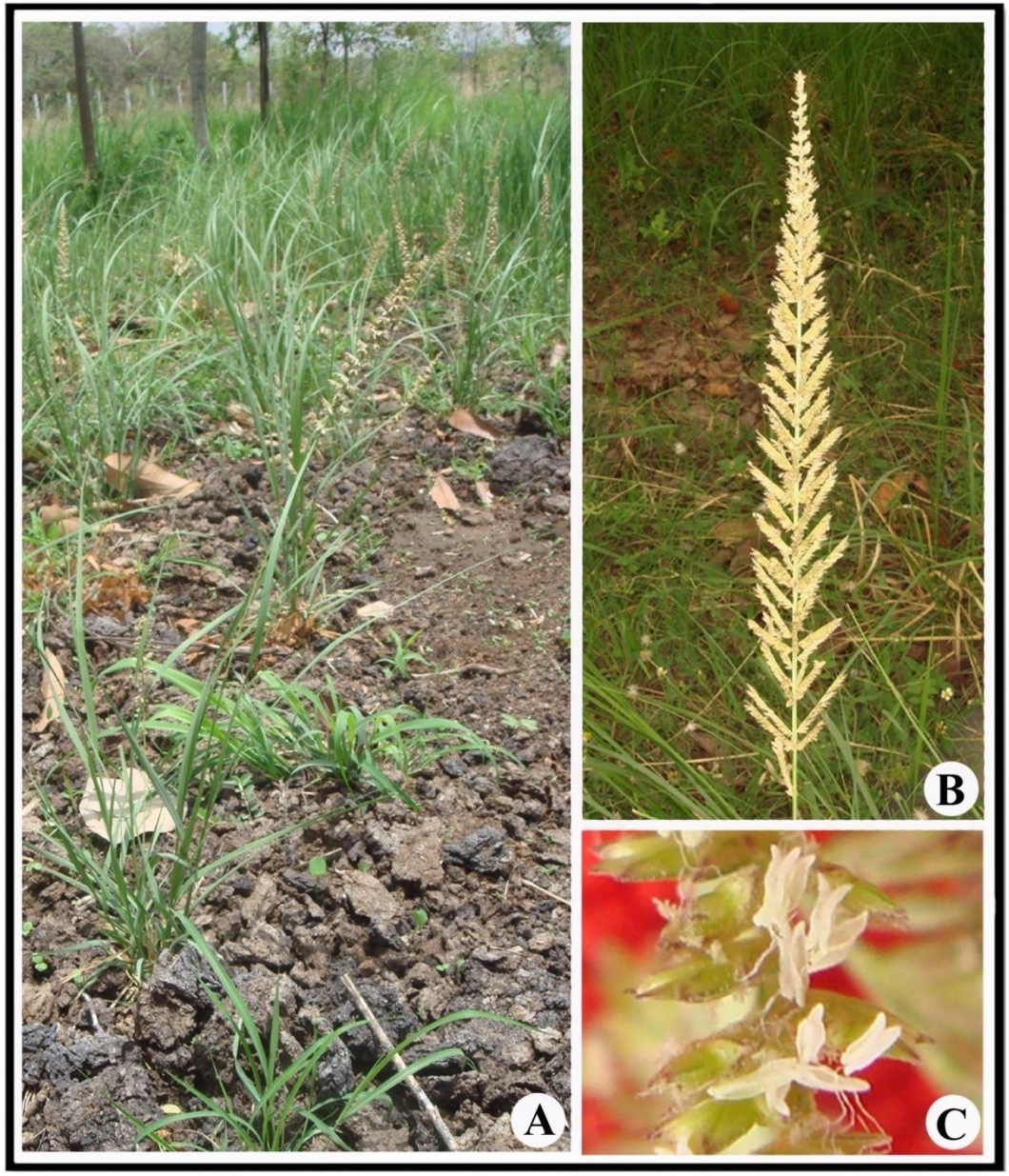


81. *Dactyloctenium aegyptium*

Fig. 42

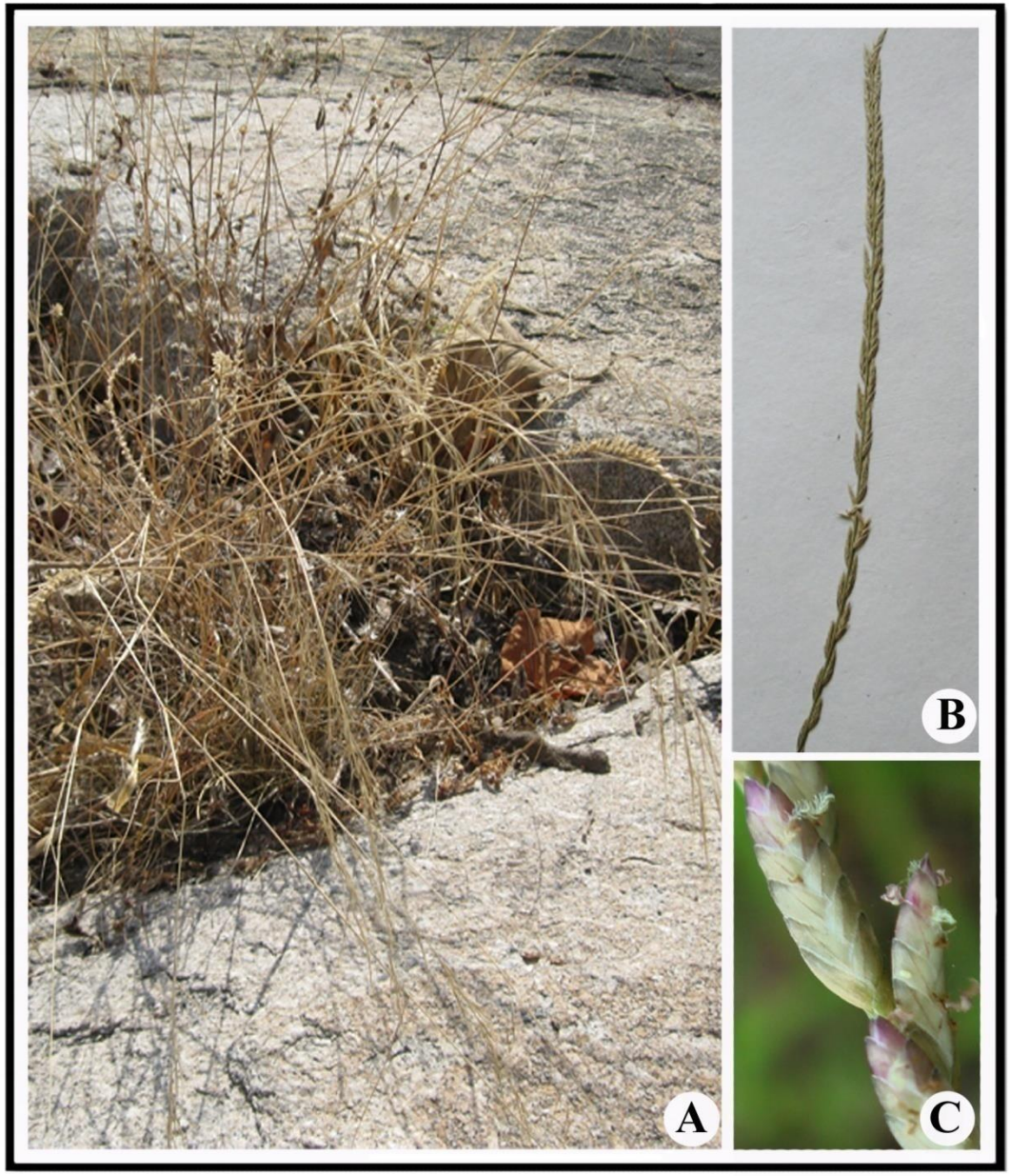


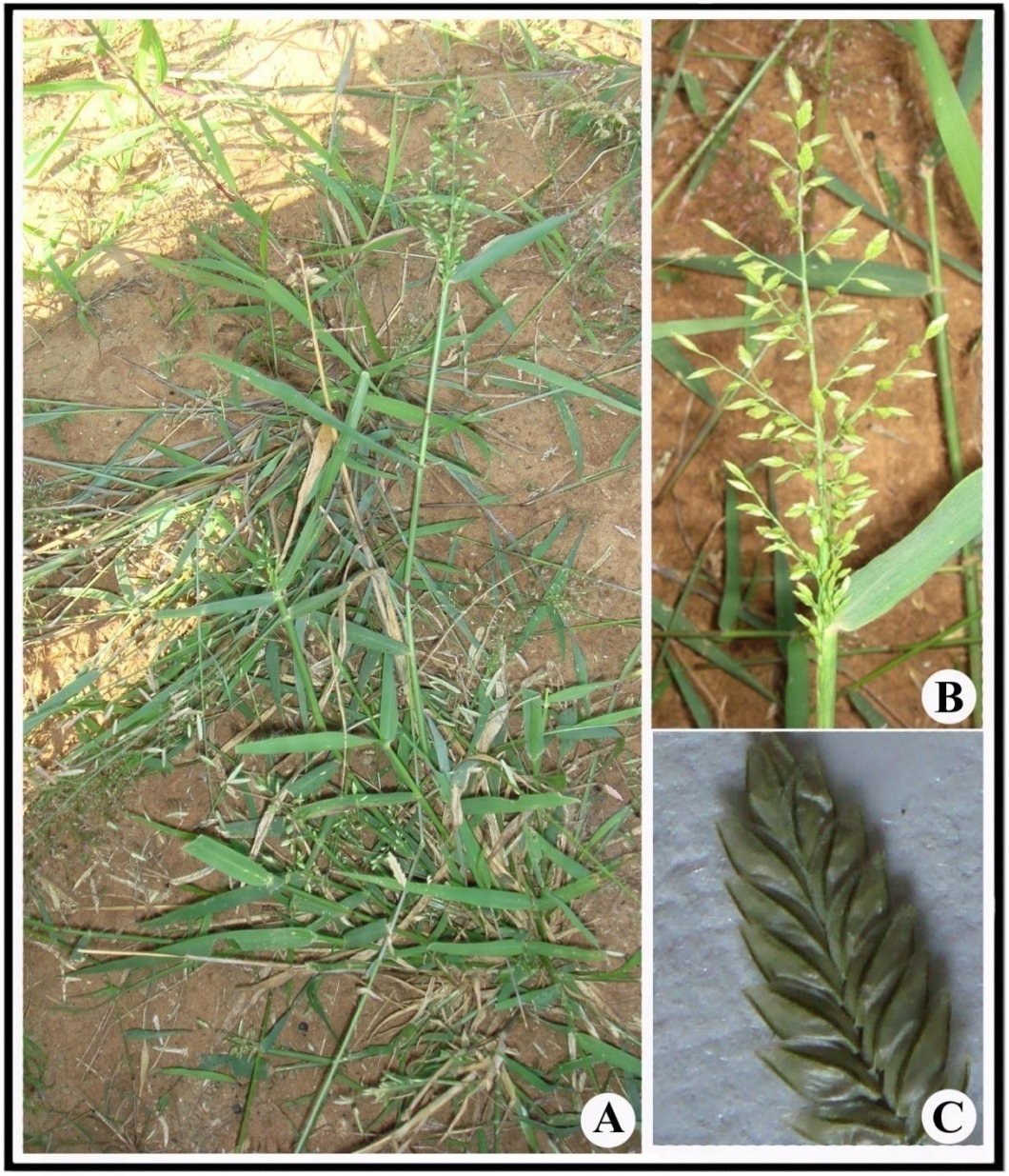
82. *Dactyloctenium sindicum*



83. *Desmostachya bipinnata* **Fig. 43** **84. *Dinebra retroflexa***

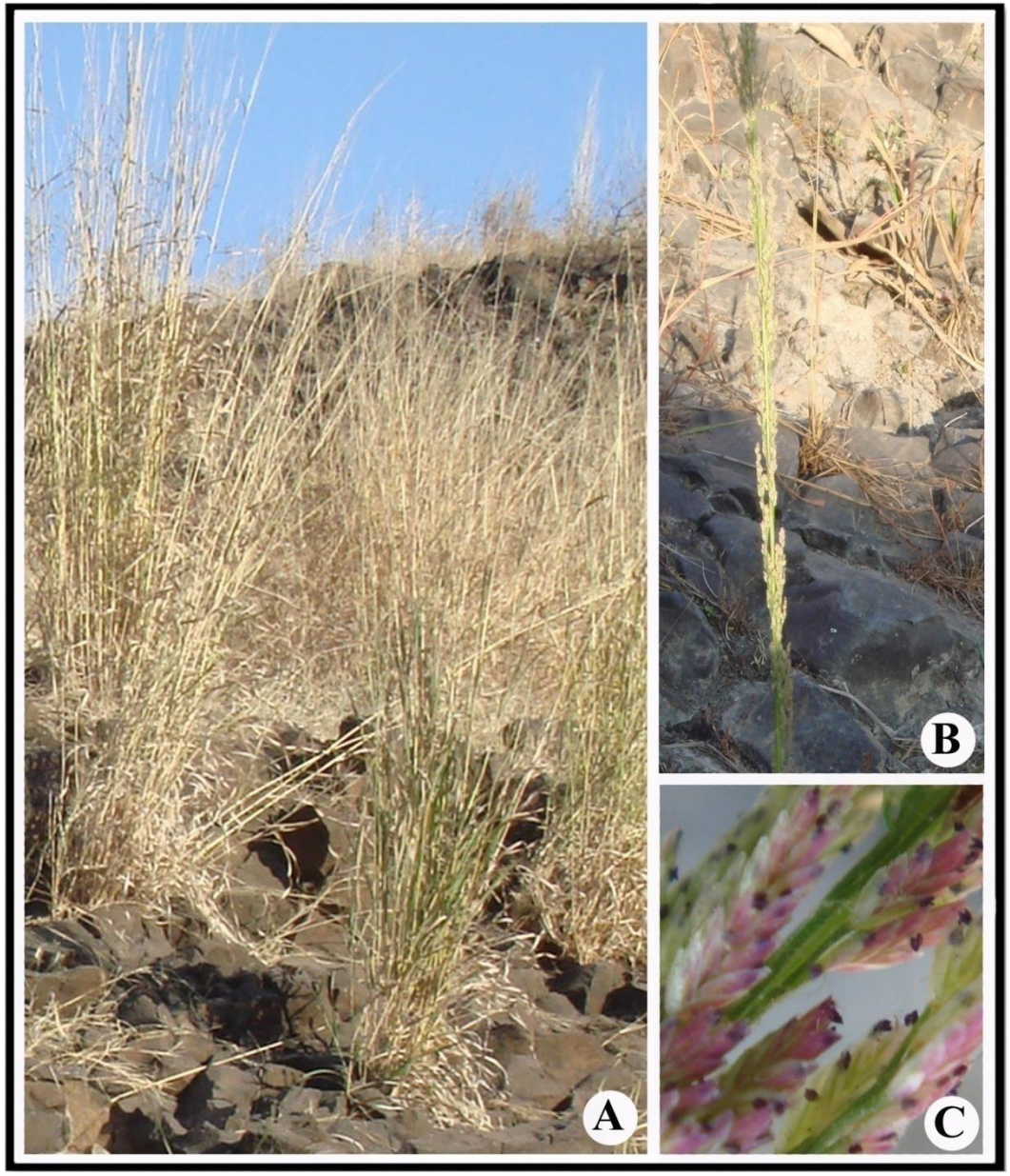
85. *Eleusine indica* **Fig. 44** **86. *Eragrostiella bachylla***





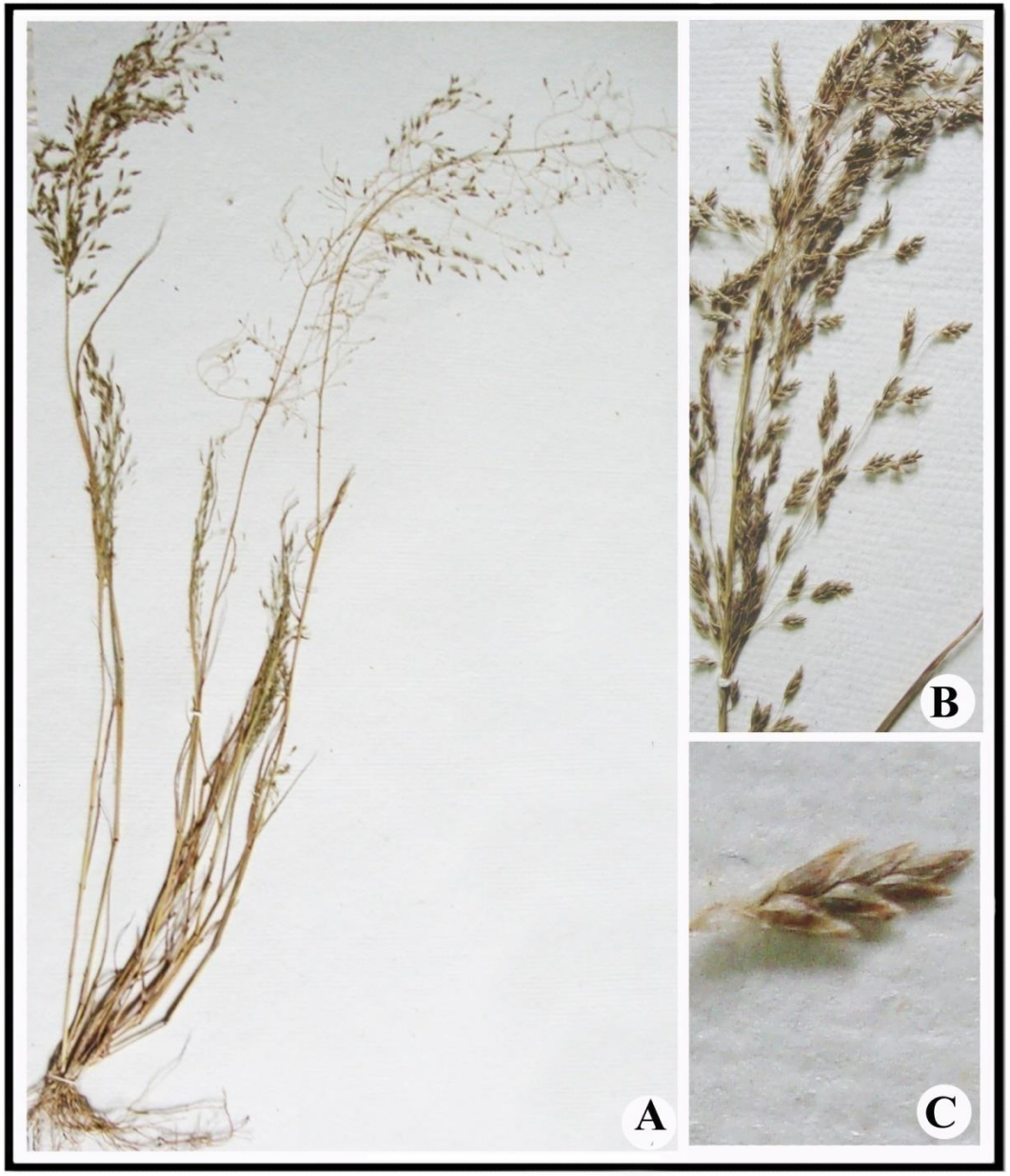
87. *Eragrostiella bachyphylla* **Fig. 45** **88. *Eragrostis cilianensis***

89. *Eragrostis ciliaris* **Fig. 46** **90. *Eragrostis japonica***



91. *Eragrostis nutans*

Fig. 47



92. *Eragrostis pilosa*

93. *Eragrostis tenella*

Fig. 48

94. *Eragrostis tremula*

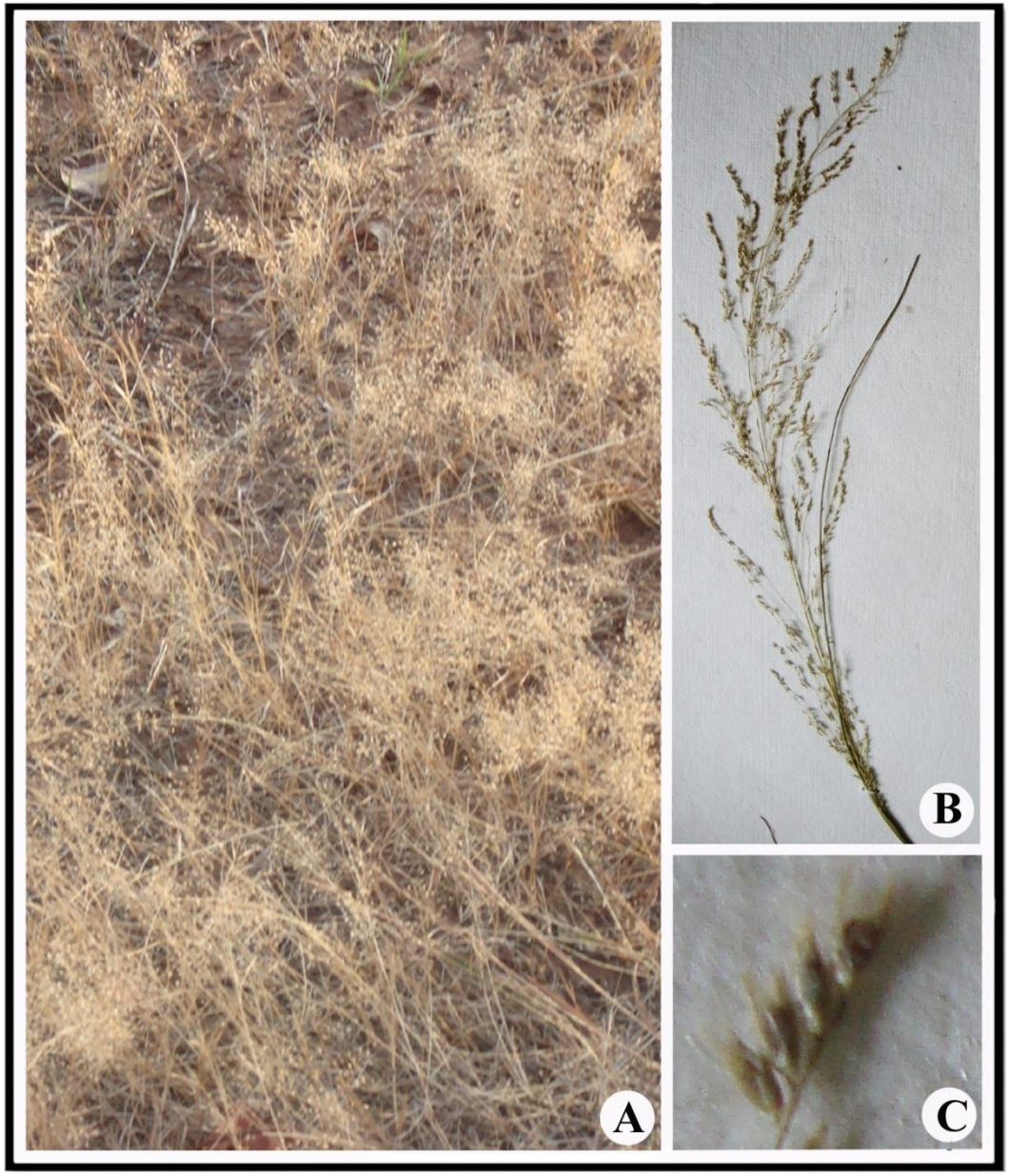
95. *Eragrostis unioloides*

Fig. 49

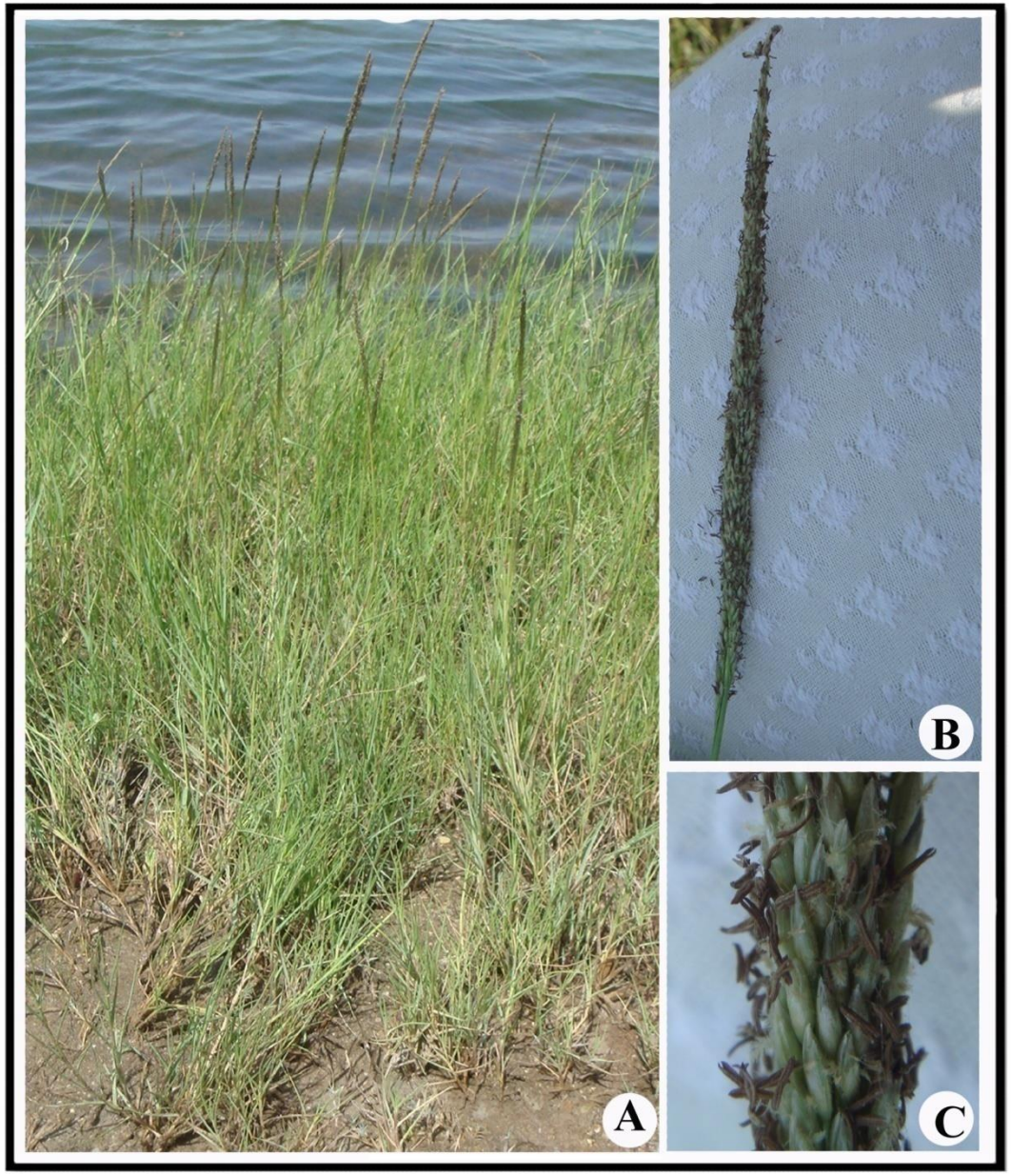
96. *Eragrostis viscosa*

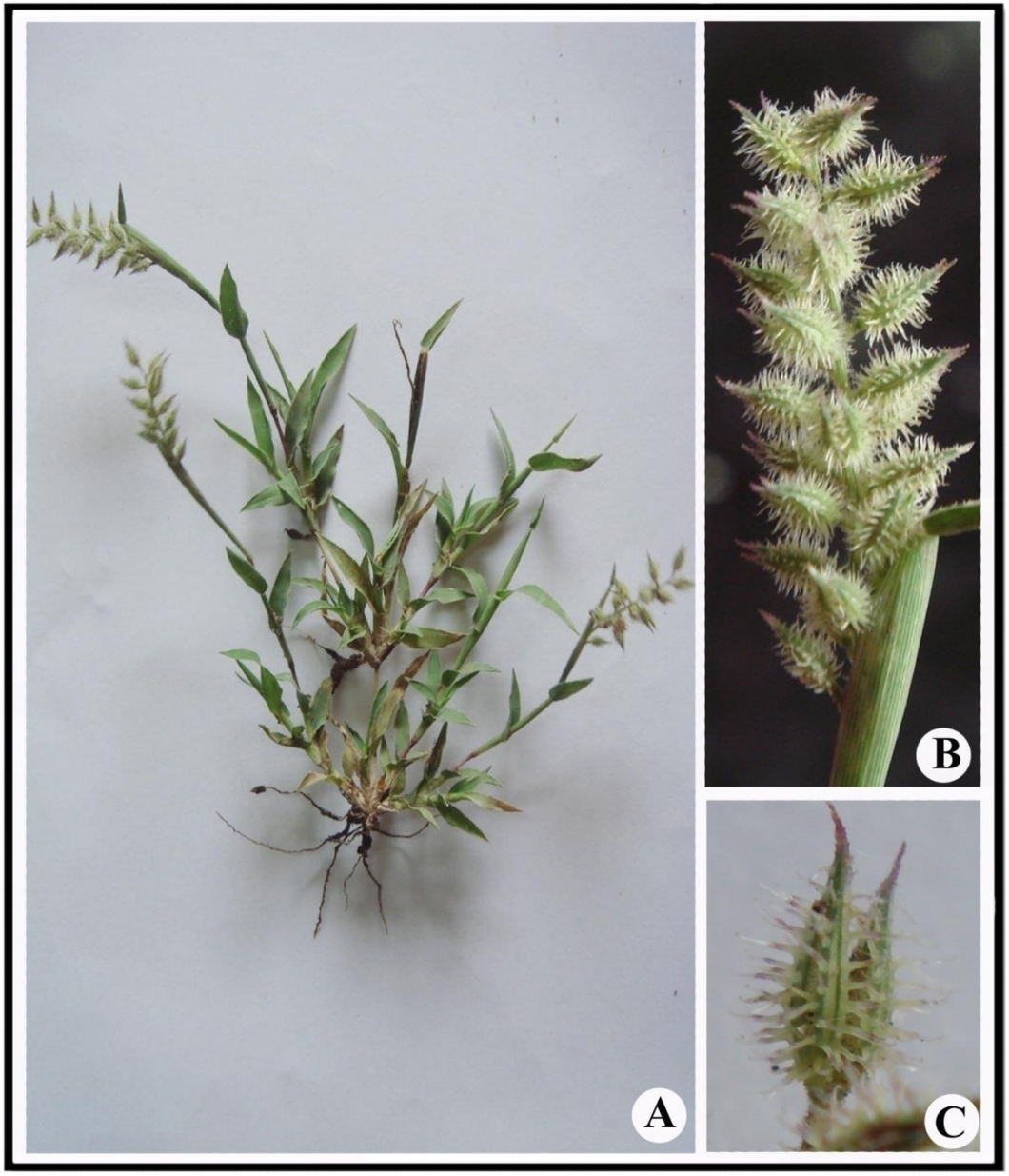
97. *Sporobolus coromardelianus*

Fig. 50



98. *Sporobolus diander*





99. *Sporobolus indicus* **Fig. 51** **100. *Tragrus biflorus***

Discussion

Family Poaceae is a dominating family on the earth. Grasses from Western India has been accounted by Cooke (1902-08) and Blatter and McCann (1935). Initially Chavan and Mehta (1959) published "Grasses of Pavagadh" of Gujarat in Western India. They recorded 33 genera and 48 species of grasses distributed in this region. Sutaria (1962) in his publication"Flora of Gujarat state"describes 24 genera and 31 species of grasses. Further Patel (1965) gave a great contribution to the Flora of Gujarat. He reported 90 genera and 203 species of grass diversity from Gujarat. Some of the other major contributions added to the Flora of Gujarat are by Santapau and Janardhan (1967), Shah (1978), Raghavan *et al.* (1981), Bole and Pathak (1988), Pandey and Padhye (1997, 2005, 2006), Gandhi and Yusufzai (1999), Pandey (2001, 2002), Meena and Pandey (2004), Meena (2004, 2005, 2007), Gohil (2006), Gohil and Patel (2006) and Raole and Desai (2008, 2011, 2012, 2013). Shah (1978) reported 89 genera and 235 species of grasses in Flora of Gujarat. Gandhi and Ysufzai (1999) recorded 79 genera and 184 species in Grasses of Gujarat and these numbers are increased up to 105 genera and 295 species which were added by different taxonomist. Desai (2012) studied South Gujarat and reported 75 genera and 182 species of grasses. Parmar *et al.* (2012) studied grass of Gujarat and they documented 286 species of Poaceae. Working Plant Circle, Vaodara (2011) reported around 89 grass species from the Panchmahal and Dahod divisions. In Gujarat, *Eragrostis, Panicum, Ischaemum, Aristida, Digitaria, Sporobolus, Cymbopogon, Arthraxon* like genera are majorly found, contributing up to around 30.5% grass diversity of the State.

During the present study, 55 genera and 100 species were found from the family Poaceae. These species were utilized in the further studies. The highest diversity of the grasses was found to be in Baria taluka. Highest species were belongs to the tribe Andropogoneae while tribe Zoysieae had only one species. Forest area of Panchmahal and Dahod showed many common grass species. Species like *Apluda mutica, Bothriochloa pertusa, Cymbopogon martini, Dicanthium annulatum, Themeda triandra, Brachiaria eruciformis, Brachiaria reptans, Digitaria ciliaris, Echinochloa colona, Panicum trypheron, Aristida adscensionis, Aristida funiculata, Cynodon dactylon, Eleusine indica, Eragrostis tenella* and *Sporobolus diander* are observed in all the 17 talukas. Grass species like *Heteropogon triticeus, Brachiaria ramosa, Echinochloa stagnina, Tetrapogon tenellus, Tetrapogon villosus, Oropetium villosum, Eragrostis japonica, Eragrostiella bachyphylla*and *Tragus biflorus* have a restricted distribution i.e. they were found only at one place from the study area. *Tetrapogon tenellus* was found in Baria taluka. *Tetrapogon villosus* was found only in Dahod taluka. The grasslands of Rampur were formed as a result of human activity. Earlier the whole area, except for some rocky plateax, was covered with thick teak forests, the remnants of which are still seen in some valleys. Large scale cutting and

hunting of wildlife made the area totally blank except some areas where grassland came up, when these forests were cut through millennia.

Grasses generally grow on all types of habitats like sandy, murshy, rocky, wetlands, normal plain land, etc. In Godhra range, Bandheli vidi is major grassland with rocky habitat, moist habitat and normal plain land habitat in the study area. Species like *Oropetium, Eragrostiella bachyphylla* was located in crevices of rocks. Species like *Cenchrus ciliaris* was found at the edges of rock. *Imperata, Saccharum* type of species found at moist places. In Rampur range also therewere different types of habitats found. Mostly a wet habitat found at Kalitalai. Species like *Dicanthium caricosum, Ischaemum molle, Ischaemum rugosum* were found growing in the wet habiat. Garbada has a rocky habitat. In Garbada small water stream was present so species like *Ischaemum indicus*was found dominantly.

Grasses are either annual or perennial herbs except woody bamboos. Grasses shows diverse variations in their shape, size, vegetative features, infloroscence, etc. Species like *Pennisetum, Saccharum, Coix, Imperata* are much heighted while species like *Oropetium, Eragrostis tenella, Eragrostis tremula, Eragrostis unioloides, Cynodon, Tragus* are smaller in size.

In the Panchmahal region has 14 dominating species, *Apluda mutica, Cymbopogon martini, Themeda triandra, Cynodon dactylon, Dactyloctenium aegyptim, Eleusine indica, Bothriochloa pertusa, Capillipedium hugelii, Aristida adscendionsis, Eragrostis tenella, Sporobolus diander, Echinochloa colona, Imperata cylindrica, Heteropogon contortus*were dominationg species while in Dahod region has 11 dominating species, *Dicanthium annulatum, Sehima nervosum, Apluda mutica, Chrysopogon fulvus, Eleusine indica, Dactyloctenium aegyptium, Heteropogon contortus, Ischaemum pilosum, cenchrus biflorus, Eragrostis tenella, Sporobolus diander* more dominating species were present. From the diversity point of view Panchmahal district showed more diversity of grass species. In Panchmahal, Bandheli grassland showed more diversiy. In the Bandheli, *Apluda mutica, Cymbopogon martini, Themeda triandra, Cynodon dactylon, Dactyloctenium aegyptium, Eleusine indica* were dominating species. *Oropetium villosum* and *Eragrostiella bachyphylla* were only found at Bandheli grassland. *Rottboellia exaltata* was only found at Kalitalai.

Most of the grasses were useful in one or other way. They were used as a fodder, for making roof of house, etc. but grasses like *Heteropogon contortus, Heteropogon ritchei, Sorghum halepense* were not used generally by tribals. All most all grasses were growing naturally in grasslands and in forest area. Species like *Pennisetum setosum, Sehima nervosum* and *Dicanthium annulatum* were also cultivated by forest people. *Pennisetum setosum* and *Sehima nervosum* they brought form the saurashtra and *Dicanthium annulatum* was grow in studied area but forest people promote cultivation of it to increase the fodder. *Pennisetum setosum* cultivated at Kalitalai and *Sehima nervosum* cultivated at Rampura.

3.2. Socioeconomic

Socio economic survey was done in 10 villages which are near by the study area. Based on the survey of tribal peoples the grasses which are palatable and unpalatable are listed in Table 10. Palatable grasses are further classified into three categories: highly palatable, moderately palatable and low palatable. Likewise, the associated legumes in grasslands and other legumes which are highly palatable and moderately palatable are listed in Table 11. Traditional knowledge of tribal people i.e. the plants which are they used as a medicine or as foods are noted in Table 12. The studied are has different tribes like Baria, Raval, Muslim, Nayak, Harijan, Vankar, Pateliya, OBC, SC, ST, Navi, Vanzara, Malivad, Rajput, Savam, Adivasi, Patel, etc. and number of tribals which are belonging to the different tribes in the studied villages are described in Table 13.

Table 10: List of Palatable Grasses

Sr. No	Palatability			Unpalatable
	High	**Moderate**	**Low**	
1	*Bothriochloa pertusa*	*Andropogon pumilus*	*Apluda mutica*	*Aristida adscensionis*
2	*Cenchrus ciliaris*	*Arthraxon lanceolatus*	*Cymbopogon martinii*	*Aristida funiculata*
3	*Chrysopogon fulvus*	*Brachiaria eruciformis*	*Melanocenchris jaequemontii*	*Desmostachya bipinnata*
4	*Coix lachryma-jobi*	*Brachiaria reptans*	*Oplismenus burmannii*	*Dinebra retroflexa*
5	*Cynodon dactylon*	*Capillipedium hugelii*	*Sachoenefeldia gracilis*	*Imperata cylindrica*
6	*Dactyloctenium aegyptium*	*Cenchrus biflorus*	*Setaria verticillata*	*Ophiuros exaltatus*
7	*Dicanthium annulatum*	*Cenchrus setigerus*	*Sorghum halepense*	
8	*Dicanthium caricosum*	*Chionachne koenigii*	*Sporobolus diander*	
9	*Eleusine indica*	*Chloris barbata*		
10	*Hackelochloa granularis*	*Chloris virgata*		
11	*Ischaemum molle*	*Digitaria adscendens*		
12	*Ischaemum pilosum*	*Digitaria granularis*		
13	*Ischaemum rugosum*	*Echinochloa colona*		
14	*Iseilema laxum*	*Echinochloa crusgalli*		
15	*Paspalidium flavidum*	*Echinochloa stagnina*		

16	*Paspalum scrobiculatum*	*Eragrostiella bifaria*		
17	*Pennisetum setosum*	*Eragrostis cilianensis*		
18	*Sehima ischaemoides*	*Eragrostis ciliaris*		
19	*Sehima nervosum*	*Eragrostis japonica*		
20	*Sehima sulcatum*	*Eragrostis nutans*		
21	*Sorghum bicolor*	*Eragrostis tenella*		
22	*Themeda laxa*	*Eragrostis unioloides*		
23	*Themeda quadrivalvis*	*Eragrostis viscosa*		
24	*Themeda triandra*	*Heteropogon contortus var. genuinus sub var. hispidissimus*		
25		*Heteropogon contortus var. genuinus sub var. typicus*		
26		*Isachne globosa*		
27		*Ischaemum indicus*		
28		*Panicum antidotale*		
29		*Panicum trypheron*		
30		*Perotis indica*		
31		*Setaria glauca*		
32		*Setaria tomentosa*		
33		*Thelepogn elegans*		
34		*Themeda cymbaria*		

Table 11: List of Palatable Legumes

Sr. No.	**Highly Palatable**	**Moderately Palatable**
1	*Alysicarpus bulgaumensis*	*Crotolaria spectabilis*
2	*Alysicarpus monilifer*	*Goniogyna hirta*
3	*Alysicarpus procumbens*	*Indigofera enneaphylla*
4	*Alysicarpus tetragonolobus*	*Indigofera tinctoria*
5	*Alysicarpus vaginalis*	*Sesbania aculeata*
6	*Atylosia scarabaeoides*	*Sesbania sesban*
7	*Cassia absus*	*Tephrosia purpurea*

8	*Cassia occidentalis*	*Tephrosia villosa*
9	*Cassia tora*	
10	*Clitoria ternatea*	
11	*Crotalaria albida*.	
12	*Crotalaria linifolia*	
13	*Crotolaria burhia*	
14	*Crotolaria calycina*	
15	*Crotolaria filipes* var. *trichophora*	
16	*Crotolaria juncea*	
17	*Crotolaria mysorensis*	
18	*Crotolaria notonii*	
19	*Crotolaria orixensis*	
20	*Crotolaria retusa*	
21	*Indigofera cordifolia*	
22	*Indigofera echinata*	
23	*Indigofera glandulosa*	
24	*Indigofera linifolia*	
25	*Rhynchosia minima*	
26	*Zornia gibbosa* Span.	

Table 12: List of plants which are used as food or medicinal purposes

Sr. No.	**Plant name**	**Family**	**Local Name**	**Used part**	**Uses**
As food					
1	*Cassiaabsus*	Leguminosae	Saved	Leaves at vegetative stage	As vegetables
2	*Leucas aspera*	Lamiaceae		Leaves	As food
3	*Cassia tora*	Leguminosae	Puvad	Young leaves	As vegetable
				Flowers	For food
4	*Crotolaria albida*	Leguminosae	Nano Gughro	Leaves	As food
5	*Cucumis callosus*	Cucurbitaceae	Khachara	Leaves, dried ripe fruit	As food

6	*Paspalum scorbiculatum*	Poaceae	Kodri	Seeds	As food
7	*Indigofera glandulosa*	Leguminosae	Zinjaru	Seeds	As food
8	*Echinochloa colona*	Poaceae	Samo	Seeds	As food
For medicine					
1	*Cassia occidentalis*	Leguminosae	Puvad	Root	Jaundice
				Seeds	As traditional medicine
2	*Coix lachryma-jobi*	Poaceae	Kasai	Seeds	7 seeds mixed with honey and used as a medicine in Asthma.
3	*Butea monosperma*	Leguminosae	Kesudo	Bark, flowers	Use in fractures
4	*Hemidesmus indicus*	Apocynaceae		Whole plant	Used in polymorphs bite, in dysentery and in diarrhoea.
5	*Solanum xanthocarphum*	Solanaceae	Bhoy ringni	Seeds	Fumes of seeds are use for the treatment of teeth decay.
6	*Cassiaabsus*	Leguminosae	Saved	Dry seeds powder	Used for the treatment of conjunctivitis.
7	*Rhynchosia minima*	Leguminosae		root paste	Used to cure joint pain.
				Leaves	For Achne.

Table 13: Distribution of the different tribes in the selected villages

	Range- Godhara						**Range- Rampura**								**Range- Dahod**		**Range- Garbada**		**Range- Vasia Dundri**	
	Segva		**Samli**		**Bakkahr**		**Kalitalai**		**Jekot**		**Rozam**		**Rampur**		**Kharoda**		**Bhe**		**Kantu**	
Total House Hold	437		500		950		220		350		401		172		1450		275		100	
Total Population	1500		5000		5000		1207		2406		2089		1280		11461		5619		1800	
Total Area	985ha.		790 ha.		859 ha.		1368 ha		999.46 ha		759 ha		572 ha		1836.77 ha		5219.44		649.58	
Different Tribe with their House Hold	Tribe	No.	Tribe	No.	Tribe	No.	Tribe	No.	Tribe	No.	Tribe	No.	Tribe	No.	Tribe	No.	Tribe	No.	Tribe	No.
1	Baria	382	Baria	250	Baria	400	ST	220	OBC	66	Adivasi	389	Savarn	24	ST SC	1450	SC	109	Adivasi	99
2	Raval	1	Rajput	40	Patel	300			SC	4	OBC	8	ST	148			ST	168	Patel	1
3	Muslim	9	Muslim	10	Muslim	1			ST	280	Pateliya	4								
4	Nayak	45	Vadand	7	Nayak	75			Savarn	7										
5			Harijan	30	Vadi	4														
6			Vankar	140	Vankar	5														
7			Brahmin	1	Navi	65														
8			Rathava	22	Vanzara	80														
9					Malivad	25														

OBC – Other Backward Class
ST – Scdhedule Tribe
SC –Scdhedule Class

Fig. 52 Tribals of the villages and their activities

A. Tribal people of Kantu using leaves of *Madhuca indica* as bowl

B. Drying of cucurbits on ropes

C. Tribal people of Rampura cutting grasses

D. Storing of gansdi (baled grass)

E. Forest officials weighing gansdi

F. Transportation of gansdi by bullock cart

G. Pressing machine to bale the grasses

H. Baled grasses stored

I. Handmade equipment used for collection of grasses

J. Tribal people collecting grasses

Fig. 52

Discussion

Socioeconomic survey and ethanobotanical studies indicated that the tribals in the forest areas are mainly dependant on the resources from these areas for their livelihood. Traditional knowledge accumulated over generations helped people to protect their nutrition and health (Etkin, 2000). It also help to manage habitats (Redford and Padoch, 1992; Laird and Kate, 2002; Olsson, Floke and Berkers, 2004). In our three year survey in collaboration with the forest department, we could see that the grasslands had grasses associated with specific legumes. Legumes are one of the largest and most valuable groups of flowering plants. It was thought worthy to understand the economic importance of these plants in the grasslands.

The purpose of the socioeconomic study was to document the multiple uses of the grasses and associated species, especially the legumes present in the some grasslands of Baria and Godhra in Panchmahal and Dahod districts of Gujarat.

The availability of green fodder is the most important single factor responsible for the success of animal husbandry (Hazra, 2014). With the intensification of livestock development the importance of fodder production is fully recognized. Natural grasslands play an important role in supplying fodder to the animals. But due to heavy grazing pressure productivity in some of the grasslands in the study area is very poor.

Most of the tribal in these areas are farmers and are almost completely dependent on the forest resources. The grasslands nearby these villages are in the custody of the forest department and so they work as laborers in these grasslands for harvesting these grasses. The main occupations of the villagers are to grow *Zea mays* and *Paspalum scorbiculatum.* Other than this the land nearby their huts are used for growing vegetables like Bringal, Lady's finger, Cucurbits etc. for their own household purposes. When the production of grasses in the grasslands is more than the requirement of the villagers, these are sold in the nearby markets.

Fodders from the forest are an important source for cattle and other grazing animals of these regions. These are many varieties of grasses, trees and shrubs that are nutritious for the live stock. Many of the grasses are helpful in soil conservation.

During the monsoon period, the growth of natural grasses is appreciable and plenty of grasses are available. Species like *Dichanthium annulatum, Bothriochloa pertusa, Sehima nervosum, Sehima sulcatum, Chrysopogon fulvus* are highly palatable grasses and are frequently used. Few grasses are considered to be palatable only at its vegetative phase (before the flowering appears). For example, *Cymbopogon martini* is considered palatable only in the vegetative and bud condition. In scarcity after drying these grasses are also used as fodder. *Sorghum halepanse* is an unpalatable grass and cattles never prefer them especially when it is in vegetative and flowering stage i.e. in both the stages. According to Adivasi tribals*Sorghum halepanse* is considered to be toxic during the vegetative and flowering period, but after the seed dispersal and drying this grass is eaten by cattles, especially in a scarcity period. *Ophiuros exaltatus* is an unpalatable grass, having allelopathic effect on other plants. This species occurs especially where soil is black and sticky.

It is a tradition of the villagers in this region that the first cutting of the grass is done after monsoon period. When the monsoon season is over, the grasses from the grassland is harvested even before fully drying and is stored as hay by the forest

department. These grasses are baled and stored in the store house of the forest department.

The tribal people of the villages are dependent on grasslands for the fodder and on forest area for the live hood products. The tribal people of Garbada collect wood from the forest mainly to prepare farming implements like plough and for fuel.

The tribals, store the grass species by preparing a bale at their homes. They collected grasses from the grasslands. But the tribals of Garbada, collect grasses from forest and from surrounding of their farming area because in these villages no such type grasslands are present. During summer,the tribal people purchase grasses in form of Gansadi, which weighs around 50kg/gansadi paying around 1000 – 1200 Rs. each. At the time of scarcity fodder is purchased from Government quota.

Other than the fodder various other uses of the plant species could also be documented. Sometimes the tribal people use *Cymbopogon martinii* species after drying, to make "Kachcha Ghar" i.e. as the base material for temporary huts. *Desmostachya bipinnata*was used during the death of the person for preparing the funeral bed while *Cynodon dactylon* was used for worship. Seeds of *Heteropogon contortus* were used to kill crow. The tribal people make chapattis (bread) which were made by using powdered seed flour to keep the crows away from the food items carried by them to eat in the field during their work. Leaves of *Madhuca indica* were use to make a bowl for tea. Flowers and fruits were also used for brewery by distillation process. During the flowering season fruits of *Madhuca*were used in fermentation for liquor preparation and sold in nearby markets. Oil extracted from the flowerswas sold in the market. Seeds of *Coix lachryma-jobi* and *Chionachne koenigii* were used for making jewellery. Few other plants are specially used for food as well as for medicinal purposes. *Cassia occidentalis* root was used in Jaundice and seeds are used as traditional medicine. Powder of 7 seeds of *Coix* was mixed with honey and used as medicine in Asthma. Bark and flowers of *Butea monosperma* were used to treat fractures. *Hemidesmus indicus* is used in bite of polymorphic insects, in dysentery and in diarrhoea. Seeds of *Solanum xanthocarphum* were used totreatdecay of tooth. Dry seed powder of *Cassia absus* was used for the treatment of conjunctivitis. Root paste of *Rhynchosia minima* is used to cure joint pain and leaves were used for achne. Yadaiah *et al.* (2011) studied ethano-medico-botany of 19 villages of Godhra forest division. Result of their survey indicateds that plants like *Cassia auriculata, Cassia occidentalis, Holarrhena, Tridax* are used as medicinal plants by the tribals.

In Goghra range, Baria tribals were dominant. Villages like Segva, Samli and Bakkahr had Baria tribals. In Bakkahr, Patel tribe comes on second number, they had 300 house holds. Muslim tribe was found in all villages. In Rampur range, four villages were studied in which major catergory of the tribals were ST. In Kalitalai villages all tribals were ST while in Rampur village included ST and Savam tribals. Among the four villages, Jekot had the highest populations and in this village OBC, SC, ST and Savam tribals were staying. In Kharoda village, totoal 11,461 populations were staying and all were belongs to either SC or ST. Tribals of Bhey village also belongs to the SC or ST category. 109 house holds belongs to SC category while 168 house holds belongs to ST category. In Kantu village 99 percentage Adivasi tribals were staying, only 1 house of Patel tribals were their.

Total of 100 species of Gramineae were studied. Numerical and morphological characteristics were used to study the diagnostic features of identification. For the numerical study caryopses length, breadth, thickness, embryo and hilum sizes were taken into consideration.Great variations in the dimentions of the caryopses were noted between the genera as well as different species of the same genera. Grass caryopsis feature represented in Fig. 53. Graphical representation of all neumerical data are represented in Figs. 54-57.The morphometric details of the studied caryopses are represented in Table 14.

Length:

Length of the caryopses in the studied species varied form 0.47 mm (*Eragrostis ciliaris* and *Eragrostis japonica*) to 10.20 mm *Heteropogon triticeus.* Caryopses of Panicoideae group showed large variation in length and it ranges from 0.87 mm – 10.20 mm, *Digitaria granularis* and *Heteropogon triticeus* respectively.

In Maydeae, *Coix lachryma-jobi* showed length 4.50 mm while *Chionachne Koengii* was 3.34 mm long.

In tribe Andropogoneae showed wide range in terms of length, 1.37 mm (*Ophiuros exaltatus*) to 10.20 mm (*Heteropogon triticeus*). Except *Heteropogon triticeus*, all the species of this group have length below 5 mm. Five species were belongs to range 4 mm – 5 mm., *Chrysopogon fulvus* (4.89 mm), *Heteropogon contortus* var. *genuinus* sub var. *hispidissimus* (4.28 mm), *Heteropogon ritchiei* (4.48 mm) and *Sehima sulcatum* (4.22 mm). Paniceae showed length ranged from 0.87 mm (*Digitaria granularis*) to 2.67 mm (*Echinochloa stagnina*).

Group Pooideae showed great variation in carayopses length from 0.47 mm (*Eragrostis ciliaris* and *Eragrostis japonica*) to 5.05 mm (*Aristida adscensionis*). Tribe Isachneae have single genera, *Isachne globosa* showed length 1.06 mm. Tribe Aristideae has two species, *Aristida adscensionis* have largest size among the group pooideae and it is 5.05 mm while *Aristida funiculata* have 3.77 mm long caryopses. Tribe Chlorideae, *Oropetium villosulum* have minimum length (0.83 mm) while *Tetrapogon villosus* have maximum length (2.81 mm). Tribe Eragrosideae showed smallest caryopses, namely, *Eragrostis ciliaris* and *Eragrostis japonica* both have 0.47 mm length while *Eleusine indica* have largest caryopses and its size is 1.35 mm.
Large variations in length aided in classifying the studied species into three groups:

(i) short (entirely <3 mm)
(ii) long (entirely > 5 mm)
(iii) medium (falling between 3.1 and 4.9 mm)

Breadth:

Breadth of the caryopses in the studied grass species varied from 0.14 mm (*Eragrostis viscosa*)to 3.51 mm (*Coix lachryma-jobi*). Caryopses of Panicoideae group showed large variation in breadth with a minimum breadth of 0.39 mm (*Heteropogon contortus* var. *genuinus* sub var. *typicus* and *Heteropogon ritchei*) and maximum breadth 2.78 mm (*Heteropogon triticeus*). In Maydeae*Coix lachryma-jobi* showed maximum beadth (3.51 mm) while *Chionachne Koengii* had minimum (2.21 mm).

Among the studied species, Andropogoneae, *Heteropogon triticeus* (2.78 mm), *Rottboellia exaltata* (1.93 mm), *Sorghum halepense* (1.64 mm), *Thelepogon elegans* (1.36 mm) and *Themeda quadrivlavis* (1.09 mm) showed the breadth above 1 mm while in the other species breadth caryopses was below 1 mm. In tribe Paniceae,caryopses breadth ranged from 0.58 mm – 2.32 mm with the minimum recorded in*Digitaria granularis* and *Echinochloa stagnina*.

Group Pooideae showed the range of the carayopses breadth 0.14 mm – 0.88 mm, *Eragrostis viscosa* and *Tetrapogon tenellus* respectively. Tribe Isachneae with single genera, *Isachne globosa* showed breadth of 0.93 mm. Tribe Aristideae,*Aristida adscensionis* has a caryopses breadth of 0.26 mm while *Aristida funiculata* have 0.52 mm breadth of caryopses. Tribe Chlorideae, *Oropetium villosulum* has theminimum of 0.19 mm and*Tetrapogon tenellus* has 0.88 mm breadth. Tribe Eragrosideae showed smallest caryopses, with the breadth ranging from 0.14mm (*Eragrostis viscosa*)and 0.52 mm (*Acrachne ramosa*). *Sporobolus indicus*and *Sporobolus diander*of tribe Sporoboleaeshowed caryopses breadth 0.22 mm and 0.46 mm respectively.

Thickness:

Thickness of the caryopses in the studied grass ranged from 0.17 mm (*Eragrostis viscosa*) to 2.99 mm (*Coix lachryma-jobi*). Caryopses of Panicoideae group showed variation in thickness with ranged from 0.25 mm (*Bothriochloa pertusa*) to 2.99 mm(*Coix lachryma-jobi*). In Maydeae, *Coix lachryma-jobi* showed maximum thickness while *Chionachne koengii* has thickness 1.31 mm.

In tribe Andropogoneae thickness ranged from 0.22 mm (*Hackelochloa granularis*)to 2.46 mm (*Heteropogon triticeus*) *Heteropogon triticeus* (2.46 mm), *Rottboellia exaltata* (1.75 mm), *Sorghum halepense* (1.16 mm), *Thelepogon elegans* (1.03 mm) and *Tiplopogon ramosissimus* (1.03 mm) showed the breadth above the 1 mm while other studied species showed breadth below 1 mm.

Tribe Paniceae caryopses showed thicness rangedfrom 0.30 mm (*Oplismenus composites*) to 1.54 mm (*Echinochloa stagnina*).

Group Pooideae caryopses showed the great variations in thickness from 0.17 mm (*Eragrostis viscosa*)to 1.07 mm (*Tetrapogon tenellus*). *Isachne globosa* from tribe Isachneae showed thickness 0.62 mm. Tribe Aristideae has two species, *Aristida adscensionis* had 0.26 mm while *Aristida funiculata* had 0.53 mm thickness of caryopses. Tribe Chlorideae caryopses showed minimum thickness in *Oropetium villosulum* (0.22 mm) while *Tetrapogon tenellus* showed maximum thickness(1.07 mm). Tribe Eragrosideae showed smallest caryopses, namely, *Eragrostis viscosa* had 0.17 mm thickness while *Eragrostiella bachyphylla*(0.94 mm)had maximum thickness of caryopses. In tribe Sporoboleae,*Sporobolus indicus*showed 0.22 mm thickness while *Sporobolus diander* had 0.61 mm thickness.

L:B ratio:

L:B ratio was calculated as the length of caryopses divided by breadth and multiplied by 10. When difference between length and breadth becomes more than the ratio will come more and viceversa. L:B ratio of caryopses in the studied grass species varied from 10.53 (*Paspalum scorbiculatum*) to 192.84 (*Aristida adscensionis*).

Caryopses of Panicoideae group showed large variation in ratio and it ranges from 10.53 (*Paspalum scorbiculatum*)to 113.18(*Heteropogon ritchei*). In tribe Maydeae, *Coix lachryma-jobi* showed minimum ratio (12.81) while *Chionachne koengii* had 15.08.

Tribe Andropogoneae, L:B ratio ranged from 10.76 (*Hackelochloa granularis*) to 113.18 (*Heteropogon ritchiei*). Among the studied species of tribe Andropogoneae only four species like *Andropogon plumis* (68.53), *Chryopogon fulvus* (71.89), *Heteropogon contortus* and *Heteropogon ritchiei* (113.18) showed L:B ratio above 50.

Tribe paniceae showed the range of the L:B ratio from 10.53 – 28.16, *Paspalum scorbiculatum* and *Pennisetum setosum* respectively it indicatesthat the difference between the length and breadth is not more.

Group Pooideae showed the range of the ratio 11.39 (*Isachne globosa*) to 192.84(*Aristida adscensionis*). In tribe Aristideae,*Aristida adscensionis* had maximum L:B ratio while *Aristida funiculata* had 71.92 L:B ratio. Among the tribe Chlorideae, *Chloris montana* showed minimum L:B ratio (22.58) while *Sachoenefeldia gracilis* showed maximum L:B ratio(48.35). In the tribe Eragrosideae, *Eragrostis cilianensis* showed minimum L:B ratio (12.25) while *Dinebra retroflexa* showed maximum L:B ratio (30.59). Tribe Sporoboleae, *Sporobolus coromardelianus* had 34.65 ratio.

T:B ratio:

Compression is one of the valuable diagnostic features for characterization of grass caryopses. Caryopses are compressed or non-compressed. If compressed than either dorsally or laterally.

(i) If T: B ratio is < 100: Dorsally compressed

(ii) If T: B ratio > 100: Laterally compressed

(iii) If T:B ratio is ~100: Non compressed

This ratio was calculated as the thickness of caryopses divided by breadth and multiplied by 100.

T:B ratio of the caryopses among the studied species ranged from 32.64 (*Bothriochloa pertusa*) to 217.12 (*Sporobolus coromardelianus*). Caryopses of Panicoideae group showed large variation and it ranges from 32.64 (*Bothriochloa pertusa*) to 162.99 (*Apluda mutica*). In Maydeae, *Coix lachryma-jobi* showed 85.14 T:B ratio while *Chionachne koengii* had 59.24 T:B ratio.

In tribe Andropogoneae caryopses of *Bothriochloa pertusa* showed minimum T:B ratio (32.64) while *Apluda mutica* showed maximum ratio (162.99). Tribe Paniceae caryopses showed the range of the T:B ratio from 33.71 – 86.04, *Oplismenus compositus* and *Paspalidium flavidum* respectively.

Caryopses of group Pooideae showed ranged of T:B ratio from 41.31 (*Melanocenchris jaquemontii*) to 217.12 (*Sporobolus coromardelianus*). *Ischane globosa* from the tribe Ischaneae had 66.61 ratio. Tribe Aristideae have two species, caryopses of *Aristida adscensionis* had 108.55 T:B ratio while caryopses of*Aristida funiculata* had 100.99 T:B ratio. Among the tribe Chlorideae, *Melanocenchris jaquemontii*had minimum T:B ratio (41.31) while *Sachoenefeldia gracilis* had maximum T:B ratio (139.42). Caryopses of tribe Eragrosideae, *Acraachne ramosa* had minimum T:B ratio (79.76) while *Eragrostis unioloides* have maximum T:B ratio (204.66). From the tribe Sporoboleae, *Sporobolus indicus*showed ratio 101.10 while *Sporobolus diander* have 132.18 ratio.

Embryo %:

Embryo size is related caryopses length on the basis of which embryo percentage can be calculated. Depending on the embryo percentage caryopses could be categorized into two classes:

(i) Embryo % 46 or over: large embryo class

(ii) Embryo % 45 or under: short embryo class

Embryo % of the caryopses in the studied species ranged from 15.02% (*Aristida adscensionis*) to 85.62% (*Coix lachryma-jobi*).

Caryopses of Panicoideae group showed large variation in embryo % and it ranged from 44.70 – 85.62%, *Hackelochloa granularis* and *Coix lachryma-jobi* respectively. In tribe Maydeae, embryo % of caryopses in *Coix lachryma-jobi* was 85.62% while *Chionachne koengii* had 81.22%.

Tribe Andropogoneae caryopses showed variations in embryo % from 44.70% (*Hackelochloa granularis*) to 84.03%(*Rottboellia exaltata*) embryo %. Tribe Paniceae caryopses showed minimum embryo % in 46.05 (*Digitaria ciliaris*) while maximum in 83.62 % (*Paspalidium flavidum*).

Embryo % in caryopses of group Pooideae varied from 15.02% (*Aristida adscensionis*) to 78.13% (*Chloris montana*). From the tribe Isachneae,*Isachne globosa* showed 24.68% embryo %. Tribe Aristideae showed, *Aristida adscensionis* had 15.20 % while *Aristida funiculata* had 48.84%. Among the tribe Chlorideae, *Oropetium villosulum* (33.39%) had minimum embryo % while *Chloris montana* had maximum embryo %(78.13%). Among the tribe Eragrostedeae, *Eragrostis japonica* (31.91%) had minimum embryo % while *Eragrostis viscosa* had maximum embryo % (64.08%). From the tribe Sporoboleae, *Sporobolus coromardelianus* showed minimum embryo % (48.60%) while *Sporobolus diander* had maximumembryo % (50.64%).

Hilum %:

Hilum % of the caryopses among the studied species showed large variations from 3.42% (*Eragrostiella bachyphylla*) to 68.15% (*Ischane globosa*).

Caryopses of Panicoideae group showed large variation in hilum % with a minimum hilum % of 6.25% (*Heteropogon ritcheii*) and maximum hilum % of 43.55% (*Paspalum scrobiculatum*). In Maydeae*Coix lachryma-jobi* showed maximumhilum %(53.50%) while *Chionachne koengii* had minimum (30.41%).

Among the studied species, Andropogoneae, *Heteropogon ritcheii*had minimum hilum % (6.25%) while *Rottboellia exaltata* had maximum hilum % (22.95%) among the tribe. In tribe Paniceae,caryopses hilum % ranged from 11.39% – 43.55 % recorded in *Cenchrus ciliaris* and *Paspalum scorbiculatum* respectively.

Group Pooideae showed the range of the caryopses hilum %3.42% - 68.15%, *Eragrostiella bachypahylla*and *Ischane globosa* respectively. Tribe Isachneae with single genera, *Isachne globosa* showedhilum % of 68.15% mm. Tribe Aristideae,*Aristida adscensionis* has a caryopses hilum % of 10.67% while *Aristida funiculata* have 7.13% hilum % of caryopses. Tribe Chlorideae, *Oropetium villosulum* has theminimum of 5.44 %and*Cynodon dactylon*has 21.11% hilum %. Tribe Eragrosideae showed smallest caryopses, with the breadth ranging from 3.42% (*Eragrostiella bachyphylla*)and 24.46% (*Eragrostis viscosa*). *Sporobolus indicus*and *Sporobolus diander*of tribe Sporoboleaeshowed caryopses hilum % 8.31% and 20.85% respectively.

Table 14: Morphometric features of caryopses

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
Group: Panicoideae												
Tribe: Maydeae												
1.	*Chionachne koenigii*	3.34 ±0.16	2.21 ±0.14	1.31 ±0.12	15.08 ±0.94	59.24 ±5.66	2.71 ±0.32	0.55 ±0.08	1.01 ±0.09	0.59 ±0.05	81.22 ±6.16	30.41 ±1.49
2.	*Coix lachryma-jobi*	4.50 ±0.31	3.51 ±0.40	2.99 ±0.58	12.81 ±1.43	85.14 ±10.50	3.85 ±0.44	3.62 ±0.49	2.41 ±0.29	0.93 ±0.12	85.62 ±11.59	53.50 ±4.54
Tribe: Andropogoneae												
3.	*Andropogon pumilus*	2.73 ±0.10	0.40 ±0.05	0.31 ±0.03	68.53 ±7.49	77.77 ±16.45	1.37 ±0.09	0.38 ±0.03	0.25 ±0.04	0.15 ±0.03	49.97 ±3.39	8.99 ±1.80
4.	*Apluda mutica*	2.20 ±0.87	0.48 ±0.36	0.78 ±0.23	46.11 ±24.68	162.99 ±53.14	1.64 ±0.53	0.75 ±0.23	0.33 ±0.11	0.25 ±0.08	74.58 ±20.66	14.84 ±10.09
5.	*Arthraxon lanceolatus*	2.29 ±0.17	0.48 ±0.05	0.41 ±0.03	48.11 ±5.18	86.36 ±12.52	1.22 ±0.20	0.43 ±0.06	0.22 ±0.06	0.18 ±0.03	53.21 ±5.04	9.40 ±3.01
6.	*Bothriochloa pertusa*	1.68 ±0.11	0.75 ±0.08	0.25 ±0.01	22.26 ±3.53	32.64 ±3.29	1.16 ±0.09	0.67 ±0.06	0.24 ±0.03	0.22 ±0.02	69.20 ±5.26	14.38 ±0.91
7.	*Capillipedium hugelii*	1.39 ±0.14	0.62 ±0.12	0.29 ±0.06	22.53 ±3.27	46.39 ±17.42	0.87 ±0.08	0.45 ±0.07	0.24 ±0.05	0.26 ±0.06	62.76 ±4.23	17.12 ±4.43
8.	*Chrysopogon fulvus*	4.89 ±0.48	0.68 ±0.08	0.97 ±0.05	71.89 ±7.74	142.22 ±17.25	2.54 ±0.66	0.68 ±0.08	0.45 ±0.08	0.18 ±0.04	51.91 ±10.48	9.13 ±2.60
9.	*Cymbopogon martini*	2.52 ±0.11	0.94 ±0.04	0.43 ±0.03	26.73 ±1.79	45.81 ±2.75	1.68 ±0.11	0.69 ±0.04	0.35 ±0.07	0.25 ±0.04	66.75 ±4.24	14.04 ±2.85
10.	*Dichanthium annulatum*	1.92	0.76	0.45	25.32	59.59	1.18	0.54	0.22	0.23	61.42	11.47

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
		±0.09	±0.04	±0.03	±1.21	±5.14	±0.15	±0.04	±0.03	±0.02	±6.76	±1.41
11.	*Dichanthium caricosum*	1.88 ±0.15	0.90 ±0.05	0.41 ±0.01	20.90 ±0.79	46.07 ±3.44	1.16 ±0.11	0.66 ±0.09	0.30 ±0.03	0.26 ±0.03	61.47 ±2.50	15.76 ±1.49
12.	*Hackelochloagranularis*	0.85 ±0.34	0.79 ±0.45	0.22 ±0.09	10.76 ±3.79	27.85 ±6.46	0.38 ±0.32	0.27 ±0.05	0.16 ±0.03	0.12 ±0.04	44.70 ±6.56	18.82 ±2.32
13.	*Heteropogon contortus var. genuinus sub var. typicus*	3.89 ±0.22	0.39 ±0.06	0.42 ±0.03	100.89 ±12.76	109.38 ±15.26	2.39 ±0.20	0.30 ±0.02	0.32 ±0.01	0.29 ±0.01	61.40 ±3.00	8.13 ±0.59
14.	*Heteropogon contortus var. genuinus sub var. hispidissimus*	4.28 ±0.17	0.66 ±0.02	0.46 ±0.05	65.06 ±2.56	70.52 ±6.21	2.58 ±0.32	0.39 ±0.03	0.36 ±0.03	0.28 ±0.01	60.34 ±8.19	8.29 ±1.00
15.	*Heteropogon ritchiei*	4.48 ±0.03	0.39 ±0.04	0.37 ±0.03	113.18 ±9.26	94.44 ±7.37	2.69 ±0.02	0.29 ±0.02	0.28 ±0.03	0.18 ±0.01	60.06 ±6.15	6.25 ±8.73
16.	*Heteropogon triticeus*	10.20 ±1.11	2.78 ±0.17	2.46 ±0.10	36.64 ±3.00	88.21 ±3.04	6.86 ±0.59	2.07 ±0.13	1.60 ±0.21	1.34 ±0.15	67.20 ±3.63	15.72 ±1.93
17.	*Imperata cylindrica*	1.28 ±0.28	0.53 ±0.23	0.37 ±0.44	24.15 ±1.44	69.81 ±4.76	0.78 ±0.15	0.52 ±0.21	0.26 ±0.04	0.16 ±0.07	60.93 ±3.69	20.31 ±3.54
18.	*Ischaemum indicus*	1.58 ±0.12	0.71 ±0.04	0.40 ±0.02	22.02 ±1.59	56.31 ±4.69	1.18 ±0.07	0.68 ±0.05	0.28 ±0.04	0.29 ±0.02	74.67 ±2.52	17.66 ±3.49
19.	*Ischaemum molle*	2.13 ±0.31	0.88 ±0.06	0.70 ±0.03	24.41 ±2.85	79.64 ±7.13	1.29 ±0.19	0.74 ±0.12	0.52 ±0.09	0.45 ±0.08	60.59 ±3.26	24.48 ±5.27
20.	*Ischaemum pilosum*	2.47 ±0.15	0.83 ±0.03	0.69 ±0.05	29.67 ±2.06	83.09 ±7.22	1.40 ±0.12	0.71 ±0.03	0.33 ±0.06	0.26 ±0.03	56.70 ±1.79	13.42 ±2.38
21.	*Ischaemum rugosum*	2.20 ±0.20	0.99 ±0.06	0.81 ±0.07	22.26 ±2.78	82.29 ±9.72	1.45 ±0.19	0.87 ±0.07	0.41 ±0.03	0.39 ±0.08	66.07 ±4.39	18.55 ±1.32
22.	*Iseilema laxum*	1.87	0.69	0.28	27.18	40.66	1.18	0.59	0.31	0.27	63.12	16.75

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
		±0.13	±0.03	±0.01	±1.92	±1.66	±0.14	±0.03	±0.02	±0.01	±3.82	±2.64
23.	*Ophiuros exaltatus*	1.37 ±0.03	0.66 ±0.03	0.62 ±0.03	20.73 ±0.99	94.01 ±5.13	0.92 ±0.05	0.56 ±0.04	0.24 ±0.01	0.24 ±0.02	67.00 ±4.32	17.82 ±0.51
24.	*Rottboellia exaltata*	3.73 ±0.02	1.93 ±0.02	1.75 ±0.06	19.31 ±0.15	90.52 ±2.98	3.13 ±0.11	0.74 ±0.02	0.86 ±0.04	0.51 ±0.01	84.03 ±3.19	22.95 ±1.03±
25.	*Saccharum spontaneum*	1.68 ±0.07	0.51 ±0.02	0.28 ±0.01	32.97 ±0.90	55.89 ±2.76	0.64 ±0.02	0.31 ±0.02	0.35 ±0.01	0.24 ±0.01	38.09 ±1.59	20.97 ±1.20
26.	*Sehima ischaemoides*	2.71 ±0.39	0.88 ±0.06	0.53 ±0.11	30.98 ±4.41	60.35 ±10.05	1.76 ±0.28	0.79 ±0.13	0.39 ±0.13	0.29 ±0.04	64.82 ±2.88	14.27 ±4.08
27.	*Sehima nervosum*	3.18 ±0.44	0.95 ±0.05	0.57 ±0.11	33.66 ±2.79	60.22 ±9.60	2.07 ±0.35	0.81 ±0.05	0.60 ±0.06	0.37 ±0.02	64.98 ±8.33	18.94 ±3.09
28.	*Sehima sulcatum*	4.22 ±0.23	0.97 ±0.15	0.39 ±0.06	43.34 ±5.17	39.80 ±8.67	2.44 ±0.24	0.97 ±0.12	0.44 ±0.04	0.29 ±0.02	57.84 ±6.00	10.46 ±1.46
29.	*Sorghum halepense*	2.95 ±0.32	1.64 ±0.20	1.16 ±0.05	18.01 ±0.54	70.70 ±10.15	1.94 ±0.14	1.17 ±0.08	0.42 ±0.05	0.40 ±0.07	65.70 ±11.86	14.14 ±2.65
30.	*Thelepogn elegans*	3.66 ±0.12	1.36 ±0.06	1.03 ±0.07	26.94 ±1.63	76.06 ±6.05	2.33 ±0.16	1.23 ±0.22	0.55 ±0.10	0.41 ±0.07	63.69 ±2.61	14.96 ±2.38
31.	*Themeda cymbaria*	2.08 ±0.19	0.75 ±0.06	0.46 ±0.03	27.80 ±4.47	61.24 ±9.06	1.22 ±0.10	0.63 ±0.06	0.32 ±0.04	0.30 ±0.05	58.59 ±9.38	15.48 ±3.18
32.	*Themeda laxa*	2.82 ±0.43	0.74 ±0.05	0.41 ±0.04	38.18 ±7.32	55.96 ±3.57	1.79 ±0.08	0.56 ±0.01	0.38 ±0.04	0.27 ±0.02	63.21 ±11.84	13.52 ±2.92
33.	*Themeda triandra*	3.42 ±0.37	0.91 ±0.06	0.69 ±0.09	37.54 ±5.43	75.42 ±10.98	1.83 ±0.30	0.60 ±0.06	0.29 ±0.06	0.22 ±0.05	53.37 ±5.12	8.46 ±1.94
34.	*Themeda quadrivalvis*	3.5 ±0.02	1.09 ±0.03	0.39 ±0.04	31.99 ±6.36	35.47 ±3.18	1.69 ±0.03	0.81 ±0.04	0.52 ±0.24	0.31 ±0.02	48.4 ±5.20	14.85 ±1.23

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
35.	*Triplopogon ramosissimus*	2.28 ±0.24	0.73 ±0.11	1.03 ±0.12	31.17 ±6.75	140.80 ±31.21	1.31 ±0.06	0.65 ±0.02	0.33 ±0.04	0.19 ±0.01	57.39 ±9.45	14.64 ±3.19
36.	*Vetivaria zizanioides*	2.41 ±0.09	0.60 ±0.03	0.83 ±0.01	40.37 ±1.39	138.75 ±7.00	1.64 ±0.11	0.51 ±0.04	0.32 ±0.02	0.22 ±0.01	68.13 ±7.16	13.16 ±1.03
Tribe: Paniceae												
37.	*Alloteropsis cimicina*	1.76 ±0.08	1.19 ±0.06	0.47 ±0.08	14.85 ±1.01	39.39 ±6.63	1.00 ±0.03	0.62 ±0.05	0.39 ±0.04	0.25 ±0.04	56.80 ±3.25	22.00 ±3.49
38.	*Bracharia distachya*	1.91 ±0.01	1.16 ±0.01	0.54 ±0.01	16.53 ±0.09	46.32 ±0.42	1.34 ±0.01	0.66 ±0.01	0.66 ±0.01	0.31 ±0.01	70.23 ±0.34	34.45 ±0.27
39.	*Bracharia eruciformis*	1.07 ±0.03	0.68 ±0.03	0.38 ±0.03	15.73 ±0.80	55.12 ±5.53	0.64 ±0.06	0.34 ±0.09	0.27 ±0.05	0.24 ±0.05	59.10 ±5.12	25.26 ±4.74
40.	*Bracharia ramosa*	1.63 ±0.04	1.14 ±0.06	0.61 ±0.02	14.31 ±0.53	53.95 ±3.52	1.16 ±0.04	0.55 ±0.02	0.53 ±0.02	0.21 ±0.01	71.50 ±1.51	32.68 ±1.91
41.	*Bracharia reptans*	1.94 ±0.10	1.38 ±0.09	0.62 ±0.06	14.07 ±0.37	44.82 ±4.76	1.34 ±0.05	0.58 ±0.01	0.56 ±0.01	0.29 ±0.01	69.00 ±1.96	28.66 ±1.84
42.	*Cenchrus biflorus*	1.60 ±0.26	1.07 ±0.14	0.76 ±0.13	14.99 ±1.19	71.27 ±8.84	1.20 ±0.30	0.72 ±0.08	0.30 ±0.06	0.35 ±0.02	74.78 ±12.63	18.81 ±4.32
43.	*Cenchrus ciliaris*	2.42 ±0.07	0.96 ±0.07	0.54 ±0.06	25.17 ±1.75	55.91 ±7.90	1.37 ±0.12	0.71 ±0.08	0.28 ±0.04	0.24 ±0.03	56.60 ±3.68	11.39 ±1.60
44.	*Cenchrus setigerus*	1.78 ±0.07	1.09 ±0.04	0.68 ±0.04	16.22 ±0.46	62.07 ±4.17	1.30 ±0.09	0.76 ±0.10	0.28 ±0.04	0.29 ±0.05	73.49 ±2.50	15.77 ±1.96
45.	*Digitaria ciliaris*	2.12 ±0.06	0.93 ±0.02	0.55 ±0.04	22.83 ±0.98	59.26 ±5.56	0.97 ±0.06	0.59 ±0.02	0.55 ±0.06	0.32 ±0.04	46.05 ±3.53	26.16 ±3.17
46.	*Digitaria granularis*	0.87 ±0.02	0.58 ±0.03	0.43 ±0.02	14.95 ±0.83	73.00 ±4.85	0.43 ±0.04	0.23 ±0.01	0.15 ±0.03	0.11 ±0.01	49.48 ±4.93	17.76 ±3.89

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
47.	*Digitaria longiflora*	2.27 ±0.06	1.14 ±0.02	1.34 ±0.03	19.91 ±0.86	117.54 ±4.38	0.97 ±0.02	0.63 ±0.01	0.49 ±0.02	0.16 ±0.01	42.37 ±2.81	21.58 ±1.37
48.	*Digitaria stricta*	1.88 ±0.03	0.80 ±0.01	0.49 ±0.03	23.55 ±0.20	61.25 ±3.40	0.99 ±0.02	0.53 ±0.01	0.45 ±0.01	0.25 ±0.01	52.34 ±1.15	23.89 ±0.34
49.	*Echinochloa colona*	1.52 ±0.10	1.07 ±0.09	0.56 ±0.04	14.21 ±0.77	52.20 ±7.81	1.10 ±0.10	0.63 ±0.05	0.44 ±0.03	0.33 ±0.02	72.24 ±2.31	29.03 ±3.32
50.	*Echinochloa crusgalli*	1.83 ±0.08	1.40 ±0.05	0.70 ±0.05	13.06 ±0.76	50.09 ±5.25	1.51 ±0.07	0.81 ±0.06	0.44 ±0.06	0.34 ±0.01	82.96 ±1.76	24.19 ±4.21
51.	*Echinochloa stagnina*	2.67 ±0.14	2.32 ±0.07	1.54 ±0.06	11.50 ±0.36	66.59 ±3.68	2.07 ±3.68	1.13 ±0.08	0.92 ±0.10	0.90 ±0.10	77.70 ±4.90	34.45 ±3.39
52.	*Eremopogon foveolatus*	1.46 ±0.02	0.41 ±0.02	0.17 ±0.01	34.76 ±1.21	40.47 ±3.83	0.64 ±0.01	0.41 ±0.01	0.19 ±0.01	0.10 ±0.01	28.08 ±2.18	6.84 ±0.16
53.	*Eriochloa procera*	1.75 ±0.05	0.88 ±0.05	0.46 ±0.01	20.05 ±1.27	52.62 ±2.47	1.04 ±0.05	0.52 ±0.02	0.43 ±0.01	0.25 ±0.03	59.51 ±3.38	24.67 ±0.83
54.	*Oplismenus burmannii*	1.63 ±0.03	0.83 ±0.02	0.70 ±0.02	19.69 ±0.66	85.17 ±3.76	0.77 ±0.09	0.47 ±0.08	0.71 ±0.09	0.18 ±0.02	47.57 ±5.78	43.53 ±5.50
55.	*Oplismenus compositus*	1.98 ±0.09	0.89 ±0.04	0.3 ±0.02	22.25 ±2.44	33.71 ±5.29	1.18 ±0.03	0.58 ±0.04	0.38 ±0.05	0.14 ±0.02	59.49 ±2.46	19.19 ±6.16
56.	*Panicum antidotale*	1.65 ±0.03	0.95 ±0.04	0.73 ±0.01	17.43 ±0.60	76.67 ±3.01	0.96 ±0.07	0.73 ±0.06	0.35 ±0.03	0.27 ±0.05	58.27 ±5.23	21.10 ±2.12
57.	*Panicum maximum*	1.96 ±0.02	0.75 ±0.01	0.32 ±0.01	26.14 1.13	42.67 ±2.38	1.14 ±0.01	0.56 ±0.01	0.13 ±0.01	0.89 ±0.03	58.16 ±2.26	6.63 ±0.61
58.	*Panicum miliaceum*	2.04 ±0.03	1.62 ±0.07	0.92 ±0.07	12.58 ±0.60	56.93 ±6.70	1.63 ±0.05	0.93 ±0.07	0.70 ±0.07	0.24 ±0.04	79.97 ±1.85	34.56 ±2.96

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
59.	*Panicum trypheron*	1.70 ±0.03	1.24 ±0.06	0.73 ±0.02	13.73 ±0.50	58.78 ±3.62	1.27 ±0.06	0.61 ±0.01	0.54 ±0.02	0.27 ±0.04	74.37 ±2.65	31.74 ±0.92
60.	*Paspalidium flavidum*	1.34 ±0.05	1.19 ±0.04	1.02 ±0.06	11.30 ±0.53	86.04 ±6.32	1.12 ±0.07	0.60 ±0.03	0.51 ±0.02	0.26 ±0.05	83.62 ±7.66	37.72 ±2.03
61.	*Paspalidium geminatum*	1.25 ±0.03	1.15 ±0.05	0.47 ±0.01	10.91 ±0.50	40.77 ±2.10	0.65 ±0.01	0.47 ±0.02	0.36 ±0.02	0.23 ±0.04	52.00 ±1.16	28.45 ±1.12
62.	*Paspalum scrobiculatum*	2.17 ±0.06	2.06 ±0.02	1.34 ±0.08	10.53 ±0.29	65.22 ±3.93	1.12 ±0.05	0.90 ±0.10	0.94 ±0.04	0.27 ±0.02	51.61 ±2.56	43.55 ±2.72
63.	*Pennisetum setosum*	1.65 ±0.11	0.59 ±0.03	0.24 ±0.01	28.16 ±2.46	41.07 ±1.73	0.76 ±0.06	0.40 ±0.03	0.28 ±0.03	0.24 ±0.01	46.19 ±5.27	17.08 ±1.93
64.	*Setaria glauca*	1.59 ±0.09	1.00 ±0.04	0.51 ±0.05	15.90 ±0.48	51.10 ±5.36	1.18 ±0.20	0.62 ±0.06	0.28 ±0.03	0.23 ±0.02	74.19 ±11.28	17.43 ±1.32
65.	*Setaria tomentosa*	1.29 ±0.10	0.90 ±0.08	0.50 ±0.03	14.40 ±1.37	55.97 ±2.24	0.88 ±0.09	0.51 ±0.03	0.28 ±0.02	0.21 ±0.01	67.75 ±5.46	21.89 ±1.53
66.	*Setaria verticillata*	1.54 ±0.02	1.06 ±0.02	0.65 ±0.02	14.48 ±0.39	60.71 ±2.33	1.19 ±0.02	0.57 ±0.02	0.34 ±0.03	0.25 ±0.02	77.39 ±2.15	21.86 ±2.12
Group: Pooideae												
Tribe: Isachneae												
67.	*Isachne globosa*	1.06 ±0.04	0.93 ±0.09	0.62 ±0.04	11.39 ±0.88	66.61 ±7.90	0.26 ±0.02	0.42 ±0.04	0.72 ±0.03	0.10 ±0.01	24.68 ±1.79	68.15 ±4.23
Tribe: Aristideae												
68.	*Aristida adscensionis*	5.05 ±0.60	0.26 ±0.03	0.28 ±0.03	192.84 ±36.99	108.55 ±10.53	0.76 ±0.14	0.30 ±0.18	0.54 ±0.08	0.21 ±0.06	15.02 ±2.84	10.67 ±2.16
69.	*Aristida funiculata*	3.77 ±0.21	0.52 ±0.05	0.53 ±0.08	71.92 ±8.06	100.99 ±20.50	1.84 ±0.27	0.42 ±0.01	0.27 ±0.04	0.17 ±0.02	48.84 ±6.22	7.13 ±0.83

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
Tribe: Perotideae												
70.	*Perotis indica*	1.74 ±0.06	0.29 ±0.02	0.31 ±0.04	60.92 ±3.98	106.85 ±14.93	0.58 ±0.06	0.21 ±0.02	0.17 ±0.03	0.14 ±0.01	33.40 ±3.93	9.96 ±2.06
Tribe: Chlorideae												
71.	*Chloris barbata*	1.42 ±0.08	0.52 ±0.06	0.39 ±0.07	27.50 ±3.11	75.85 ±15.77	0.96 ±0.08	0.32 ±0.06	0.14 ±0.03	0.12 ±0.01	67.81 ±6.04	9.70 ±1.98
72.	*Chloris montana*	1.45 ±0.05	0.64 ±0.02	0.53 ±0.02	22.58 ±0.42	82.92 ±1.46	1.14 ±0.04	0.48 ±0.02	0.20 ±0.02	0.13 ±0.02	78.13 ±1.46	13.48 ±0.72
73.	*Chloris virgata*	1.70 ±0.11	0.50 ±0.05	0.52 ±0.06	33.97 ±4.60	103.03 ±9.59	1.28 ±0.10	0.44 ±0.04	0.15 ±0.01	0.12 ±0.03	74.92 ±1.70	8.62 ±0.49
74.	*Cynodon dactylon*	1.35 ±0.05	0.55 ±0.06	0.71 ±0.03	24.70 ±3.60	130.03 ±16.20	0.67 ±0.09	0.34 ±0.02	0.28 ±0.07	0.23 ±0.05	49.87 ±7.41	21.11 ±4.79
75.	*Melanocenchris jaequemontii*	1.65 ±0.06	0.64 ±0.02	0.26 ±0.01	25.95 ±0.84	41.31 ±2.31	0.76 ±0.07	0.42 ±0.02	0.19 ±0.01	0.17 ±0.01	46.22 ±5.50	11.25 ±0.92
76.	*Oropetium villosulum*	0.83 ±0.01	0.19 ±0.02	0.22 ±0.01	44.36 ±4.33	116.87 ±12.97	0.28 ±0.02	0.13 ±0.01	0.05 ±0.01	0.08 ±0.01	33.39 ±2.15	5.44 ±0.58
77.	*Sachoenefeldia gracilis*	1.87 ±0.05	0.40 ±0.01	0.56 ±0.02	46.35 ±0.86	139.42 ±5.16	1.03 ±0.06	0.32 ±0.02	0.18 ±0.02	0.13 ±0.02	55.36 ±3.62	9.37 ±1.00
78.	*Tetrapogon tenellus*	2.32 ±0.12	0.88 ±0.04	1.07 ±0.07	26.31 ±35.53	121.04 ±3.72	1.40 ±0.03	0.50 ±0.03	0.43 ±0.03	0.24 ±0.04	60.28 ±2.26	18.57 ±6.24
79.	*Tetrapogon villosus*	2.81 ±0.18	0.80 ±0.07	0.72 ±0.06	35.35 ±4.93	90.32 ±13.47	1.63 ±0.10	0.68 ±0.06	0.29 ±0.05	0.24 ±0.01	58.12 ±4.73	10.19 ±1.83
Tribe: Eragrosteae												

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
80.	*Acrachne racemosa*	0.84 ±0.07	0.52 ±0.03	0.41 ±0.06	16.12 ±1.49	79.76 ±13.81	0.46 ±0.05	0.33 ±0.03	0.11 ±0.01	0.12 ±0.01	54.36 ±6.51	12.63 ±1.51
81.	*Dactyloctenium aegyptium*	0.92 ±0.05	0.46 ±0.03	0.73 ±0.05	19.87 ±0.56	157.24 ±17.51	0.43 ±0.06	0.30 ±0.05	0.15 ±0.01	0.13 ±0.03	46.66 ±4.32	16.33 ±1.63
82.	*Dactyloctenium sindicus*	1.01 ±0.07	0.51 ±0.04	0.70 ±0.06	19.65 ±1.14	137.39 ±2.27	0.37 ±0.05	0.29 ±0.03	0.14 ±0.01	0.11 ±0.01	36.42 ±6.70	13.87 ±0.85
83.	*Desmostachya bipinnata*	0.75 ±0.15	0.39 ±0.05	0.48 ±0.05	19.08 ±3.84	121.60 ±15.76	0.34 ±0.07	0.25 ±0.02	0.10 ±0.02	0.11 ±0.03	44.65 ±15.23	13.13 ±3.88
84.	*Dinebra retroflexa*	1.34 ±0.04	0.44 ±0.03	0.45 ±0.02	30.59 ±2.25	103.75 ±12.32	0.59 ±0.05	0.30 ±0.03	0.23 ±0.04	0.18 ±0.05	43.87 ±4.38	17.31 ±2.50
85.	*Eleusine indica*	1.35 ±0.13	0.61 ±0.03	0.58 ±0.05	22.10 ±2.29	95.34 ±7.38	0.41 ±0.02	0.35 ±0.03	0.20 ±0.02	0.17 ±0.03	30.63 ±4.35	14.90 ±2.52
86.	*Eragrostiella bachyphylla*	2.34 ±0.03	0.51 ±0.02	0.94 ±0.01	45.88 ±2.81	145.09 ±12.18	1.12 ±0.04	0.37 ±0.01	0.22 ±0.02	0.08 ±0.00	47.86 ±4.83	3.42 ±0.28
87.	*Eragrostiella bifaria*	0.66 ±0.02	0.39 ±0.02	0.40 ±0.02	16.75 ±1.15	101.37 ±6.25	0.26 ±0.02	0.28 ±0.01	0.09 ±0.01	0.08 ±0.01	39.47 ±2.03	13.71 ±0.93
88.	*Eragrostis cilianensis*	0.49 ±0.01	0.40 ±0.02	0.41 ±0.02	12.25 ±0.55	102.32 ±2.83	0.17 ±0.03	0.17 ±0.03	0.09 ±0.01	0.09 ±0.01	35.58 ±6.24	17.73 ±1.11
89.	*Eragrostis ciliaris*	0.47 ±0.01	0.26 ±0.02	0.26 ±0.01	18.45 ±0.72	100.70 ±5.32	0.18 ±0.02	0.16 ±0.01	0.08 ±0.01	0.07 ±0.01	38.88 ±5.43	17.83 ± 1.50
90.	*Eragrostis japonica*	0.47 ±0.01	0.23 ±0.01	0.25 ±0.01	20.46 ±0.79	106.89 ±4.45	0.15 ±0.03	0.13 ±0.04	0.07 ±0.01	0.07 ±0.01	31.91 ±6.38	15.30 ±2.82
91.	*Eragrostis nutans*	0.53 ±0.01	0.24 ±0.02	0.23 ±0.02	22.34 ±2.16	98.64 ±11.58	0.24 ±0.03	0.15 ±0.02	0.08 ±0.01	0.06 ±0.01	45.64 ±5.28	14.57 ±0.64

Sr. No.	Name of Plant	Length (mm)	Breadth (mm)	Thickness (mm)	L:B Ratio	T:B Ratio	Embryo		Hilum		Embryo %	Hilum %
							Length (mm)	Breadth (mm)	Length(mm)	Breadth (mm)		
92.	*Eragrostis pilosa*	0.74 ±0.05	0.34 ±0.01	0.42 ±0.01	21.50 ±1.70	120.89 ±5.05	0.46 ±0.03	0.18 ±0.01	0.10 ±0.01	0.11 ±0.01	61.75 ±5.77	13.33 ±1.60
93.	*Eragrostis tenella*	0.55 ±0.02	0.30 ±0.02	0.29 ±0.02	18.19 ±1.39	96.33 ±9.81	0.26 ±0.01	0.16 ±0.02	0.06 ±0.01	0.05 ±0.01	47.82 ±3.34	11.69 ±2.03
94.	*Eragrostis tremula*	0.55 ±0.03	0.38 ±0.02	0.50 ±0.02	14.48 ±1.42	131.36 ±9.38	0.27 ±0.03	0.25 ±0.01	0.07 ±0.01	0.07 ±0.01	49.82 ±5.76	13.46 ±0.78
95.	*Eragrostis unioloides*	0.69 ±0.04	0.19 ±0.01	0.40 ±0.03	35.51 ±3.67	204.66 ±17.35	0.33 ±0.04	0.17 ±0.02	0.09 ±0.01	0.07 ±0.01	48.76 ±4.35	12.55 ±1.86
96.	*Eragrostis viscosa*	0.25 ±0.01	0.14 ±0.01	0.17 ±0.01	17.33 ±0.86	117.20 ±6.85	0.16 ±0.03	0.09 ±0.01	0.06 ±0.01	0.05 ±0.01	64.08 ±15.37	24.46 ±3.38
Tribe: Sporoboleae												
97.	*Sporobolus coromardelianus*	0.96 ±0.05	0.28 ±0.05	0.60 ±0.03	34.65 ±4.93	217.12 ±42.34	0.47 ±0.03	0.14 ±0.03	0.16 ±0.01	0.10 ±0.01	48.60 ±1.95	16.26 ±0.93
98.	*Sporobolus diander*	1.09 ±0.11	0.46 ±0.03	0.61 ±0.03	23.46 ±1.37	132.18 ±11.84	0.55 ±0.06	0.33 ±0.02	0.18 ±0.03	0.16 ±0.02	50.64 ±7.66	16.13 ±1.07
99.	*Sporobolus indicus*	0.49 ±0.02	0.22 ±0.01	0.22 ±0.01	22.47 ±1.62	101.10 ±8.04	0.25 ±0.01	0.14 ±0.01	0.04 ±0.01	0.03 ±0.01	50.33 ±0.42	8.31 ±0.85
Tribe: Zoysieae												
100.	*Tragrus biflorus*	1.50 ±0.11	0.57 ±0.04	0.40 ±0.04	26.51 ±3.37	71.60 ±11.91	0.80 ±0.06	0.39 ±0.05	0.21 ±0.01	0.19 ±0.01	53.09 ±5.44	14.30 ±1.01

*L = Length, B = Breadth, T = Thickness, L:B = (Length/Breadth) × 10, T:B = (Thickness/Breadth) × 100

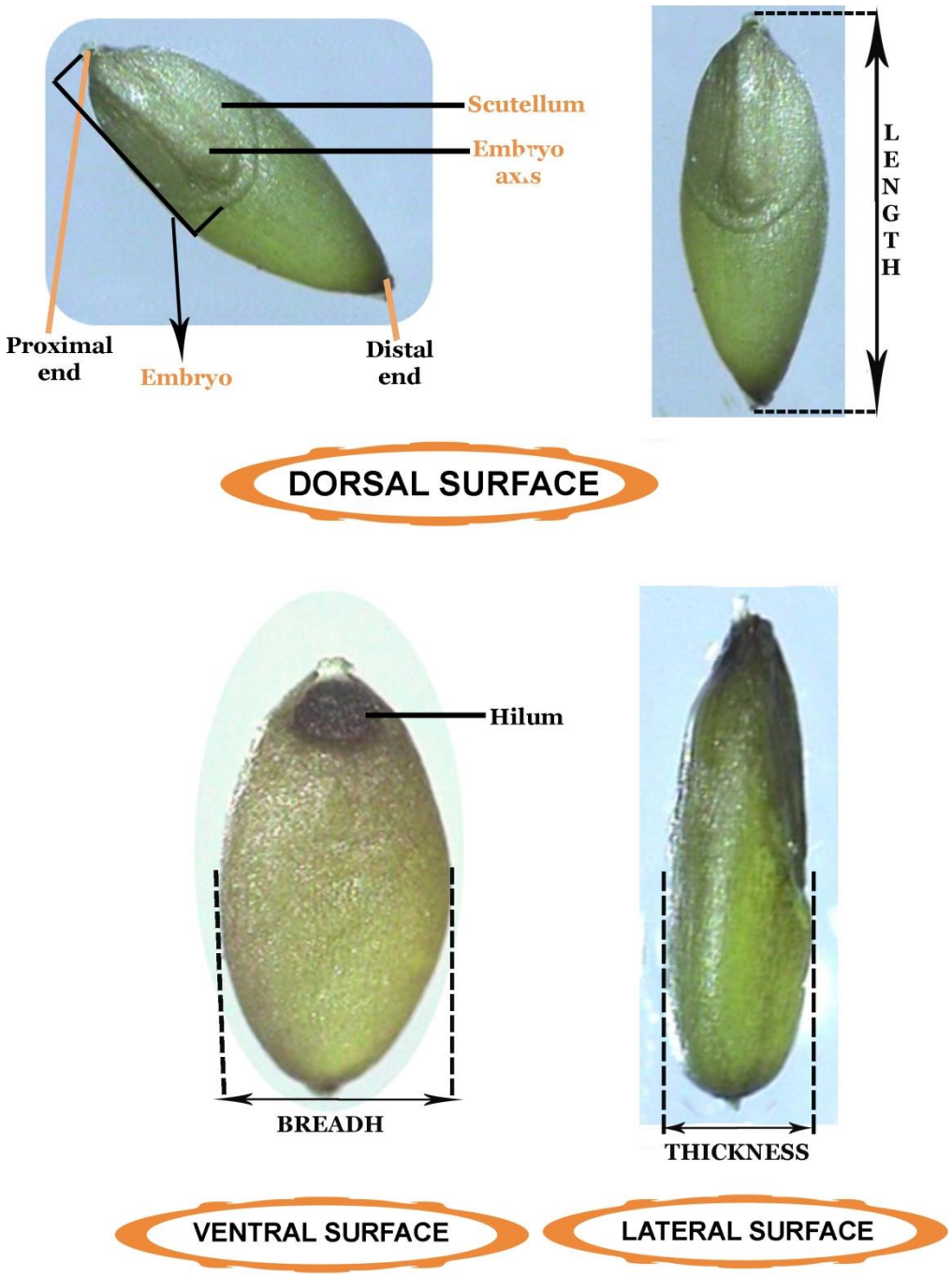


Fig. 53 Grass caryopses features

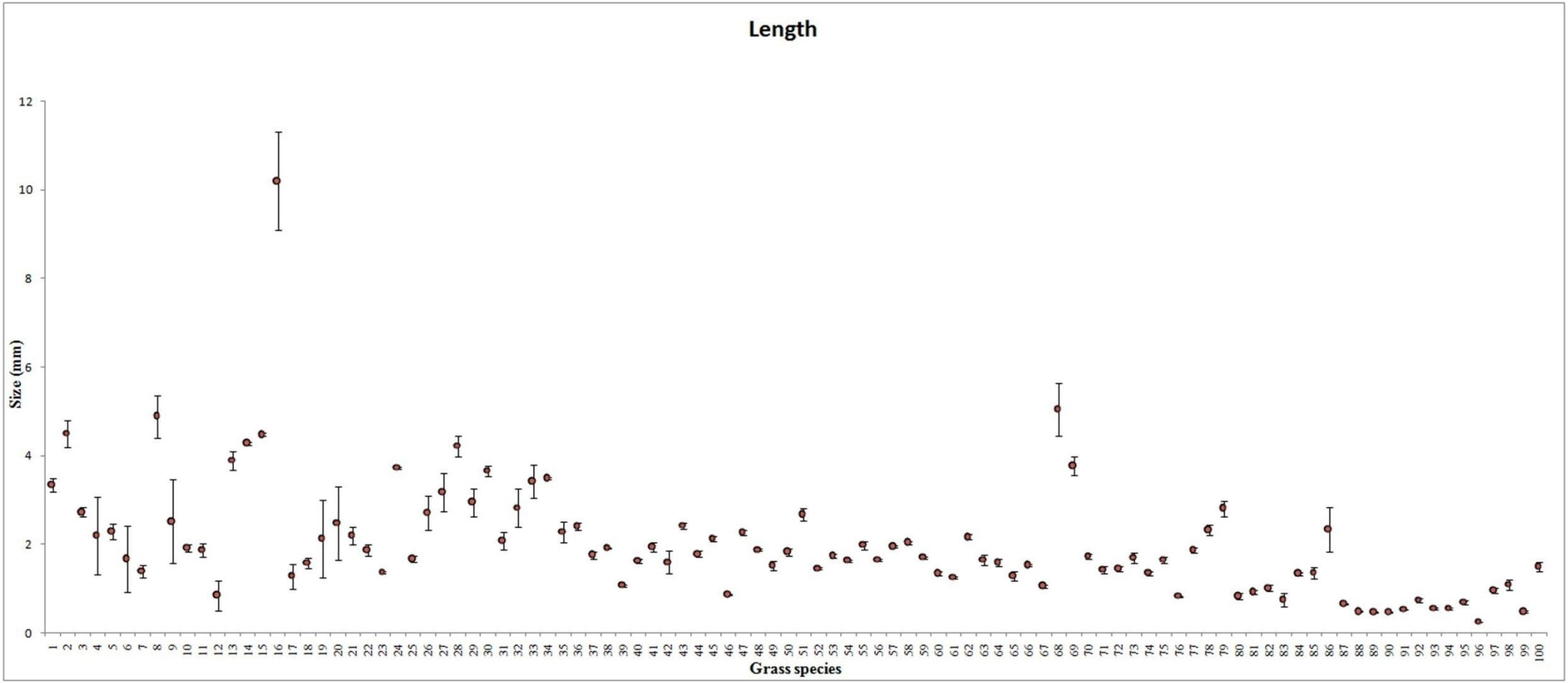


Fig. 54 Graph showing variations in length of caryopses

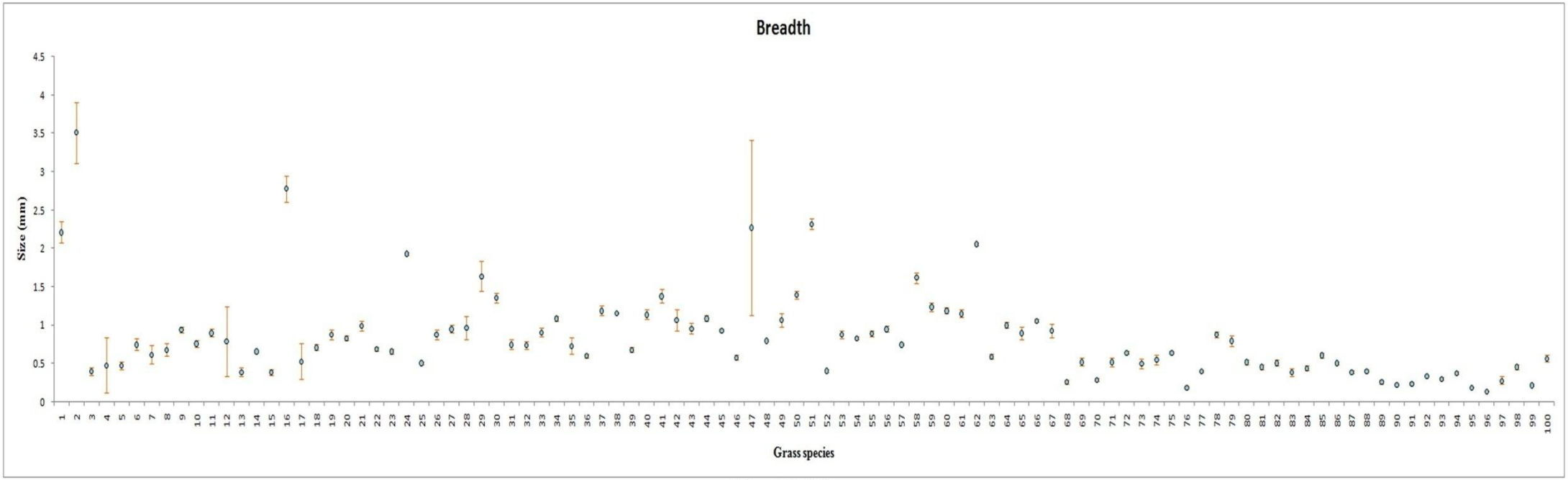


Fig. 55 (a)

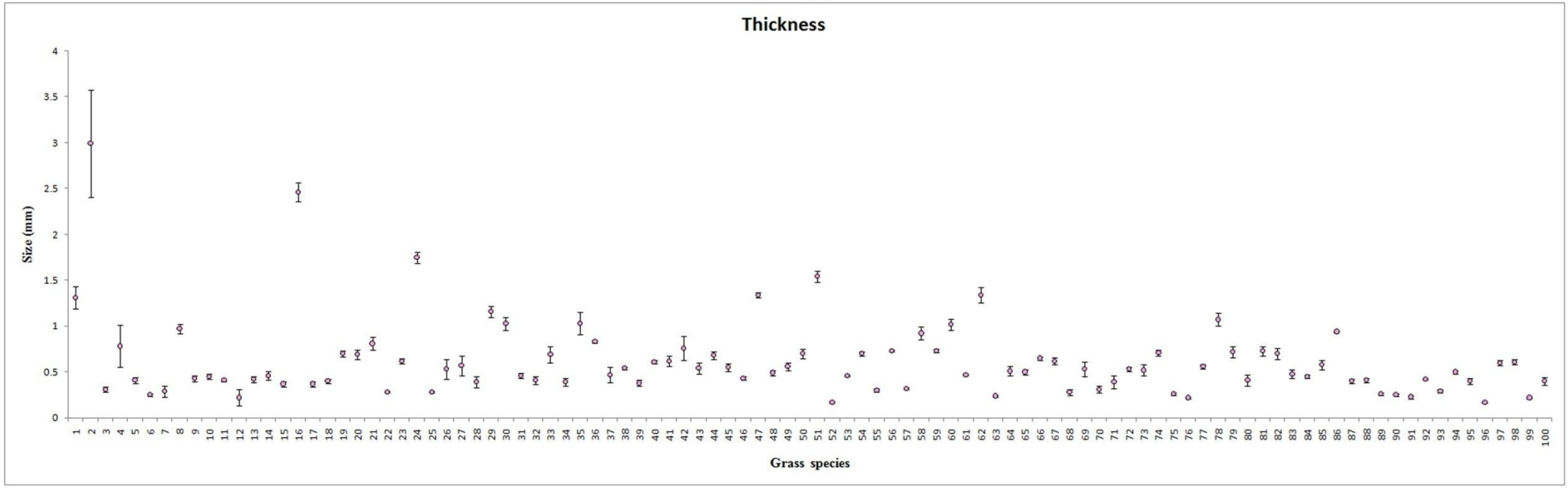


Fig. 55 (b)

Fig. 55 (a) Graph showing ranges of breadth in caryopses Fig. 55 (b) Graph showing ranges of thickness in caryopses

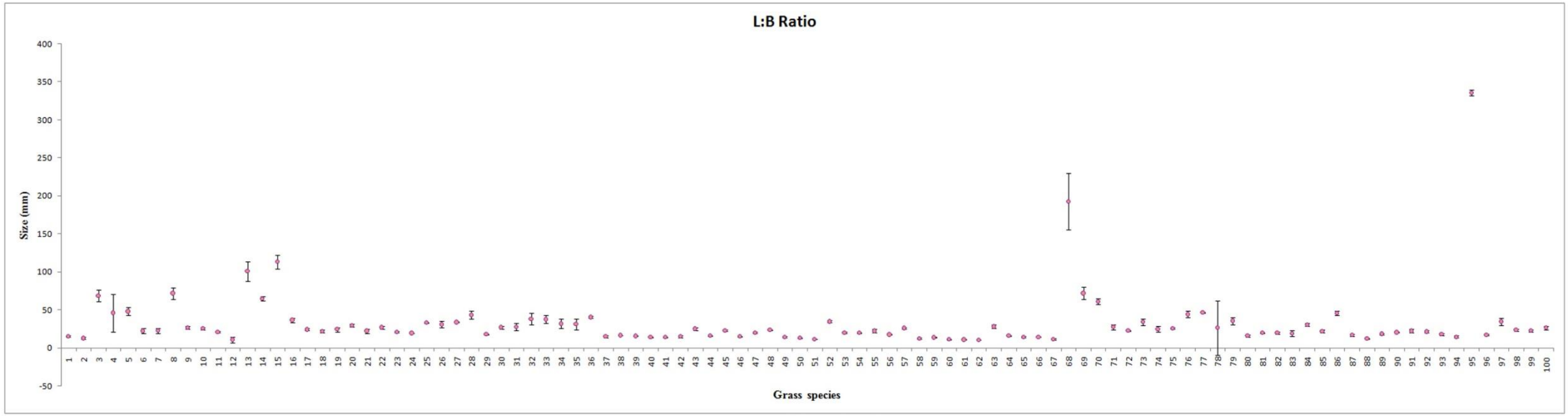


Fig. 56 (a)

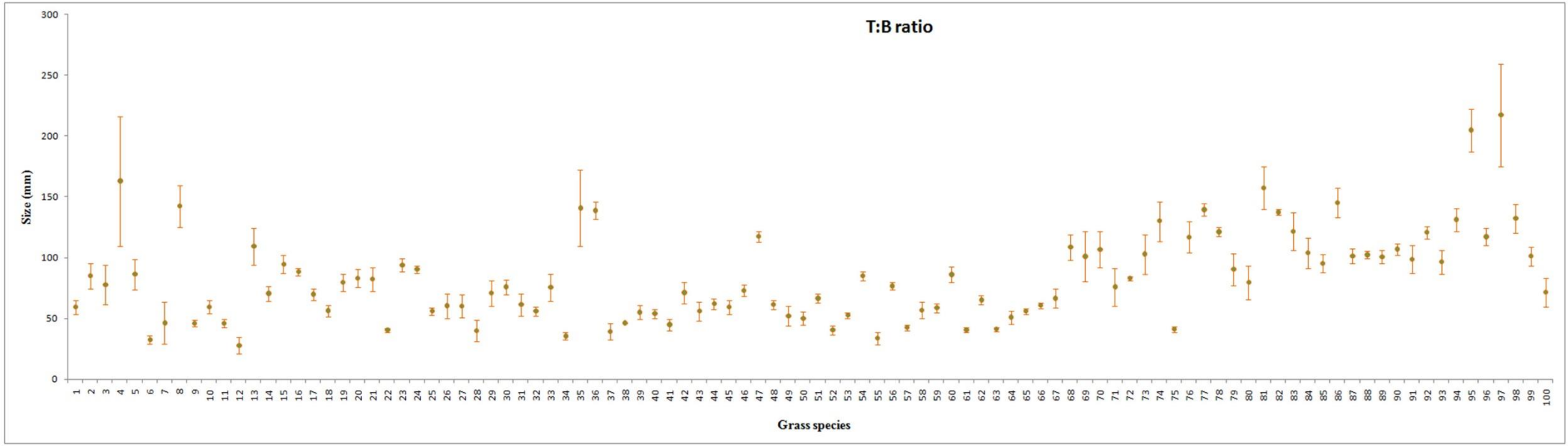


Fig. 56 (b)

Fig. 56 (a) Graph showing variations in L:B ratio in caryopses Fig. 56 (b) Graph showing variations in T:B ratio in caryopses

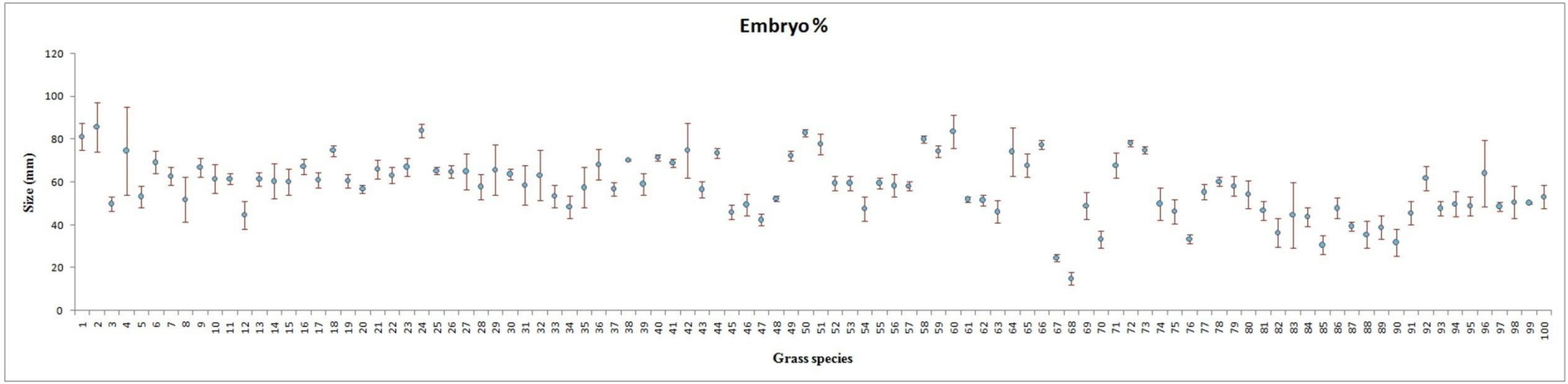


Fig. 57 (a)

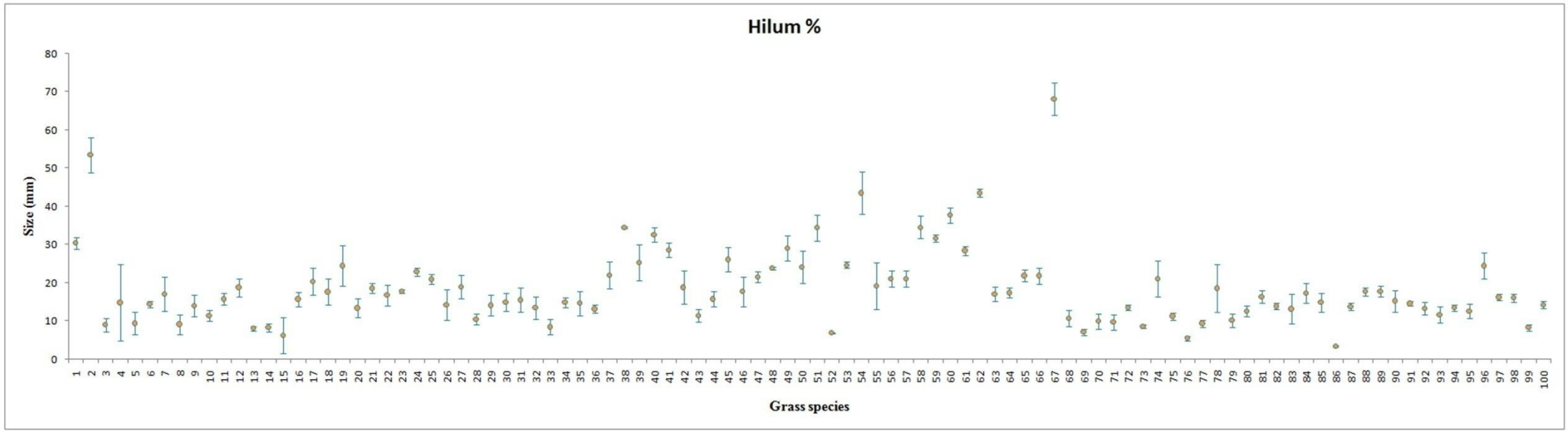


Fig. 57 (b)

Fig. 57 (a) Graph showing variations in embryo % in caryopses Fig. 57 (b) Graph showing variations in hilum % in caryopses

Discussion

Nesbitt (2006) caterised caryopses into three classeson the bases of length: short (<3), medium (3.1-4.99) and long (>5). Members of tribe Maydeae belongs to the class medium. Most of the caryopses of tribe Andropogoneae belongs to the short class but only *Heteropogon triticeus* (10.20mm) belongs to the class large. Species like *Heteropogon contortus*, *Heteropogon ritchei*(4.48mm), *Rottboellia exaltata* (3.73mm), *Thelepogon elegans* (3.66mm), *Sehima nervosum* (3.18mm), *Sehima sulcatum* (4.22mm), *Themeda triandra* (3.42mm), *Themeda quadrivalvis* (3.5mm) were belongs to the class medium. Among all the caryopses of studied species in tribe Paniceae belongs to the short class. Among the group pooideae, caryopses of all tribes like Ischaneae, Chlorideae, Perotideae, Eragrosteae, Sporoboleae, Zoysieae were belongs to the short class while only tribe Aristideae caryopses belongs to the different class. *Aristida adscensionis* (5.05mm) belongs to the large class and *Aristida funiculata* (3.77mm) belongs to the medium class. Among the studied species, only two species were belongs the large class and most of species belongs to the short class. Among the studied grass species the length the grass species was found minimum in *Eragrostis ciliaris* (0.47mm), *Eragrostis japonica* (0.47mm) and maximum in *Heteropogon triticeus* (10.20mm) while the breadth was minimum in *Eragrostis viscosa* (0.14mm) and maximum in *Coix lachyrma-jobi* (3.51mm).

On the basis of length and breadth, L:B ratio caluculated which indicates the narrowness of the caryopses. When length was more compared to the breadth than caryoses was narrow. Narrowness is a valuable character in seperating genera. If L:B ratio is 10 that means length and breadth are equal. If L:B ratio 20 than caryopses twice as long as breadth. If it is 100 than caryopses ten times as long as broad. *Paspalum scorbiculatum* showed 10.53 L:B ratio that means length and breadth of caryopses all most similar so that caryopses was look globular in shape while *Aristida adscensionis* have 192.84, so caryopses appeared narrow. Other than this, *Heteropogon ritcheii* (113.18) and *Heteropogon contortus* var. *genuinus* sub var. *typicus* (100.89) showed ratio above 100 that means those caryopses also appeared narrow.

Rather than length and breadth, thickness also play important role in caryopses morphology. With the help of thickness and breadth T:B ratio can calculated. This is also known as compression ratio and it is a valuable diagnostic feature for characterisation of grass infloroscence. When difference between thickness and breadth becomes more than the ratio will come more and vice versa.If T:B ratio is

above 100 than caryopses is dorsally compressed, if T:B ratio is less than 100 than caryopses is laterlly compressed and if T:B ratio is equal to 100 than caryopses is non compressed. Among the studied species 24 species showed T:B ratio above the 100 i.e. they are dorsally compressed caryopses. But out of these 24 species, few species like *Aristida funiculata, Eragrostiella bifaria, Eragrostis cilianensis, Eragrostis ciliaris, Eragrostis japonica, Sporobolus indicus, Eragrostis nutans* have T:B ratio near by 100.

Most of caryopses of the studied speices are laterally compressed. Likewise length of embryo is relative to the length of the caryopses. Reeder (1961) illustrated grasses into two groups based on the embryo size.

(1). True festucoids (current subtribes Festucoideae, Pooideae and Aruninoideae) with small embryos. Small embryo size that means relatively large food reserves in the endosperm. The grasses which are adapted to grow under shady habitats, where stored food is essential to support the seedling until it start photosynthesis.

(2). True Panicoids (Chlorideae and Panicoideae) with large embryos. Large embryo size that means relatively small/less food reserves in the endosperm. The grasses which are grow in moist and relatively warm tropical conditions where the embryo needs less support from food reserves.

Among the studied caryopses of group Panicoideae, only *Eremopogon* have small embryo size (28%) while *Hackelochloa granularis, Themeda quadrivalvis, Digitaria ciliaris* and *Digitaria longiflora* have embryo size in between 40%-50%. Rather than these species, all species showed embryo % above 50. That means 95% species of Panicoideae group belongs to the large embryo size i.e. they are true panicoids.

Among the studied caryopses of Pooideae 95% species showed small embryo size. *Sachenelfeldia gracilis* (55.36%), *Tetropogon villosus* (58.12%), *Arcrachne ramosa* (54.36%), *Sporobolus diander* (50.64%), *Sporobolus indicus* (50.33%) and *Tragus biflorus* (53%) have embryo size between 50%-60%. *Chloris barbata, Chloris virgata, Chloris montana, Tetropogon tenellus, Eragrostis pilosa, Eragrostis viscosa* have above 60%.

Hilum % is also one of the good character. Among the studied caryopses of *Ischanae globosa, Aristida* sps. showed linear hilum. Out of that only *Ischanae globosa* (68.15%) have hilum% above 59% while *Aristida adscensionsis* and *Aristida funiculata* have 10.17 % and 7.13% hilum% respectively. Other studied species of caryopses showed either basal or subbasal hilum and all have hilum % below 50%.

3.4. Caryopses Morphology

For the light microscopic study shape, colour, compression, dorsal/lateral striations, ventral groove, scutellum shape, embryo type, embryo class, hilum type, hilum shape were considered and for the scanning electron microscopy surface of each individual species i.e. dorsal, ventral and lateral including embryo and hilum features of caryopses were taken into consideration. Photographs of studied species represented in Figs. 58-101.

Microscopic study:

The studied species belongs to the different tribes and a great variation in the microscopic features have been noted. For the light microscopic total 12 different morphological features like shape, colour, texture, compressions, straitioins, ventral groove, scutellum shape, embryo type and class, Hilum shape, type and visibility were noted and are represented in Table 15.Microscopic features appear to be different on the dorsal, ventral and lateral surfaces of the caryopses. These features appear to differ between different genera as well as between species of the same genera. Variational features observed under different views in the studied species have been represnted in Figures 58-67. Shape of the caryopses ranges from ovate, obovate, oblong, ovoid, linear to fusiform. Around 90% of the species have smooth surface (eg. *Eragrostis*, *Brachaira*, *Cenchrus* etc.) either with a shiny or dull appearance while remaining 10% species have rough surface (eg. *Dactyloctenium, Eleusine* etc.). Caryopses are either compressed or not compressed. If they are compressed than either dorsally or laterally compressed. Around 80% species show dorsally compressed caryopses. Most of the species belonging to tribe Maydeae, Andropogoneae and Paniceae.Most of the members in Eragrosteae show non compressed caryopses. On the dorsal side of the caryopses embryo is present. Generally embryo axis is surrounded by the scutellum. Sometimes clear and prominent embryo axis is seen which is surrounded by band of scutellum and sometimes scutellum band is narrow or indistinct with an indistinct embryo axis. Based on these characters embryo could be categorised into two types:

(i) N type: clearly defined embryo axis and scutellum

(ii) L type: 'blob-like' embryo without clear embryo axis and invisible or very narrow scutellum

In the studied species most of the members of Andropogoneae, Paniceae, Chlorideae, Eragrosteae and Sporoboleae has N-type of embryo while members of Maydeae, Perotideae, Ischaneae and Aristideae has L-type of embryo. Scutellum also has two types based on the shape of it and is either sickle shaped of V-shaped. Most of the members of Andropogoneae, Chlorideae and Sporoboleae have sickle shaped scutellum. 50% members of Paniceae have sickle shaped scutellum while 50% have V-shaped scutellum. In the Eragrosteae, species of *Eragrostis* have V-shaped scutellum while others have sickle shaped scutellum. Similarly on the ventral side, towards the proximal end hilum is present. Hilum is the attachment scar of the funicle. It refers only to the scar left on the seed by the stalk of the ovule (Guest, 1966). In grasses, hilum is present on ventral surface and towards the proximal end.

Nesbitt divided the type of hilum into eight groups which are follows (2006):

(i) Linear (long type) - narrow, over 50% of the caryopsis length

(ii) Linear (short type) - narrow, under 50% of the caryopsis length
(iii) Basal – oval type
(iv) Basal – circular
(v) Basal – fan shaped: obovate or wedge shaped, usually in a distinct depression
(vi) Basal – 'V' shaped: a 'V' shaped thickening projecting from the bottom of the ventral side; exact morphology unclear
(vii) Basal – linear
(viii) Basal – unclear

Based on observations of the studied species hilum could be categorized on the basis of:

(I) Position of hilum
  (i) Basal
  (ii) Sub basal
  (iii) Linear
    (a) Long (extending throughout the length of caryopses)
    (b) Short (extending upto 3/4th of the caryopses length)

(II) Shape of the hilum
  (i) Oval
  (ii) Fan shaped
  (iii) Circular
  (iv) Linear
  (v) 'V' shaped

Member of Ischaneae, Aristideae and Perotideae have linear hila while members of other tribes have either basal or sub basal hila. If linear type of hilum is present than either it is short and long but if basal or sub basal hilum is present than there are different shapes are present. Either oval shape, circular shape, fan shape or V-shaped.

Surface topographical features of dorsal, ventral and lateral surface, embryo and hilum are represented in Table 16. Microphotographs of the diagnostic features are represented in figures 68-101. Most of the members have reticulate type of pattern on their surface. This reticulate pattern has either undulating wall or straight wall. Undulations also have different types: wavy wall or '∩' shaped,'Ω' shaped or 'ʌ' shaped. In this undulation either they have smooth angled or sharp angled or they also have either broad undulation or narrow undulation. One unit of the reticulate pattern known as reticulum. Within this reticulum interspace is present. This interspace is shallow, concave or sunken; depend upon the elevation of the wall. Apart from reticulate pattern, ruminate or blister or rugose pattern are also seen. Hilum of most of species have ruminate pattern and they also show folded walls which are running either in same direction or in different directions.

Cluster analysis:

The software used displays a single tree among the possible ones (Fig. 102). In the dendrogram based on the morphological characters of the caryopses.

The following features are taken into consideration for the preparation of dendrogram:

I. Texture (4 criteria)
Smooth shiny (1), Smooth (2), Rough (3), Smooth dull (4)

II. Compression (3 criteria)
Dorsally compressed (1), Laterally compressed (2), Not compressed

III. Dorsal/Lateral straitions (2 criteria)
Present (1), Absent (2)

IV. Ventral groove (2 criteria)
Present (1), Absent (2)

V. Scutellum shape (2 criteria)
V-shaped (1), Sickle shaped (2)

VI. Embryo type (2 criteria)
N-type (1), L-type (2)

VII. Embryo class (2 criteria)
Large (1), Short (2)

VIII. Hilum type (3 criteria)
Basal (1), Sub basal (2), Linear (3)

IX. Hilum shape (8 criteria)
Circular (1), V-shaped (2), Oval (3), Fan (4), Long (5), Short (6), Linear (7), Semi circular (8)

Majorly two clusters form with the similarity at 50.31%. Under one major cluster only one sub cluster is present and is cluster 10, which have three species with the similarity about 84%. Other nine clusters are present under the second major group. The observations are presented in Table 17.

Cluster 1 shows highest number of species with about 83% of similarity with the other clusters. In this cluster 47 species were present. Out of those few species like *Tragus, Alloteropis, Heteropogon* shows 100% similarity i.e. on the basis of cladogram they all are have same characteristic features, so these species further classified on the basis of morphometric and scanning electron microscopic features.

Clusters 6, 9 and 10 have two species in their clusters. Clusters 6 and 9 are more closely compared to cluster 10. They have maximum value 0.50 from centroid while cluster 10 have 0.71 from the centroid. Cluster 6 shows similarity at about 95%. Both the species belongs to the tribe Eragrostedeae and genus *Dctyloctenium.* Cluster 9 shows similarity at about 91%. These species also belongs to tribe Eragrostedeae but different genera i.e. *Acrachnae ramose* and *Eleusine indica.* All most all features belong to the large embryo class while *Eleusine* belongs to the short embryo class. Cluster 10 also shows similarity at about 95%. These two species belongs to the different tribes. *Thelepogon elegans* belongs to the tribe Andropogoneae and *Melanocenchris* belongs to tribe Chlorideae. Both the species have sickle shaped scutellum, 'L' type of embryo and belongs to the large embryo class. But *Thelepogon* have 'V' shaped basal hilum while *Melanocenchris* have circular shaped sub basal hilum.

Clusters 4 and 7 have three numbers of species. Cluuster 4 shows similarity at about 83%. Cluster 4 has maximum value 1.00 from centroid while cluster 7 has one species from tribe Ischanae and other two speices from the tribe Aristideae. These

species shows linear type of hilum, 'V' shaped scutellum, 'L' type of embyo and prescence of dorsal/lateral straitions. Cluster 7 shows similarity at about 85% and have maximum value 1.05 from centroid. In this cluster two species of *Digitaria* and *Imperata* are present.

Clusters 2 and 8 have seven numbers of species. Cluster 2 shows similarity at about 95% while cluster 8 shows similarity at about 86%. All the species of cluster 8 have large type of embryo class. *Brachairia distachya* have 'V' shaped sceutellum while others have sickle shaped scutellum. Only *Sehima nervosum* shows prescence of ventral groove while other species shows absence of it.

Light and Scanning Electon microscopic features

1. *Chionachne koenigii*

Light microscopy (Fig. 58(1))

Color: White to creamish **Shape:** Ovate to obovate
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** L
Embryo class: Large **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 69(1))

Dorsal surface: Rugose ruminate, undulating wall, strong even undulation
Ventral surface: Rugose ruminate, undulating wall, strong even undulation
Lateral surface: Scalariform, both walls elevated, wide
Embryo surface: Reticulate, long rectangular reticulum, undulating walls, depressions between reticulum
Hilum surface: Rugose, both walls feebly undulating elevated and flat wall

2. *Coix lachryma-jobi*

Light microscopy (Fig. 58(2))

Color: Dull yellowish to lightish brown **Shape:** Suborbicular
Texture: Smooth, dull**Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 68)

Dorsal surface: Ruminate rugose, uneven elevated walls, big and irregular depressions
Ventral surface: Reticulate rugose-foveate, uneven elevated, thick and flat walls, smooth and irregular elevations, deep depressions between reticulum
Lateral surface: Ruminate rugose, undulate uneven elevated walls, big and irregular depressions

Embryo surface: Ruminate rugose, convolute walls, proximal end undulate and distal end reticulate blister, rugose and foveate, concave interspace

Hilum surface: Reticulate rugose, smooth undulate and narrow wall, irregular deprrsions towards the proximal end of caryopsis

3. ***Andropogon pumilus***

Light microscopy (Fig. 58(3))

Color: Light yellowish to cream **Shape:** Oblong, slender
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 69(3))

Dorsal surface: Striate reticulate, elongated and thin reticulum, thick and feebly undulating walls

Ventral surface: Reticulate, rectangular reticulum, thin, narrow, slightly undulating wall

Lateral surface: Striate reticulate, elongated and thin reticulum, thick and feebly undulating walls

Embryo surface: Reticulate, squarish to rectangular reticulum, thick, flat wall, straight horizontal depressions present on the surface

Hilum surface: Striate ribbed

4. ***Apluda mutica***

Light microscopy (Fig. 58(4))

Color: Light brown to brown **Shape:** Ovate
Texture: Smooth, shiny **Compression:** Laterally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 69(4))

Dorsal surface: Reticulate, undulating periclinal walls, '∩' and 'ʌ' shaped undulation, flat, straight or slant anticlinal walls

Ventral surface: Reticulate, undulating perclinal walls, 'ʌ' shaped undulation pattern, flat, straight anticlinal walls

Lateral surface: Reticulate, undulating periclinal walls, '∩' and 'ʌ' shaped undulation, flat, straight or slant anticlinal walls

Embryo surface: Reticulate, undulating periclinal walls, '∩' shaped undulation, flat, straight anticlinal walls

Hilum surface: Reticulate, feebly undulating walls

5. ***Arthraxon lanceolatus***

Light microscopy (Fig. 58(5))

Color: Whitish green to light brown **Shape:** Oblong
Texture: Smooth, shiny **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 70(5))

Dorsal surface: Reticulate, feebly undulating walls
Ventral surface: Reticulate, undulating periclinal walls, 'W' shaped undulation, straight anticlinal walls
Lateral surface: Reticulate, undulating periclinal walls, 'W' shaped undulation, straight anticlinal walls
Embryo surface: Reticulate, undulating periclinal walls, 'W' shaped undulation, straight anticlinal walls
Hilum surface: Ruminate rugose, convoluted walls

6. ***Bothriochloa pertusa***

Light microscopy (Fig. 58(6))

Color: Light brown to brown **Shape:** Obovate
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 70(6))

Dorsal surface: Reticulate, undulating periclinal walls, 'V' shaped undulation, straight anticlinal walls
Ventral surface: Reticulate, undulating periclinal walls, straight anticlinal walls
Lateral surface: Reticulate, undulating periclinal walls, straight anticlinal walls
Embryo surface: Reticulate, undulating periclinal walls, straight anticlinal walls
Hilum surface: Reticulate, elongated reticulams, straight to convoluted walls

7. ***Capillipedium hugelii***

Light microscopy (Fig. 58(7))

Color: Light brown to yellow **Shape:** Oblong to obovate
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 70(7))

Dorsal surface: Reticulums not very clear, undulating elevated walls periclinal walls, depressed anticlinal walls

Ventral surface: Reticulums not very clear, are undulating walls, '∩' shaped undulation

Lateral surface: Reticulums not very clear, undulating elevated walls periclinal walls, anticlinal walls not clear

Embryo surface: Reticulums not clear, undulating walls, anticlinal walls not clear

Hilum surface: Ruminate rugose, convoluted walls, depressed interspace

8. ***Chrysopogon fulvus***

Light microscopy (Fig. 58(8))

Color: White to creamish **Shape:** Oblong to elliptic, linear

Texture: Smooth **Compression:** Laterally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Linear

Scanning electron microscopy (Fig. 71(8))

Dorsal surface: Reticulate, elongated reticulum, straight walls, depressed interspace

Ventral surface: Straight pattern, no reticulum formation seen, feebly features

Lateral surface: Reticulate, elongated reticulum, straight walls

Embryo surface: Reticulate, straight and elevated walls, irregular elevations, depressed interspace

Hilum surface: Ruminate rugose, convoluted walls

9. ***Cymbopogon martinii***

Light microscopy (Fig. 58(9))

Color: Pale yellow to light brown **Shape:** Oblong

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Present

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 71 (9))

Dorsal surface: Reticulum not seen, undulating wall, 'W' shaped, sharp pointed undulation

Ventral surface: Reticulate, undulating walls, '∩' and 'ʌ' shaped mixed undulation

Lateral surface: Reticulum not seen, undulating wall, undulation shape is not clear

Embryo surface: Reticulum not seen, undulating wall, 'W' shaped, sharp pointed undulation

Hilum surface: Ribbed straite, convolute walls

Dichanthium

10. *Dichanthium annulatum*

11. *Dichanthium caricosum*

10. *Dichanthium annulatum*

Light microscopy (Fig. 58(10))

Color: Light brown **Shape:** Oblong to ovate

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 71(10))

Dorsal surface: Reticulum feebly seen, feebly undulating wall

Ventral surface: Reticulate, feebly undulating periclinal wall, slanting and straight anticlinal wall

Lateral surface: Reticulate, undulating periclinal wall, straight anticlinal wall

Embryo surface: Reticulum feebly seen, thick undulating elevated wall

Hilum surface: Reticulate, straight walls, convex interspace

11. *Dichanthium caricosum*

Light microscopy (Fig. 59(11))

Color: Whitish brown to light brown **Shape:** Ovate

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 72(11))

Dorsal surface: Reticulate, periclinal wall undulating and elevated, 'ʌ' shaped undulation, straight or slant anticlinal wall

Ventral surface: Reticulate, undulating, thick, smooth periclinal wall, 'W' shaped broad undulation, straight anticlinal wall

Lateral surface: Reticulate, undulating periclinal wall, 'ʌ' shaped undulation, straight anticlinal wall

Embryo surface: Reticulum feebly seen, undulating and thick wall, broad undulation

Hilum surface: Ruminate rugose, convoluted walls, depressed interspace

Differentiating features:

Dorsal surface has feeble undulation (under SEM) ……..……*D. annulatum*

Dorsal surface has 'ʌ' shaped and elevated undulation (under SEM) ……*D. caricosum*

12. ***Hackelochloa granularis***

Light microscopy (Fig. 59(12))

Color: Light brown**Shape:** Obovate

Texture: Smooth **Compression:** Not compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Short

Embryo class: L **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 72(12))

Dorsal surface: Reticulate, elongated reticulum, straight or feebly undulating, thin periclinal wall, straight anticlinal wall,

Ventral surface: Reticulate, elongated reticulum, are straight thin wall

Lateral surface: Reticulate, thin and elongated reticulum, feebly undulating or straight periclinal wall, straight anticlinal wall

Embryo surface: Reticulate, straight or feebly undulating periclinal wall, straight anticlinal wall, concave interspace

Hilum surface: Ruminate rugose, convoluted walls, depressed interspace

Heteropogon

13. ***Heteropogon contortus var. genuinus sub var. typicus***

14. ***Heteropogon contortus var. genuinus sub var. hispidissimus***

15. ***Heteropogon ritcheii***

16. ***Heteropogon triticeus***

13. ***Heteropogon contortus var. genuinus sub var. typicus***

Light microscopy (Fig. 59(13))

Color: White to light brown **Shape:** Linear

Texture: Smooth**Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent**Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 72(13))

Dorsal surface: Reticulate, undulating periclinal wall, 'W' shaped undulation, smooth angle, straight anticlinal wall

Ventral surface: Reticulate, straight wall

Lateral surface: Reticulate, feebly undulating or straight walls

Embryo surface: Reticulate, periclinal wall of embryo axis feebly undulating while periclinal wall of scutellum straight, straight anticlinal wall

Hilum surface: Ruminate pattern, rugose surface, irregular and deep channels

14. ***Heteropogon contortus var. genuinus sub var. hispidissimus***

Light microscopy (Fig. 59(14))

Color: White to light brown
Shape: Linear
Texture: Smooth
Compression: Dorsally compressed
Dorsal/Lateral straitions: Absent
Ventral groove: Absent
Scutellum shape: Sickle
Embryo type: Large
Embryo class: N
Hilum visibility: Prominent
Hilum type: Basal
Hilum shape: Fan shaped

Scanning electron microscopy (Fig. 73(14))

Dorsal surface: Reticulate, undulating periclinal wall, 'W' shaped undulation with sharp angle, straight anticlinal wall, concave interspace
Ventral surface: Reticulate, undulating periclinal wall, 'W' shaped undulation with sharp angle, straight anticlinal wall
Lateral surface: Reticulate, undulating periclinal wall, 'W' shaped undulation with sharp angle, straight anticlinal wall, concave interspace
Embryo surface: Reticulate, undulating periclinal wall, 'W' shaped undulation with sharp angle, straight anticlinal wall
Hilum surface: Ruminate, rugose, convoluted walls, irregular depressions, multidirectional crimpes

15. ***Heteropogon ritchiei***

Light microscopy (Fig. 59(15))

Color: Light brown
Shape: Linear
Texture: Smooth
Compression: Dorsally compressed
Dorsal/Lateral straitions: Absent
Ventral groove: Absent
Scutellum shape: Sickle
Embryo type: Large
Embryo class: N
Hilum visibility: Prominent
Hilum type: Basal
Hilum shape: Fan shaped

Scanning electron microscopy (Fig. 73(15))

Dorsal surface: Reticulate, undulating periclinal wall, straight anticlinal wall
Ventral surface: Reticulate, undulating periclinal wall, sharp undulation, straight anticlinal wall, concave interspace
Lateral surface: Reticulate, undulating periclinal wall, straight anticlinal wall
Embryo surface: Reticulate, straight walls
Hilum surface: Reticulate, straight or slant, elevated wall

16. ***Heteropogon triticeus***

Light microscopy (Fig. 59(16))

Color: Brown
Shape: Ovate
Texture: Smooth
Compression: Dorsally compressed
Dorsal/Lateral straitions: Present
Ventral groove: Absent
Scutellum shape: Sickle
Embryo type: Large
Embryo class: N
Hilum visibility: Prominent
Hilum type: Basal
Hilum shape: Fan shaped

Scanning electron microscopy (Fig. 73(16))

Dorsal surface: Reticulate, striate and thick walls, depressed interspace

Ventral surface: Reticulate, straight or feebly undulating walls, depressed interspace

Lateral surface: Reticulate, straight and thick walls, depressed interspace

Embryo surface: Reticulate, straight walls, depressed and narrow interspace

Hilum surface: Ruminate rugose, depressed interspace, irregular depressions

Differentiating features:

Dorsal/lateral striations present ……..*H. triticeus*

Dorsal/lateral striations absent

Reticulate pattern on hilum surface (under SEM)……...……*H. ritchei*

Ruminate pattern on hilum surface (under SEM)

Feebly undulations on lateral surface (under SEM)…….. ……..……*H. contortus var. genuinus sub var. typicus*

'W' shaped, sharp undulations on lateral surface (under SEM)……..… ……*H.contortus var. genuinus sub var. hispidissimus*

17. *Imperata cylindrica*

Light microscopy (Fig. 59(17))

Color: Light brown **Shape:** Oblong

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Short

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Oval shaped

Scanning electron microscopy (Fig. 74(17))

Dorsal surface: Straite pattern, uneven surface

Ventral surface: Straite pattern, straight walls present on the surface, uneven surface

Lateral surface: Straite pattern, undulating walls present on the surface, uneven surface

Embryo surface: Reticulate pattern, undulating periclinal wall, straight anticlinal wall, uneven surface

Hilum surface: Ruminate rugose, uneven depressions

Ischaemum

18. *Ischaemum indicus*

19. *Ischaemum molle*

20. *Ischaemum pilosum*

21. *Ischaemum rugosum*

18. *Ischaemum indicus*

Light microscopy (Fig. 59(18))

Color: Light brown to brown **Shape:** Oblong

Texture: Smooth, dull **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 74(18))

Dorsal surface: Reticulate, undulating periclinal wall, 'ʌ' shaped sharp angled undulation, straight anticlinal wall, slightly depressed interspace
Ventral surface: Reticulate striate, thick and wide walls
Lateral surface: Reticulate, undulating periclinal wall, 'ʌ' shaped smooth angled undulation, straight anticlinal wall, slightly depressed interspace
Embryo surface: Reticulate, undulating periclinal wall, 'ʌ' shaped sharp angled undulation, straight anticlinal wall, slightly depressed interspace
Hilum surface: Reticulate, squarish reticulum, straight, thick and wide walls, depressed interspace

19. ***Ischaemum molle***

Light microscopy (Fig. 59(19))

Color: Light brown **Shape:** Oblong, ovate to ovoid
Texture: Smooth, dull **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 74(19))

Dorsal surface: Reticulate, feebly reticulum, straight walls intermittent with undulating walls, slightly depressed interspace
Ventral surface: Reticulate, straight walls intermittent with undulating walls, slightly depressed interspace
Lateral surface: Reticulate, undulating periclinal wall, straight anticlinal wall
Embryo surface: Reticulate, straight walls intermittent with undulating walls, slightly depressed interspace
Hilum surface: Striate ribbed, elevated walls

20. ***Ischaemum pilosum***

Light microscopy (Fig. 59(20))

Color: Brown **Shape:** Oblong
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 75(20))

Dorsal surface: Reticulate foveate, undulating periclinal wall, broad 'ʌ' shaped undulation, striate anticlinal wall, pitted interspace

Ventral surface: Reticulate, undulating periclinal wall, narrow 'ʌ' shaped undulation, striate anticlinal wall, filled interspace

Lateral surface: Reticulate, undulating periclinal wall, 'ʌ' shaped undulation, striate or slant anticlinal wall, depressed interspace

Embryo surface: Reticulate, undulating periclinal wall, 'ʌ' shaped undulation, straight anticlinal wall

Hilum surface: Striate, narrow and convoluted wall, depressed interspace

21. ***Ischaemum rugosum***

Light microscopy (Fig. 60(21))

Color: Light brown **Shape:** Ovate

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 75(21))

Dorsal surface: Reticulate not clear, undulating and thick walls, smooth undulation undulation

Ventral surface: Reticulate not clear, somewhat ribbed, undulating and thick walls, smooth undulation

Lateral surface: Reticulate not clear, undulating and thick walls, broad 'ʌ' shaped blunt angle undulation

Embryo surface: Reticulate not clear, undulating and thick walls, smooth undulation

Hilum surface: Ruminate rugose, convoluted walls, irregular, narrow depressions

Differentiating features:

Sub basal type of hilum……...……..*I. indicus*

Basal type of hilum

Ruminate rugose pattern on hilum surface (under SEM)……*I. rugosum*

Reticulate foveate, 'ʌ' shaped undulations on hilum surface (under SEM)……...

……...*I. pilosum*

Reticulate, feeble undulation on hilum surface (under SEM)…….……..*I. molle*

22. ***Iseilema laxum***

Light microscopy (Fig. 60(22))

Color: Lightish green to cremish **Shape:** Oblong

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 75(22))

Dorsal surface: Reticulate, undulating periclinal wall, 'ʌ' shaped sharp angled undulation, straight anticlinal wall, slightly depressed interspace

Ventral surface: Reticulate, undulating periclinal wall, straight anticlinal wall

Lateral surface: Reticulate, undulating periclinal wall, 'ʌ' shaped sharp angled undulation, straight anticlinal wall, slightly depressed interspace

Embryo surface: Reticulate pattern, anticlinal wall is undulating, periclinal wall is striate, undulating wall is mixed with striate wall

Hilum surface: Reticulate pattern, walls are striate, narrow, 4-5 sided reticulum, between two reticulum narrow channels are running, deeply sunken interspace

23. ***Ophiuros exaltatus***

Light microscopy (Fig. 60(23))

Color: Light brown to brown **Shape:** Oblong

Texture: Smooth **Compression:** Not compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 76(23))

Dorsal surface: Reticulate, undulating periclinal wall, sharp undulation, straight or undulating anticlinal wall

Ventral surface: Reticulate, undulating periclinal wall, sharp undulation, straight anticlinal wall

Lateral surface: Reticulate, undulating periclinal wall, sharp and uneven undulation, straight anticlinal wall

Embryo surface: Reticulate, undulating periclinal wall, sharp undulation, straight anticlinal wall

Hilum surface: Ruminate rugose, uneven depressions

24. ***Rottboellia exaltata***

Light microscopy (Fig. 60(24))

Color: Greenish to light colour **Shape:** Oblong

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 76(24))

Dorsal surface: Reticulate, undulating periclinal wall, sharp angle undulation, straight anticlinal wall
Ventral surface: Reticulate, undulating periclinal wall, straight or slant anticlinal wall
Lateral surface: Reticulate, undulating periclinal wall, sharp angle 'V' shaped undulation, straight anticlinal wall
Embryo surface: Reticulate, undulating periclinal wall, uneven undulation, straight anticlinal wall
Hilum surface: Ruminate reticulate, narrow deprressions between reticulum

25. ***Saccharum spontaneum***

Light microscopy (Fig. 60(25))

Color: Light brown **Shape:** Lanceolate
Texture: Rough **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Linear

Scanning electron microscopy (Fig. 76(25))

Dorsal surface: Reticulate, uneven reticulum, wide and thick perilcinal wall, thin, straight anticlinal wall, concave interspace
Ventral surface: Reticulate-scalariform rugose, is thick, elevated, undulating anticlinal wall, undulating periclinal wall, concave interspace
Lateral surface: Rugose and rough surface
Embryo surface: Reticulate, elevated periclinal wall, straight anticlinal wall, concave interspace
Hilum surface: Reticulate, uneven reticulum, elevated, thick wall, concave interspace

Sehima

26. ***Sehima ischaemoides***
27. ***Sehima nervosum***
28. ***Sehima sulcatum***

26. ***Sehima ischaemoides***

Light microscopy (Fig. 60(26))

Color: Yellowish to light brown **Shape:** Oblong
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Present
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 77(26))

Dorsal surface: Reticulate, undulating wall, 'V' or 'W' shaped, narrow and sharp angled undulation

Ventral surface: Reticulate, undulating wall, smooth angled, broad undulation

Lateral surface: Reticulate, undulating wall, 'V' or 'W' shaped, uneven, compact and sharp angled undulation

Embryo surface: Reticulate, undulating wall, 'V' or 'W' shaped, uneven and sharp angled undulation

Hilum surface: Reticulate ribbed, penta to hexagonal reticulum

27. ***Sehima nervosum***

Light microscopy (Fig. 60(27))

Color: Pale yellow to light brown **Shape:** Fusiform to lanceolate

Texture: Smooth, dull **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Present

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 77(27))

Dorsal surface: Striate, undulating wall, 'V' or 'W' shaped, narrow and sharp angled undulation

Ventral surface: Striate, undulating wall, smooth angled, broad undulation, deep depression present between two walls of reticulum

Lateral surface: Striate, undulating wall, 'V' or 'W' shaped, uneven and sharp angled undulation

Embryo surface: Striate, undulating wall, 'V' or 'W' shaped, uneven and sharp angled undulation, filled interspace

Hilum surface: Rugose, irregular ribs seen

28. ***Sehima sulcatum***

Light microscopy (Fig. 60(28))

Color: Yellowish to light brown **Shape:** Oblong to fusifom

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Present

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 77(28))

Dorsal surface: Striate, feebly undulating wall

Ventral surface: Reticulate, undulating slightly elevated wall, Smooth angled undulation, concave interspace

Lateral surface: Reticulate, undulating periclinal wall, sharp angled undulation, straight anticlinal wall

Embryo surface: Reticulate, periclinal wall undulating, sharp angled undulation, straight anticlinal wall

Hilum surface: Reticulate rugose, uneven sized reticulum, straight and feebly seen wall

Differentiating features:

Striate pattern on ventral and lateral surface of caryopsis (under SEM)...……*S. nervosum*

Reticulate pattern on ventral and lateral surface of caryopsis (under SEM)

Reticulate rugose, uneven sized reticulum on hilum surface (under SEM)…… ……...…….*S. sulcatum*

Reticulate ribbed, penta to hexagonal reticulumon hilum surface (under SEM)… ……...……*S. ischaemoides*

29. *Sorghum halepense*

Light microscopy (Fig. 60(29))

Color: Brownish black **Shape:** Ovate

Texture: Smooth, dull **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 78(29))

Dorsal surface: Striate, undulating, thick walls

Ventral surface: Striate reticulate, straight walls, slightly concave interspace

Lateral surface: Striate, feebly seen reticulum, undulating, thick and elevated walls

Embryo surface: Striate, slightly undulating and thick walls

Hilum surface: Ribbed rugose, horizontal elevations

30. *Thelepogn elegans*

Light microscopy (Fig. 60(30))

Color: Light brown to black **Shape:** Oblong

Texture: Rough **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: L **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 78(30))

Dorsal surface: Reticulate, uneven sized reticulum, elevated undulating periclinal wall, sharp angled and broad undulation, straight anticllinal wall, concave interspace

Ventral surface: Reticulate, uneven sized reticulum, elevated undulating periclinal wall, sharp angled and broad undulation, straight anticllinal wall, concave interspace

Lateral surface: Reticulate, uneven sized reticulum, elevated undulating periclinal wall, sharp angled and broad undulation, straight anticllinal wall, concave interspace

Embryo surface: Reticulate, uneven sized reticulum, elevated undulating periclinal wall, sharp angled and broad undulation, straight anticllinal wall, concave interspace

Hilum surface: Rugose, uneven multidirectional crimpes

Themeda

31. ***Themeda cymbaria***

32. ***Themeda laxa***

33. ***Themeda triandra***

34. ***Themeda quadrivalvis***

31. ***Themeda cymbaria***

Light microscopy (Fig. 61(31))

Color: Yellowish to light brown **Shape:** Ellipse to fusiform

Texture: Smooth, dull **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 78(31))

Dorsal surface: Reticulate, undulating elevated periclinal wall, slightly smooth angled and narrow reticulum, straight or slant anticlinal wall

Ventral surface: Reticulate, undulating periclinal wall, slightly smooth angled and broad reticulum, straight anticlinal wall

Lateral surface: Reticulate, undulating periclinal wall, slightly smooth angled and broad reticulum, straight anticlinal wall

Embryo surface: Reticulate, undulating periclinal wall, smooth angled undulation, straight anticlinal wall

Hilum surface: Rugose-foveate, uneven multidirectional crimpes

32. ***Themeda laxa***

Light microscopy (Fig. 61(32))

Color: Light brown **Shape:** Ovate

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 79(32))

Dorsal surface: Reticulate, feebly undulating, thick wall

Ventral surface: Reticulate, feebly undulating, thin and elevated periclinal wall, straight thin elevated anticlinal wall, concave interspace

Lateral surface: Reticulate, undulating periclinal wall, smooth angled and broad undulation, straight anticlinal wall

Embryo surface: Reticulate, straight to feebly undulating periclinal wall, straight anticlinal wall, thick wide and elevated walls

Hilum surface: Reticulate, straight, thick and elevated walls, depressed interspace

33. ***Themeda triandra***

Light microscopy (Fig. 61(33))

Color: Whitish brown to brown **Shape:** Lanceolate to oblong

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 79(33))

Dorsal surface: Reticulate, straight, thick, elevated walls, depressed interspace

Ventral surface: Reticulate, feebly undulating periclinal wall, straight or slant anticlinal wall

Lateral surface: Reticulate, feebly undulating periclinal wall, straight or slant anticlinal wall, walls are slightly elevated, concave interspace

Embryo surface: Reticulate pattern, walls are straight, periclinal wall is straight or slant

Hilum surface: Reticulate-ruminate rugose, multidirectional crimpes, depressed interspace

34. ***Themeda quadrivalvis***

Light microscopy (Fig. 61(34))

Color: Whitish brown to brown **Shape:** Lanceolate

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Faint

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 79 (34))

Dorsal surface: Reticulate, undulating periclinal wall, sharp angled and broad undulation, straight and slant anticlinal wall, concave interspace

Ventral surface: Reticulate pitted, straight, thin walls

Lateral surface: Reticulate-ruminate, slightly wavy and thin periclinal wall, straightanticlinal wall

Embryo surface: Reticulate, undulating periclinal wall, sharp angled undulation, straight anticlinal wall

Hilum surface: Striate, unidirectional crimpes, narrow depressed intersapce

Differentiating features:

Ellipse to fusiform caryopsis……..……...……*T. cymbaria*

Ovate shaped of caryopsis…….……*T. laxa*

Lanceolate to oblong shaped of caryopsis

Reticulate ruminate rugose pattern on hilum surface (under SEM)..…*T. triandra*

Straite pattern on hilum surface (under SEM)……..……*T. quadrivalvis*

35. *Triplopogon ramosissimus*

Light microscopy (Fig. 61(35))

Color: Brown to dark brown **Shape:** Elipsoid

Texture: Smooth, shiny **Compression:** Laterally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: L **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 80(35))

Dorsal surface: Reticulate, undulating periclinal wall, smooth angled undulation, straight anticlinal wall

Ventral surface: Reticulate, undulating periclinal wall intermittent with straight, smooth angled undulation, straight anticlinal wall, concave intrspace

Lateral surface: Reticulate, undulating periclinal wall intermittent with straight, smooth angled undulation, straight anticlinal wall, concave intrspace

Embryo surface: Reticulate, elevated and thick walls, straight intermittent with undulating wall periclinal wall, straight or slant anticlinal wall, concave interspace

Hilum surface: Rugose pattern, anticlinal wall is smooth, elevated and deeply depressed periclinal walls

36. *Vetivaria zinzanoides*

Light microscopy (Fig. 61(36))

Color: Light green to whitish brown **Shape:** Lanceolate

Texture: Smooth **Compression:** Laterally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 80(36))

Dorsal surface: Reticulate, straight, thick and elevated walls, feebly undulating anticlinal wall

Ventral surface: Reticulate, straight, thick and elevated walls, feebly undulating anticlinal wall, foveate interspace

Lateral surface: Reticulate, straight, thick and elevated walls, feebly undulating anticlinal wall, foveate and concave interspace

Embryo surface: Reticulate, elevated, thick, flat and straight periclinal wall, straight or slant anticlinal wall, depressed interspace

Hilum surface: Reticulate, narrow, smooth and elevated walls, drpressed interspace

37. ***Alloteropsis cimicina***

Light microscopy (Fig. 61(37))

Color: Light brown to brown **Shape:** Oblong

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 80(37))

Dorsal surface: Rugose ruminate feature, flat walls

Ventral surface: Reticulate Rugose ruminate, squrish reticulum, flat walls

Lateral surface: Reticulate Rugose ruminate, squrish reticulum, flat and slightly elevated walls

Embryo surface: Rugose ruminate, flat and running irregularly walls, periclinal wall is more thick than the anticlinal wall

Hilum surface: Reticulate, straight slightly elevated walls, concave interspace

Brachiaria

38. ***Brachiaria distachya***

39. ***Brachiaria eruciformis***

40. ***Brachiaria ramosa***

41. ***Brachiaria reptans***

38. ***Brachiaria distachya***

Light microscopy (Fig. 61(38))

Color: Greenish to whitish **Shape:** Ovoid to oblong

Texture: Smooth, dull **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 81(38))

Dorsal surface: Reticulate,'ʌ' shape with wall undulation, periclinal wallundulating, sharp angled undulation, straight anticlinal wall

Ventral surface: Reticulate, undulating periclinal wall, wide and smooth angled undulation, straight anticlinal wall, depressed interspace

Lateral surface: Reticulate, undulating elevated periclinal wall, uneven undulation, straight anticlinal wall, depressed interspace

Embryo surface: Reticulate, undulating elevated periclinal wall, uneven smooth and sharp angled undulation, straight anticlinal wall, depressed interspace

Hilum surface: Reticulate rugose, straight flat walls, slightly concave interspace

39. ***Brachiaria eruciformis***

Light microscopy (Fig. 61(39))

Color: Yellowish to light brown **Shape:** Ovoid to oblong
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 81(39))

Dorsal surface: Reticulate, undulating and thin periclinal wall, '∩' shaped with smooth angled undulation, straight or slant anticlinal wall

Ventral surface: feebly striate

Lateral surface: Striate, horizontal elevation on the surface

Embryo surface: Reticulate, undulating and thin periclinal wall, uneven undulation, straight anticlinal wall

Hilum surface: Reticulate, straight, thick and elevated walls, depressed interspace

40. ***Brachiaria ramosa***

Light microscopy (Fig. 61(40))

Color: Greenish to whitish **Shape:** Ovoid to oblong
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Faint
Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 81(40))

Dorsal surface: Reticulate, undulating periclinal wall, '∩' shaped with smooth angled undulation, straight anticlinal wall

Ventral surface: Reticulate pitted, straight, elevated walls, depressed interspace

Lateral surface: Striate, feebly reticulum, undulating wall at some place, horizontally uneven elevations

Embryo surface: Reticulate, undulating slightly elevated periclinal wall, wide angled undulation, straight anticlinal wall

Hilum surface: Reticulate rugose, straight, elevated, thick and crimped walls, depressed interspace

41. ***Brachiaria reptans***

Light microscopy (Fig. 62(41))

Color: White to greenish **Shape:** Ovoid to orbicular

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 82(41))

Dorsal surface: Reticulate elevated, undulating periclinal wall, smooth angled, 'ʌ' shape with wall undulation, straight and elevated anticlinal wall, depressed interspace

Ventral surface: Reticulate, elevated and uneven walls, depressed interspace

Lateral surface: Reticulate foveolate, undulating elevated periclinal wall, smooth angled and walled with broad undulation, straight anticlinal walls, concave interspace

Embryo surface: Reticulate, undulating elevated periclinal wall, smooth angled, ʌ shape undulation, straight and elevated anticlinal wall, depressed interspace

Hilum surface: Reticulate, straight, slightly elevated and flat walls, superficial interspace with broad pit

Differentiating features:

Reticulate 'ʌ' shaped reticulum on dorsal surface (under SEM)

Reticulate foveolate pattern on lateral surface (under SEM)……..….*B. reptans*

Only reticulate pattern on lateral surface (under SEM)……..….*B. distachya*

Reticulate '∩' shaped reticulum on dorsal surface (under SEM)

Feeble straite pattern on ventral surface (under SEM)……..…*B. eruciformis*

Reticulate pitted pattern on ventral surface (under SEM)……*B. ramosa*

Cenchrus

42. ***Cenchrus biflorus***

43. ***Cenchrus ciliaris***

44. ***Cenchrus setigerus***

42. ***Cenchrus biflorus***

Light microscopy (Fig. 62(42))

Color: Creamish yellow **Shape:** Ovate to suborbicular

Texture: Smooth, shiny **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 82(42))

Dorsal surface: Reticulate, elevated wide walls, concave interspace, thin
Ventral surface: Reticulate, flat, wavy and thick wall, superficial interspace
Lateral surface: Reticulate, feebly undulating, elevated, thick and flat periclinal wall, slant and straight anticlinal wall, shallow interpace
Embryo surface: Reticulate pattern, walls are elevated, thick and wide, concave interspace, thin, straight lines are running in the interspace
Hilum surface: Ruminate pattern, rugose surface, irregular and narrow channels, running in different direction

43. ***Cenchrus ciliaris***

Light microscopy (Fig. 62(43))

Color: Greenish brown **Shape:** Oblong
Texture: Smooth, shiny **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 82(43))

Dorsal surface: Reticulate pattern, undulating and elevated periclinal wall, '∩' shaped with smooth angled undulation, straight anticlinal wall, concave interspace
Ventral surface: Reticulate, stongly undulating periclinal wall, smooth angled and broad undulation, straight anticlinal wall
Lateral surface: Reticulate pattern, undulating periclinal wall, '∩' shaped with smooth angled undulation, straight anticlinal wall
Embryo surface: Reticulate, stongly undulating and elevated periclinal wall, '∩' shaped with smooth angled undulation, straight anticlinal wall
Hilum surface: Reticulate, straight, elevated and thick wall, depressed interspace

44. ***Cenchrus setigerus***

Light microscopy (Fig. 62(44))

Color: Dull white to greenish **Shape:** Ovoid to oblong
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 83(44))

Dorsal surface: Reticulate, straight, thick, wide and elevated walls, slightly concave interspace

Ventral surface: Reticulate, wavy, elevated, smooth angled undulation periclinal wall, slant and straight at some place anticlinal wall, shallow interspace

Lateral surface: Reticulate foveolate, thin and elongated reticulum, straight thick walls,

Embryo surface: Reticulate, straight, thick, wide, flat and elevated walls, slightly concave interspace

Hilum surface: Reticulate ruminate, thick, crimped and elevated walls, multidirection crimpes, depressed interspace

Differentiating features:

Dorsal/lateral striations absent……...……..*C. biflorus*
Dorsal/lateral striations present
Stright walls on embryo surface (under SEM)……..…….*C. setigerus*
'∩' shaped undulating wall on embryo surface (under SEM)….…….*C. ciliaris*

Digitaria

45. *Digitaria ciliaris*
46. *Digitaria granularis*
47. *Digitaria longiflora*
48. *Digitaria stircta*

45. *Digitaria ciliaris*

Light microscopy (Fig. 62(45))

Color: White creamish to light pale yellow **Shape:** Oblong
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 83(45))

Dorsal surface: Reticulate, undulating and thin walls, '∩' shaped, smooth angled undulation, horizontally elevations on surfaces

Ventral surface: Reticulate, undulating periclinal wall, thin and elevated, smooth angled broad undulation, straight anticlinal wall, depressed interspace

Lateral surface: Reticulate, undulating and thin walls, 'Ω' shaped, smooth angled undulation, horizontally elevations on surface

Embryo surface: Reticulate, undulating and thin walls, 'Ω' shaped, smooth angled undulation, horizontally elevations on surface

Hilum surface: Reticulate, straight, slightly elevated walls, depressed interspace

46.*Digitaria granularis*

Light microscopy (Fig. 62(46))

Color: White to creamish **Shape:** Ovoid
Texture: Smooth, shiny **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 84(46))

Dorsal surface: Reticulate, horizontally elevations on surface, undulating and thin walls, '∩' and 'Ω' shaped, smooth angled undulation
Ventral surface: Reticulate, horizontally elevations on surface, undulating and thin walls, smooth angled and broad undulation
Lateral surface: Reticulate, horizontally elevations on surface, undulating and thin walls, smooth angled and broad undulation
Embryo surface: Reticulate, uneven surface, undulating and thin walls, '∩' and 'Ω' shaped, smooth angled undulation
Hilum surface: Reticulate, elevated walls, depressed interspace

47. *Digitaria longiflora*

Light microscopy (Fig. 62(47))

Color: White to creamish brown **Shape:** Elipsoid
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 84(47))

Dorsal surface: Reticulate, undulating wall, '∩' shaped, smooth angled undulation
Ventral surface: Reticulate, undulating wall, slightly concave interspace
Lateral surface: Reticulate, undulating wall, '∩' shaped, smooth angled undulation
Embryo surface: Reticulate, undulating wall, '∩' shaped, smooth angled undulation, ruminate interspace
Hilum surface: Reticulate, straight, slightly elevated walls, deprerssed interspace

48. *Digitaria stricta*

Light microscopy (Fig. 62(48))

Color: White to creamish brown **Shape:** Elipsoid
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 84(48))

Dorsal surface: Reticulate pitted, feebly features, undulating and thin walls, '∩' shaped, smooth angled undulation

Ventral surface: Reticulate, horizontally elevations on surface, undulating and thin walls, smooth angled, and broad undulation, shallow interspace

Lateral surface: Reticulate, horizontally elevations on surface, undulating and thin walls, '∩' shaped, smooth angled undulation

Embryo surface: Reticulate, undulating and thin walls, '∩' shaped, smooth angled undulation, horizontally elevations on surface, depressed interapace

Hilum surface: Reticulate, straight, slightly elevated walls, deprerssed interspace

Differentiating features:

Short embryo class……..……..*D. longiflora*

Large embryo class

L – embryo type……..*D. granularis*

N – embryo type

'∩' shaped undulation on lateral surface (under SEM)……*D. stricta*

'**Ω**' shapedundulation on lateral surface (under SEM)……..…..*D. ciliaris*

Echinichloa

49. *Echinichloa colona*

50. *Echinochloa crusgalli*

51. *Echionochloa stagnina*

49. *Echinochloa colona*

Light microscopy (Fig. 62(49))

Color: White to creamish **Shape:** Ovoid to ellipsoid
Texture: Smooth, slightly shiny **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Faint
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 84(49))

Dorsal surface: Reticulate rugose, undulating and thin walls, '∩' and 'ʌ' shaped undulation, depressed intersapce

Ventral surface: Reticulate rugose surface, undulating and thin walls, '∩' and 'ʌ' shaped undulation, depressed intersapce

Lateral surface: Reticulate rugose, undulating and thin walls, '∩' and 'ʌ' shaped undulation, depressed intersapce

Embryo surface: Reticulate rugose, undulating and elevated walls, depressed interspace

Hilum surface: Reticulate, straight and thin walls, concave interspace

50. *Echinochloa crusgalli*

Light microscopy (Fig. 62(50))

Color: Dull white **Shape:** Ellipsoid
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 85(50))

Dorsal surface: Reticulate, undulating, elevated thin perilcinal wall, '∩' and 'ʌ' shaped, smooth narrow undulation, straight anticlinal wall, depressed interspace

Ventral surface: Reticulate, undulating, thin and slightly elevated walls, '**Ω**' shaped and broad undulation, depressed interspace

Lateral surface: Reticulate, undulating, thin and slightly elevated walls, '∩' shaped and broad, smooth angled undulation, depressed interspace, thick and flat anticlinal bands in interspace

Embryo surface: Reticulate, undulating periclinal wall, 'ʌ' shaped, sharp angled and broad undulation, straight anticlinal wall, concave interspace, anticlinal elevations in interspace

Hilum surface: Reticulate, thick and elevated walls, concave interspace

51. ***Echinochloa stagnina***

Light microscopy (Fig. 63(51))

Color: Whitish to dull white **Shape:** Ellipsoid to obovate
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V**Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 85(51))

Dorsal surface: Reticulate rugose pitted, undulating elevated walls, depressed interspace

Ventral surface: Reticulate straite to rugose, straight walls, narrow depressions between the reticulum

Lateral surface: Reticulate rugose, undulating and straight walls

Embryo surface: Reticulate, undulating, elevated walls, '∩' shaped, broad, smooth angled undulation, depressed interspace

Hilum surface: Reticulate, thick and elevated walls, concave interspace

Differentiating featrures:

'∩' shaped undulations on ventral surface (under SEM)……*E. colona*
'Ω' shaped undulations on ventral surface (under SEM)……*E. crusgalli*
Straite to rugose pattern, no undulation on ventral surface (under SEM)…….
……..……*E. stagnina*

52. ***Eremopogon foveolatus***

Light microscopy (Fig. 63(52))

Color: Cremish to light brown**Shape:** Ellipsoid
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Faint
Hilum type: Sub basal **Hilum shape:** Linear

Scanning electron microscopy (Fig. 85(52))

Dorsal surface: Reticulum not clear, strongly undulating wall, 'ʌ' shaped, sharp angled undulation, concave interspace
Ventral surface: Reticulate, long and thin reticulum, undulating wall, concave interspace
Lateral surface: Reticulum not clear, strongly undulating wall, 'ʌ' shaped, sharp angled undulation, concave interspace
Embryo surface: Reticulate, strongly undulating wall, 'ʌ' shaped, sharp angled undulation, concave interspace
Hilum surface: Reticulate, elevated, floded walls, concave

53. ***Eriochloa procera***

Light microscopy (Fig. 63(53))

Color: Cremish to light brown**Shape:** Ellipsoid
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Linear

Scanning electron microscopy (Fig. 86(53))

Dorsal surface: Reticulate, undulating, thick and flat walls, '∩' shaped, smooth angled and broad undulation, concave interspace
Ventral surface: Reticulate, elevated, thick and feebly undulating walls intermittent, concave interspace
Lateral surface: Reticulate, undulating periclinal wall, 'ʌ' shaped smooth angled and broad undulation, straight anticlinal wall, concave interspace
Embryo surface: Reticulate, undulating periclinal wall, 'ʌ' shaped, sharp angled and narrow undulation, straight anticlinal wall, concave interspace
Hilum surface: Ruminate rugose surface, smooth and uneven crimpes, uneven deep depressions present

Oplismenus

54. ***Oplismenus burmannii***
55. ***Oplismenus composites***

54. ***Oplismenus burmannii***

Light microscopy (Fig. 63(54))

Color: Yellowish to light brown **Shape:** Oblong to ovate
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Linear

Scanning electron microscopy (Fig. 86(54))

Dorsal surface: Reticulate, feebly undualting periclinal wall, straight anticlinal wall, depressed interspace, anticinally elevations in interspace

Ventral surface: Reticulate, undulating periclinal wall, sharp angled, uneven and broad undulation, straight anticlinal wall, depressed interspace

Lateral surface: Reticulate, undulating periclinal wall, sharp angled, uneven broad undulation, straight anticlinal wall, depressed interspace

Embryo surface: Reticulate, slightly wavy periclinal wall, straight anticlinal wall, depressed interspace, anticinally elevations in interspace

Hilum surface: Reticulate, straight, elevated, thick slightly crimped walls, unidirectional crimpes, concave interspace

55. ***Oplismenus compositus***

Light microscopy (Fig. 63(55))

Color: Light brown **Shape:** Oblong to ovate
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Linear

Scanning electron microscopy (Fig. 86(55))

Dorsal surface: Reticulate, undulating slightly thick periclinal wall, 'ʌ' shaped sharp angled, narrow undulation, straight antilcinal wall, deeply pitted concave interspace

Ventral surface: Reticulate, undulating and slightly thick periclinal wall, 'ʌ' shaped, sharp angled, broad and undulation, straight antilcinal wall, concave interspace

Lateral surface: Reticulate, undulating slightly thick periclinal wall, 'ʌ' shaped, sharp broad uneven sized undulation, straight antilcinal wall, concave interspace

Embryo surface: Reticulate, undulating and thin periclinal wall, 'ʌ' shaped, sharp narrow uneven sized undulation, straight anticlinal wall, pitted concave interspace

Hilum surface: Reticulate, straight, slightly elevated and thin walls, pitted concave interspace

Differentiating features:

Uncompressed caryopsis, dorsal/lateral striations absent and Ltype of embryo……
…….*O. burmannii*

Dorsally compressed caryopsis, dorsal/lateral striations present, Ntype of embryo……
……..……..…….*O. composites*

Panicum

56. *Panicum antidotale*

57. *Panicum maximum*

58. *Panicum miliaceum*

59. *Panicum trypheron*

56. *Panicum antidotale*

Light microscopy (Fig. 63(56))

Color: Yellowish **Shape:** Ovoid

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 87(56))

Dorsal surface: Reticulate, undulating, elevated, thick and flat periclinal wall, '∩' shaped, smooth narrow undulation, straight/slant anticlinal wall, concave interspace

Ventral surface: Reticulate, undulating elevated, and thick periclinal wall, 'ʌ' shaped, sharp broad undulation, straight /slant anticlinal wall, narrow concave interspace

Lateral surface: Reticulate, undulating elevated, and thick periclinal wall, 'ʌ' shaped, sharp broad undulation, straight/ slant anticlinal wall, concave interspace

Embryo surface: Reticulate, undulating, elevated, thick flat periclinal walls, 'ʌ' shaped, smooth broad undulation, straight/ slant anticlinal wall, concave interspace

Hilum surface: Reticulate blister pattern, crimped interspace, unidirectional crimpes

57. *Panicum maximum*

Light microscopy (Fig. 63(57))

Color: Whitish cream **Shape:** Oval
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 87(57))

Dorsal surface: Reticulate, undulating wall, '∩' and '**Ω**' shaped, smooth angled undulation

Ventral surface: Reticulate, undulating wall, '**Ω**' shaped, smooth angled undulation, flat interspace

Lateral surface: Reticulate, undulating wall, '∩' and '**Ω**' shaped, smooth angled undulation, blister interspace

Embryo surface: Reticulate, undulating wall, '∩' shaped, smooth angled undulation

Hilum surface: Reticulate, elevated walls, slightly wavy periclinal wall, concave interspace

58. *Panicum miliaceum*

Light microscopy (Fig. 63(58))

Color: Whitish to light brown **Shape:** Ovoid to orbicular
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Linear

Scanning electron microscopy (Fig. 87(58))

Dorsal surface: Reticulate, straight, thick and elevated walls, depressed and pitted interspace

Ventral surface: Reticulate, thick and undulating walls intermittent with straight wall, uneven undulation, concave interspace

Lateral surface: Reticulate, straight, thick and elevated walls, concave and pitted interspace

Embryo surface: Reticulate, squarish reticulum, thin walls, concave interspace

Hilum surface: Reticulate, straight, elevated and thick walls, concave interspace

59. *Panicum trypheron*

Light microscopy (Fig. 63(59))

Color: White to cream **Shape:** Ovoid to orbicular
Texture: Smooth, shiny **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: V**Embryo type:** Large
Embryo class: N **Hilum visibility**: Faint
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 88(59))

Dorsal surface: Reticulate, undulating, thick, flat and slightly elevated walls, '**Ω**' shaped, smooth angled and broad undulation, depressed interspace

Ventral surface: Reticulate, undulating, thick, flat and slightly elevated walls, 'ʌ' shaped, smooth angled and broad undulation, concave interspace

Lateral surface: Reticulate, squarish reticulum, thick, flat wall, undulating, thin and flat walls intermittent, '∩' shaped, feebly, smooth angled and broad undulation,

Embryo surface: Reticulate, undulating, thick, flat slightly elevated walls, '**Ω**' shaped, smooth angled and broad undulation, depressed interspace

Hilum surface: Reticulate, straight, elevated thick walls, concave interspace, very narrow depression between reticulum

Differentiating features:

Sickle shaped scutellum……..……..*P. maximum*
'V' shaped scutellum
Linear shaped hilum…….*P. miliaceum*
Oval shaped hilum
Embryo surface with'ʌ' shaped undulation on embryo surface (under SEM).....……...*P. antidotae*
Embryo surface with'**Ω**' shaped undulation on embryo surface (under SEM).....…….……...*P. tryperon*

Paspalidium

60. *Paspalidium flavidum*
61. *Paspalidium geminatum*

60. *Paspalidium flavidum*

Light microscopy (Fig. 63(60))

Color: Creamish, yellowish to light greenish **Shape:** Ovoid to orbicular
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 88(60))

Dorsal surface: Reticualte, undulating and slightly elevated periclinal wall, 'ʌ' shaped, sharp angled and narrow undulation, straight anticlinal wall, concave interspace

Ventral surface: Reticualte, undulating and slightly elevated periclinal wall, 'ʌ' shaped, sharp angled and broad undulation, straight anticlinal wall

Lateral surface: Reticualte, undulating and slightly elevated periclinal wall, 'ʌ' shaped, sharp angled and broad undulation, straight anticlinal wall, depressed interspace

Embryo surface: Reticualte, undulating and slightly elevated periclinal wall, 'ʌ' shaped, sharp angled and broad undulation, straight anticlinal wall, depressed interspace

Hilum surface: Reticulate, straight, elevated, thick walls, concave interspace

61. ***Paspalidium geminatum***

Light microscopy (Fig. 64(61))

Color: Light brown to brown
Shape: Ovoid to oblong
Texture: Smooth
Compression: Dorsally compressed
Dorsal/Lateral straitions: Absent
Ventral groove: Absent
Scutellum shape: V
Embryo type: Large
Embryo class: N
Hilum visibility: Prominent
Hilum type: Basal
Hilum shape: Oval

Scanning electron microscopy (Fig. 88(61))

Dorsal surface: Reticulate, feebly feature, pitted granular interspace,

Ventral surface: Reticulate, walls straight or slightly wavy, elevated, depressed interspace

Lateral surface: Reticulate, feebly feature, thick, flat and straight walls, depressed pitted interspace

Embryo surface: Reticulate, straight, thick and slightly elevated walls, pimple-foveate and concave interspace

Hilum surface: Reticulate, straight, elevated, thick and crimped walls, unidirectional crimpes, concave interspace

Differentiating features:

'ʌ' shaped, sharp angled and broad undulation on embryo surface (under SEM)…….
……*P. flavidum*
Straight walls, foveate on embryo surface (under SEM)…….……..….*P. geminatum*

62. ***Paspalum scrobiculatum***

Light microscopy (Fig. 64(62))

Color: Light brown to brown
Shape: Ovoid
Texture: Smooth
Compression: Dorsally compressed
Dorsal/Lateral straitions: Absent
Ventral groove: Absent
Scutellum shape: V
Embryo type: Large
Embryo class: N
Hilum visibility: Prominent
Hilum type: Basal
Hilum shape: Oval

Scanning electron microscopy (Fig. 89(62))

Dorsal surface: Rugose, very feebly undulating, '∩' shaped, smooth angled and broad undulation

Ventral surface: Reticulate, thin flat walls, flat interspace

Lateral surface: Rugose, undulating wall, '∩ shaped, uneven, smooth angled and broad undulation

Embryo surface: Rugose-foveate, undulating thin wall, '∩' shaped, smooth angled and broad undulation

Hilum surface: Reticulate, straight, elevated and thick walls, concave interspace

63. ***Pennisetum setosum***

Light microscopy (Fig. 64(63))

Color: Greenish to whitish **Shape:** Obovate

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 89(63))

Dorsal surface: Reticulate, straight, thick and elevated walls, concave interspace

Ventral surface: Reticulate, straight, thick, flat and slightly elevated walls, little depressed interspace

Lateral surface: Reticulate, straight or slightly wavy, thick and slightly elevated walls, concave interspace

Embryo surface: Reticulate, straight, thick and elevated walls, concave interspace

Hilum surface: Reticulate rugose surface, elevated and crimped walls, multidirectional crimpes, depressed interspace

Setaria

64.*Setaria glauca*

65. ***Setaria tomentosa***

66. ***Setaria verticillata***

64. ***Setaria glauca***

Light microscopy (Fig. 64(64))

Color: Whitish cream to greenish brown **Shape:** Ovoid to ovate

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 89(64))

Dorsal surface: Reticulate rugose, undulating and elevated walls, 'ʌ' shaped, sharp angled and broad undulation, depressed interspace

Ventral surface: Reticulate rugose and pitted, undulating and elevated walls, 'ʌ' shaped, sharp angled and broad undulation, concave interspace

Lateral surface: Reticulate rugose and pitted, undulating and elevated walls, 'ʌ' shaped, sharp angled and broad undulation, concave interspace

Embryo surface: Reticulate, undulating walls, 'ʌ' shaped, sharp and smooth angled, short and broad undulation, depressed interspace,

Hilum surface: Reticulate, walls are straight, thin and elevated, concave interspace

65. ***Setaria tomentosa***

Light microscopy (Fig. 64(65))

Color: Whitish to creamish **Shape:** Oblong to ovoid

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 90(65))

Dorsal surface: Reticulate rugose-ruminate, undulating slightly elevated and thin walls, '∩' shaped, smooth angled and broad undulation, depressed interspace

Ventral surface: Reticulate, undulating and thin walls, 'ʌ' shaped, smooth angled and broad undulation

Lateral surface: Reticulate, undulating, thin and slightly elevated walls, 'ʌ' shaped, smooth angled and narrow undulation, depressed interspace

Embryo surface: Reticulate, undulating, slightly elevated and thin walls, 'ʌ' shaped, smooth angled and broad undulation, depressed interspace

Hilum surface: Reticulate slightly rugose, straight, thin and elevated walls, concave interspace

66. ***Setaria verticillata***

Light microscopy (Fig. 64(66))

Color: Whitish cream to very light brown **Shape:** Ovate to obovate

Texture: Slightly rough surface **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 90(66))

Dorsal surface: Reticulate pitted, undulating and thin periclinal wall, 'ʌ' shaped, sharp to smooth angled and broad undulation, straight anticlinal wall, very shallow interspace

Ventral surface: Reticulate pitted, undulating and thin periclinal wall, 'ʌ' shaped, uneven smooth angled and broad undulation, straight anticlinal

Lateral surface: Reticulate pitted, undulating and thin walls, 'ʌ' and '∩' shaped, smooth angled and broad undulation, uneven undulations

Embryo surface: Reticulate, undulating and thin periclinal walls, 'ʌ' shaped, smooth angled and broad undulation, straight anticlinal wall, depressed interspace,

Hilum surface: Reticulate, straight, thick and elevated walls, concave interspace

Differentiating features:

'∩' shaped undulation on dorsal surface (under SEM)……*S. tomentosa*

'ʌ' shaped undulation on dorsal surface (under SEM)

Rugose dorsal surface (under SEM)…….……..*S. glauca*

Pitted dorsal surface (under SEM)……...……*S. verticillata*

67. ***Isachne globosa***

Light microscopy (Fig. 64(67))

Color: Brown to dark brown **Shape:** Orbicular to subglobose

Texture: Smooth **Compression:** Not compressed

Dorsal/Lateral straitions: Present **Ventral groove:** Present

Scutellum shape: V **Embryo type:** Short

Embryo class: L **Hilum visibility**: Prominent

Hilum type: Linear **Hilum shape:** Short

Scanning electron microscopy (Fig. 90(67))

Dorsal surface: Reticulate rugose, undulating, thick and elevated walls, '∩' shaped, smooth angled broad undulation, depressed interspace, pitted circles in interspace

Ventral surface: Reticulate ruminate, feebly undulating, elevated and thin walls, '∩' shaped, smooth angled broad undulation, uneven elevation

Lateral surface: Reticulate, straight, thick and slightly elevated walls, depressed interspace

Embryo surface: Reticulate rugose, undulating elevated walls, smooth angled broad undulation, depressed interspace, pitted circles in interspace

Hilum surface: Reticulate ruminate-rugose, elevated, thin and crimped walls, multidirectional crimpes, depreeessed interspace

Aristida

68. ***Aristida adscensionis***

69. ***Aristida funiculata***

68. ***Aristida adscensionis***

Light microscopy (Fig. 64(68))

Color: Light brown to brown **Shape:** Acicular
Texture: Smooth **Compression:** Laterally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Short
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Linear **Hilum shape:** Long

Scanning electron microscopy (Fig. 91(68))

Dorsal surface: Reticulate, thin and elevated walls, anticlinal bands in interspace

Ventral surface: Reticulate, thin and elevated periclinal wall, straight or slant anticlinal wall, depressed interspace

Lateral surface: Reticulate, thin and elevated walls periclinal wall, straight or slant anticlinal wall, depressed interspace

Embryo surface: Reticulate, thin walls, anticlinal bands in interspace, narrow depressions between the reticulum

Hilum surface: Reticulate, straight and elevated walls, depressed interspace

69. ***Aristida funiculata***

Light microscopy (Fig. 64(69))

Color: Whitish to light brown **Shape:** Acicular
Texture: Smooth, shiny **Compression:** Not compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Linear **Hilum shape:** Long

Scanning electron microscopy (Fig. 91(69))

Dorsal surface: Reticulate-striate, thick and elevated walls, narrow depressions between the walls

Ventral surface: Reticulate rugose, elevated and pimple walls, depressed interspace

Lateral surface: Reticulate, thin, undulating and elevated periclinal wall, 'ʌ' shaped smooth angled and broad undulation, straight anticlinal wall, ribbed interspace

Embryo surface: Reticulate, elongated reticulum, straight and thin walls, very depressed interspace

Hilum surface: Reticulate, squarish reticulum, straight, elevated and thick walls, very depressed interspace

Differentiating features:

Short embryo class……..……*A. adscensionis*
Large embryo class…….……..*A. funiculata*

70. ***Perotis indica***

Light microscopy (Fig. 64(70))

Color: Brown**Shape:** Oblong, thin

Texture: Smooth, glossy**Compression:** Laterally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Short

Embryo class: L **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 91(70))

Dorsal surface: Reticulate, straight, thin and slightly elevated walls, shallow interspace

Ventral surface: Reticulate, slightly wavy, thin and elevated periclinal wall, straight or slant anticlinal wall, depressed interspace

Lateral surface: Reticulate, slightly wavy, thin and elevated periclinal wall, straight or slant anticlinal wall, depressed interspace

Embryo surface: Reticulate, slightly wavy, thin and elevated wall, depressed interspace

Hilum surface: Striate foveate, irregularly elevated wall, multidirectional elevations

Chloris

71. ***Chloris barbata***

72. ***Choris montana***

73. ***Chloris virgata***

71. ***Chloris barbata***

Light microscopy (Fig. 65(71))

Color: Cremish to light yellow **Shape:** Fusiform

Texture: Smooth, shiny **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 92(71))

Dorsal surface: Reticulate, thin and straightwalls

Ventral surface: Reticulate, thin and straight walls, narrow depressions intermittent between the reticulum

Lateral surface: Reticulate little foveate appearance, thin and straight walls, border pits arranged horizontally at some place

Embryo surface: Reticulate, thin and straightwalls

Hilum surface: Reticulate, walls are folded, irregular elevated walls, multidirectional elevation

72. *Chloris montana*

Light microscopy (Fig.65(72))

Color: Brown
Shape: Fusiform
Texture: Smooth, shiny
Compression: Dorsally compressed
Dorsal/Lateral straitions: Absent
Ventral groove: Absent
Scutellum shape: V
Embryo type: Large
Embryo class: N
Hilum visibility: Faint
Hilum type: Basal
Hilum shape: Circular

Scanning electron microscopy (Fig. 92(72))

Dorsal surface: Reticulate pitted, thin and straight walls, very depressed interspace

Ventral surface: Reticulate pitted, thin and straight walls, very depressed interspace

Lateral surface: Reticulate pitted, thin and straight walls, very depressed interspace

Embryo surface: Reticulate, folded surface, thin and straight walls, very depressed interspace

Hilum surface: Reticulate rugose, irregular elevated walls, multidirectional elevation

73. *Chloris virgata*

Light microscopy (Fig. 65(73))

Color: Cremish to light yellow
Shape: Ellipsoid
Texture: Smooth, shiny
Compression: Laterally compressed
Dorsal/Lateral straitions: Absent
Ventral groove: Absent
Scutellum shape: V
Embryo type: Large
Embryo class: N
Hilum visibility: Prominent
Hilum type: Basal
Hilum shape: Oval

Scanning electron microscopy (Fig. 92(73))

Dorsal surface: Reticulate, straight, thin and slightly elevated walls, depressed interspace

Ventral surface: Reticulate, smooth surface,straight and thin walls, feebly features

Lateral surface: Reticulate, smooth surface,straight and thin walls, feebly features

Embryo surface: Reticulate, straight, thin and elevated walls, depressed interspace

Hilum surface: Ruminate rugose, big and irregular depressions with uneven elevations

Differentiating features:

Uncompressed caryopsis……..…….*C. virgata*
Dorsally compressed caryopsis
Oval shaped hilum……...……*C. barbata*
Circular shaped hilum……..……..*C. montana*

74. *Cynodon dactylon*

Light microscopy (Fig. 65(74))

Color: Brownish black **Shape:** Oblong
Texture: Smooth **Compression:** Laterally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Faint
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 93(74))

Dorsal surface: Reticulum ribbed, straight, highly elevated and thick walls, narrow depressed interspace
Ventral surface: Reticulum, straight, elevated, flat and thick walls, narrow concave interspace
Lateral surface: Reticulum, straight, elevated, flat and thick walls, narrow depressed interspace
Embryo surface: Reticulum ribbed, straight, elevated and thin walls, depressed interspace
Hilum surface: Blister in the center, around that ruminate, multidirectional elevations

75. *Melanocenchris jaequemontii*

Light microscopy (Fig. 65(75))

Color: Dark brown **Shape:** Ovate
Texture: Rough **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 93(75))

Dorsal surface: Reticulate, feebly undulating and thin periclinal wall, straightanticlinal wall
Ventral surface: Reticulate and feebly pitted surface, feebly undulating and thin periclinal wall, straightanticlinal wall
Lateral surface: Reticulate and feebly pitted surface, thin elevation at some place,feebly undulating and thin periclinal wall, straightanticlinal wall
Embryo surface: Reticulate, elevated thin folded walls, feebly depressed interspace
Hilum surface: Ruminate rugose

76. *Oropetium villosulum*

Light microscopy (Fig. 65(76))

Color: Brown **Shape:** Oblanceolate
Texture: Rough **Compression:** Laterally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Short
Embryo class: N **Hilum visibility**: Faint
Hilum type: Basal **Hilum shape:** Fan shaped

Scanning electron microscopy (Fig. 93(76))

Dorsal surface: Reticulate, thin elevated walls, smooth depressed interspace
Ventral surface: Reticulate, thin elevated walls, depressed interspace
Lateral surface: Reticulate, thin flat walls, feebly features
Embryo surface: Reticulate, thin, feebly undulating and elevated walls, smooth depressed interspace
Hilum surface: Reticulate rugose, thick elevated walls, multidirectionally crimped, concave interspace

77. *Schoenefeldia gracilis*

Light microscopy (Fig. 65(77))

Color: Dark brown **Shape:** Fusiform to obovate
Texture: Smooth, shiny **Compression:** Laterally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 94(77))

Dorsal surface: Reticulate, in the middle reticulum become broader, straight, thin and elevated walls, concave interspace
Ventral surface: Reticulate, straight, thin and elevated walls, concave interspace
Lateral surface: Reticulate, in the middle reticulum become broader, straight, thin and elevated walls, shallow interspace
Embryo surface: Reticulate, folded surface, straight, thin and elevated walls, concave interspace
Hilum surface: Blister at proximal end, below that reticulate with elevated, crimped and thin walls, concave interspace

Tetrapogon

78. *Tetrapogon tenellus*
79. *Tetrapogon villosus*

78. *Tetrapogon tenellus*

Light microscopy (Fig. 65(78))

Color: Brown **Shape:** Ovate
Texture: Smooth **Compression:** Laterally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 94(78))

Dorsal surface: Reticulate, thick elevated walls, concave interspace
Ventral surface: Reticulate, feebly reticulum, thin and straight walls
Lateral surface: Reticulate, thick and elevated walls, concave interspace
Embryo surface: Blister-reticulate, narrow depressions between the reticulum
Hilum surface: Reticulate pitted-foveate, thin and straight walls, feebly reticulums

79. ***Tetrapogon villosus***

Light microscopy (Fig. 65(79))

Color: Brown **Shape:** Ellipsoid to oblong
Texture: Smooth **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: L **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 94(79))

Dorsal surface: Blister-ribbed, multidirections depressions between the blisters
Ventral surface: Reticulate, feebly reticulum, thin and straight walls
Lateral surface: Reticulate, thick and elevated walls, depressed interspace
Embryo surface: Blister, narrow depressions between the reticulum
Hilum surface: Reticulate, pitted-foveate surface, straight and thin walls, feebly reticulum

Differentiating features:

Embryo type N……*T. tenellus*
Embryo type L……*T. villosus*

80. ***Acrachne racemosa***

Light microscopy (Fig. 65(80))

Color: Dark brown to blackish brown **Shape:** Ovate, ellipsoid to subglobose
Texture: Rough **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Present
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Raised circular

Scanning electron microscopy (Fig. 95(80))

Dorsal surface: Compound reticulate with blister appearance, strongly undulating walls, 'ʌ' shaped, sharp to smooth angled broad undulation, foeavte interspace
Ventral surface: Compound reticulate with blister appearance, strongly undulating walls, 'ʌ' shaped, sharp to smooth angled broad undulation, foeavte interspace
Lateral surface: Blister, pitted surface, depressions between the blisters

Embryo surface: Compound reticulate - blister, depressed blister wall

Hilum surface: Ruminate in the middle, around that blister with curve undulating blister wall

Dactyloctenium

81. *Dactyloctenium aegyptium*

82. *Dactyloctenium scindicus*

81. *Dactyloctenium aegyptium*

Light microscopy (Fig. 66(81))

Color: light brown **Shape:** Ovoid to squarish

Texture: Rough **Compression:** Laterally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 95(81))

Dorsal surface: Reticulate, deep undulating walls, 'Ω' shaped broad undulation, anticinally arranged ridges

Ventral surface: Reticulate, deep undulating walls, 'Ω' shaped broad undulation, anticinally arranged ridges

Lateral surface: Reticulate, undulating walls, 'Ω' shaped broad undulation, anticinally arranged ridges

Embryo surface: Blister, depressed periclinal and elevated anticlinal blister wall

Hilum surface: Ruminate in the middle, around that blister with curve undulating blister wall, intermittently at some places blister become bulgy

82. *Dactyloctenium scindicus*

Light microscopy (Fig. 66(82))

Color: Brown **Shape:** Ovoid to squarish

Texture: Rough **Compression:** Laterally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Short

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Sub basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 95(821))

Dorsal surface: Compound reticulate with blister appearance, undulating walls, smooth broad undulation, bulgy blister between two reticulum, foeavte interspace

Ventral surface: Reticulate, deep undulating walls, 'Ω' shaped broad feebly undulation, ridges present on the surface

Lateral surface: Reticulate, deep undulating walls, 'Ω' shaped broad undulation, ridges present on the surface

Embryo surface: Blister, depressed periclinal and elevated anticlinal blister wall

Hilum surface: Ruminate in the middle, around that blister with curve, undulating blister wall

Differentiating features:

Large embryo class……..*D. aegyptium*
Short embryo class……..…..*D. scindicus*

83. ***Desmostachya bipinnata***

Light microscopy (Fig. 66(83))

Color: Brown **Shape:** Ovate
Texture: Smooth **Compression:** Laterally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Short
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 96(83))

Dorsal surface: Reticulate, straight, thick and elevated walls, concave interspace
Ventral surface: Reticulate, straight, thick and flat walls, depressed interspace
Lateral surface: Reticulate, straight, thin and flat walls, very deprssed interspace
Embryo surface: Reticulate, straight, thick and elevated walls, small pitted concave interspace
Hilum surface: Ruminate rugose, convoluted walls, multidirectional elevations, narrow depressed interspace

84. ***Dinebra retroflexa***

Light microscopy (Fig. 66(84))

Color: Brown **Shape:** Oblong
Texture: Smooth, glossy **Compression:** Laterally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Present
Scutellum shape: V **Embryo type:** Short
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 96(84))

Dorsal surface: Reticulate, straight, thick and elevated walls, penta to hexagonal reticulum, concave interspace
Ventral surface: Reticulate, straight, thick and elevated walls, penta to hexagonal reticulum, concave interspace
Lateral surface: Reticulate, straight, thick and flat walls, penta to hexagonal reticulum, shallow interspace
Embryo surface: Reticulate, straight, thick and elevated walls, penta to hexagonal reticulum, concave interspace

Hilum surface: Ruminate rugose, convoluted and thick walls, multidirectional elevations

85. ***Eleusine indica***

Light microscopy (Fig. 66(85))

Color: Dark brown to black **Shape:** Ovate, ellipsoid to subglobose
Texture: Rough **Compression:** Dorsally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Present
Scutellum shape: Sickle **Embryo type:** Short
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Sub basal **Hilum shape:** Raised circular

Scanning electron microscopy (Fig. 96(85))

Dorsal surface: Reticulate, deep strongly undulating walls, '**Ω**' and '**∩**' shaped broad undulation, blister interspace i.e. small hills like structure present within interspace, horizontally arranged blisters

Ventral surface: Reticulate, walls deep undulating, deep strongly undulating walls, '**Ω**' and '**∩**' shaped broad undulation, horizontally arranged blister present within interspace

Lateral surface: Reticulate, walls deep undulating, deep strongly undulating walls, '**Ω**' and '**∩**' shaped broad undulation, horizontally arranged blister present within interspace, ridges arranged in semicircular manner

Embryo surface: Blister pattern, depressed blister wall, round and hill shaped blister

Hilum surface: Ruminate in the middle, around that blister with curve, undulating blister wall

Eragrostiella

86. ***Eragrostiella bachyphylla***

87. ***Eragrostiella bifaria***

86. ***Eragrostiella bachyphylla***

Light microscopy (Fig. 66(86))

Color: Brown **Shape:** Fusiform
Texture: Smooth**Compression:** Laterally compressed
Dorsal/Lateral straitions: Absent**Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 97(86))

Dorsal surface: Reticulate, elevated, folded walls, sunken interspace
Ventral surface: Reticulate, straight, flat walls
Lateral surface: Reticulate, straight, flat walls, concave interspace
Embryo surface: Reticulate, elevated, folded walls, sunken interspace, folded surface

Hilum surface: Ruminate rugose surface, smooth and uneven crimpes, uneven deep depressions present

87. ***Eragrostiella bifaria***

Light microscopy (Fig. 66(87))

Color: Brown to dark brown
Shape: Ovoid to subglobose
Texture: Smooth, shiny
Compression: Not compressed
Dorsal/Lateral straitions: Present
Ventral groove: Absent
Scutellum shape: Sickle
Embryo type: Short
Embryo class: N
Hilum visibility: Prominent
Hilum type: Basal
Hilum shape: Circular

Scanning electron microscopy (Fig. 97(87))

Dorsal surface: Reticulate, Straight, thick and elevated walls, concave interspace

Ventral surface: Reticulate, straight, thick and elevated walls, feebly undulating periclinal wall intermittent with elevated wall, concave interspace

Lateral surface: Reticulate pattern, thick and elevated walls, feebly undulating periclinal wall intermittent with elevated wall, concave interspace

Embryo surface: Reticulate, straight, thick and elevated walls, concave interspace

Hilum surface: Ruminate, multidirectional irregular elevations

Differentiating features:

Laterally compressed caryopsis, dorsal/lateral straiations absent, large embryo class……. ……..……..……*E. bachyphylla*

Not compressed caryopsis, dorsal/lateral straiations present, short embryo class……. ……..……..……*E. bifaria*

Eragrostis

88. ***Eragrostis cilianensis***
89. ***Eragrostis ciliaris***
90. ***Eragrostis japonica***
91. ***Eragrostis nutans***
92. ***Eragrostis pilosa***
93. ***Eragrostis tenella***
94. ***Eragrostis tremula***
95. ***Eragrostis unioloides***
96. ***Eragrostis viscosa***

88. ***Eragrostis cilianensis***

Light microscopy (Fig. 66(88))

Color: Dark brown to black
Shape: Orbicular
Texture: Smooth, shiny
Compression: Not compressed
Dorsal/Lateral straitions: Present
Ventral groove: Absent
Scutellum shape: Sickle
Embryo type: Short

Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 97(88))

Dorsal surface: Reticulate, thick, flat and elevated wall, concave foveate interspace
Ventral surface: Reticulate, thin, flat and elevated wall, concave foveate interspace
Lateral surface: Reticulate, thin, flat and elevated wall, concave foveate interspace
Embryo surface: Reticulate, distinct elongated reticulum,thin, flat and elevated wall, concave interspace
Hilum surface: Reticulate pattern, walls are elevated, indistinct irregular reticulum, shallow interspace

89. ***Eragrostis ciliaris***

Light microscopy (Fig. 66(89))

Color: Dark brown **Shape:** Oblong to obovate
Texture: Smooth, shiny **Compression:** Not compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Short
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 98(89))

Dorsal surface: Smooth but superficial reticulate features present
Ventral surface: Smooth, only distal end showing converging elevations
Lateral surface: Reticulate, shallow features, indistinct straight elevations
Embryo surface: No prominent feature on embryo axis but scutellum shows elongated square reticulum, depressed walls
Hilum surface: Reticulate, elevated crimped walls, irregular wavy convolutions

90. ***Eragrostis japonica***

Light microscopy (Fig. 66(90))

Color: Dark brown **Shape:** Oblong
Texture: Smooth, shiny **Compression:** Laterally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Short
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 98(90))

Dorsal surface: Smooth but superficial reticulate features present
Ventral surface: Reticulate, elongated reticulum, slightly undulating walls, shallow interspace
Lateral surface: Feebly reticulate features, elongated reticulum,slightly undulating walls, shallow interspace

Embryo surface: Reticulated, elongated reticulum,slightly undulating and elevated walls, concave intersapce

Hilum surface: Reticulate, irregular distinct reticulum, elevated and crimped walls

91. ***Eragrostis nutans***

Light microscopy (Fig. 67(91))

Color: Dark brown **Shape:** Oblong to ovate
Texture: Smooth, shiny **Compression:** Not compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Short
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 98(91))

Dorsal surface: Reticulate, slightly undulatingwalls

Ventral surface: Reticulate, slightly undulatingwalls

Lateral surface: Reticulate, slightly undulatingand elevated walls, very shallow interspace

Embryo surface: Reticulate, slightly undulatingand elevated walls, horizontal thin elevations within reticulum

Hilum surface: Reticulate, irregular distinct reticulum elevated and crimped walls, multidirectional uneven crimpes

92. ***Eragrostis pilosa***

Light microscopy (Fig. 67(92))

Color: Dark brown **Shape:** Ovoid to oblong
Texture: Smooth **Compression:** Laterally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Faint
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 99(92))

Dorsal surface: Reticulate-foveate, elevated and thin walls, concave interspace, punctate sculpturing within reticulum

Ventral surface: Reticulate-foveate, elevated and thin walls, concave interspace, punctate sculpturing within reticulum

Lateral surface: Reticulate-foveate, elevated and thin walls, concave interspace, punctate sculpturing within reticulum

Embryo surface: Embryo axis reticulated, Reticulate-foveate scutellum, elevated and thin walls, concave interspace, punctate sculpturing within reticulum.

Hilum surface: Reticulate, irregular crimped wall

93. ***Eragrostis tenella***

Light microscopy (Fig. 67(93))

Color: Dark brown **Shape:** Oblong to obovate
Texture: Smooth, shiny **Compression:** Not compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 99(93))

Dorsal surface: Reticulated, undulating, thick and elevated periclinal wall, undulating antilcinal wall, intermittent thick undulating tangential elevations
Ventral surface: Smooth
Lateral surface: Smooth
Embryo surface: Reticulate, straight, thick and elevated walls, concave interspace
Hilum surface: Ruminate-reticulate, elevated and crimped walls, multidirectional irregular crimpes converging towards the proximal end of carypsis

94. ***Eragrostis tremula***

Light microscopy (Fig. 67(94))

Color: Creamish to light brown **Shape:** Round to oblong
Texture: Smooth, shiny **Compression:** Laterally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 99(94))

Dorsal surface: Reticulate, penta to hexagonal reticulum, straight, thick and elevated walls, shallow interspace
Ventral surface: Reticulate, straight, thin and slightly elevated walls, very shallow interspace
Lateral surface: Reticulate, straight, thick and elevated walls, penta to hexagonal reticulum, concave interspace, elongated reticulate reticulum superimposed on penta to hexagonal reticulum
Embryo surface: Reticulate, straight, thick and elevated walls, irregular sized penta to hexagonal reticulum
Hilum surface: Globular slimy glands at proximal end ventral surface

95. ***Eragrostis unioloides***

Light microscopy (Fig. 67(95))

Color: Brown to dark brown **Shape:** Ovoid
Texture: Smooth, shiny **Compression:** Laterally compressed
Dorsal/Lateral straitions: Present **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 100(95))

Dorsal surface: Reticulate, thick, straight and elevated walls, concave interspace
Ventral surface: Reticulate, thick, straight and elevated walls, concave interspace
Lateral surface: Reticulate, thick, straight and elevated walls, shallow interspace
Embryo surface: Reticulate, elongated reticulum,thick, straight and elevated walls, concave interspace
Hilum surface: Reticulate, thick, straight, elevated and undulating walls, concave interspace

96. ***Eragrostis viscosa***

Light microscopy (Fig. 67(96))

Color: Dark brown **Shape:** Oblong to ovate
Texture: Smooth, shiny **Compression:** Laterally compressed
Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: V **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Circular

Scanning electron microscopy (Fig. 100(96))

Dorsal surface: Reticulate, long rectangular reticulum intermittent with undulating margin,straight, smooth and thin walls, very shallow interspace
Ventral surface: Smooth
Lateral surface: Reticulate, long rectangular reticulumstraight, thin and slightly elevated walls, shallow interspace,
Embryo surface: Reticulate, thin, straight and elevated walls, concave interspace, reticulums convergingtowards the proximal end of caryopsis
Hilum surface: Reticulate, elevated crimped walls, highly convoluted crimpes

Differentiating features:

Short embryo class
- Sickle shaped scutellum……..……*E. cilianensis*
- V shaped scutellum
  - Reticulate pattern on dorsal surface (under SEM)……..…..……*E. nutans*
  - Smooth dorsal surface (under SEM)
    - Smooth, only distal end of ventral surface showing converging elevations (under SEM)...…..……..……..*E. ciliaris*
    - Reticulate pattern on ventral surface (under SEM)…....*E. japonica*

Large embryo class
- Sickle shaped scutellum…….……..*E. tremula*

V shaped scutellum

Laterally compressed caryopsis

Reticulate foveate pattern on dorsal surface (under SEM)…….
…….*E. pilosa*

Only reticulate pattern on dorsal surface (under SEM)…….
…….*E. unioloides*

Uncompressed caryopsis

Reticulate ruminate hilum surface (under SEM)……..….*E. tenella*

Reticulate rugose hilum surface (under SEM)……..……*E. viscosa*

Sporobolus

97. *Sporobolus coromandelianus*

98. *Sporobolus diander*

99. *Sporobolus indicus*

97. *Sporobolus coromandelianus*

Light microscopy (Fig. 67(97))

Color: Brown to dark brown **Shape:** Oblong to ovoid

Texture: Smooth **Compression:** Laterally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Faint

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 100(97))

Dorsal surface: Reticulate, thick and slightly elevated walls, very shallow interspace

Ventral surface: Reticulate-striate, thick and elevated walls, shallow interspace, horizontal elevations within interspace

Lateral surface: Reticulate, thick elevated walls, irregular feebly undulation within interspace

Embryo surface: Reticulate, irregular shaped of reticulum, elevated crimped wall, multidirectional crimples, narrow depressed channels between reticulums

Hilum surface: Reticulate rugose, elevated crimped wall, irregular crimpes converging towards the proximal end of caryopes

98.Sporobolus diander

Light microscopy (Fig. 67(98))

Color: Creamy yellowish to light brown **Shape:** Oblong to ovoid

Texture: Smooth, shiny **Compression:** Laterally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 101(98))

Dorsal surface: Reticulate, thick and slightly elevated walls, very shallow interspace

Ventral surface: Reticulate-striate, thick, elevated and wrinkled walls, unidirectional wrinkles, shallow interspace, horizontal elevations within interspace

Lateral surface: Reticulate, shallow features, thin and flat walls

Embryo surface: Reticulate, elevated crimped wall, multidirectional crimples, narrow depressed channels between reticulums

Hilum surface: Reticulate, elevated crimped wall, irregular crimples, depressed intersapce, broad depressed channels between the reticulums

99. ***Sporobolus indicus***

Light microscopy (Fig. 67(99))

Color: Dark brown to black **Shape:** Ovoid

Texture: Smooth, shiny **Compression:** Not compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent

Scutellum shape: Sickle **Embryo type:** Large

Embryo class: N **Hilum visibility**: Prominent

Hilum type: Basal **Hilum shape:** V shaped

Scanning electron microscopy (Fig. 101(99))

Dorsal surface: Reticulate, flat surface, thin and very feebly undulating wall

Ventral surface: Reticulate, thin and very feebly undulating wall, anticlinal wall straight or slanting, shallow interspace

Lateral surface: Reticulate, thin and very feebly undulating wall, anticlinal wall straight or slanting, shallow interspace

Embryo surface: Reticulate, flat surface, thin and very feebly undulating wall

Hilum surface: Reticulate rugose, elevated and folded walls, irregular crimp in multidirection, depressed intersapce

Differentiating features:

Not compressed caryopsis…….*S. indicus*

Laterally compressed caryopsis

Hilum prominently visible and having reticulate surface (under SEM)…….
……..*S. diander*

Hilum not prominent and having reticulate rugose surface (under SEM)……
……...……*S. coromardelianus*

100. ***Tragrus biflorus***

Light microscopy (Fig. 67(100))

Color: Light brown **Shape:** Ellipsoid to ovate

Texture: Smooth **Compression:** Dorsally compressed

Dorsal/Lateral straitions: Absent **Ventral groove:** Absent
Scutellum shape: Sickle **Embryo type:** Large
Embryo class: N **Hilum visibility**: Prominent
Hilum type: Basal **Hilum shape:** Oval

Scanning electron microscopy (Fig. 101(100))

Dorsal surface: Reticulate, strongly undulating and elevated walls, '∩' shaped, smooth angled and narrow to broad undulations, shallow to concave interspace

Ventral surface: Reticulate, strongly undulating elevated walls, '∩' shaped, smooth very broad undulations, shallow interspace, small circles within reticulum

Lateral surface: Reticulate, feebly undulating walls, ∩ shaped, smooth angled and broad undulations, shallow interspace

Embryo surface: Reticulate, feebly undulating and elevated walls, '∩' shaped, smooth angled and broad undulations, shallow interspace

Hilum surface: Reticulate, straight, elevated and thick walls, concave interspace

Tabel 17: Distribution of caryopses into culsters on the basis of their qualitative features

Cluster number	Number of observation (grass species) per cluster	Maximum value from centroid	Avarage distance from centroid
1	56	1.50	0.96
2	7	1.13	0.90
3	5	1.03	0.81
4	3	1.00	0.79
5	13	1.25	0.92
6	2	0.50	0.50
7	3	1.05	0.92
8	7	0.96	0.58
9	2	0.71	0.71
10	2	0.50	0.50

Fig. 58 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

1. ***Chionachne koenigii***
2. ***Coix lachryma-jobi***
3. ***Andropogon pumilus***
4. ***Apluda mutica***
5. ***Arthraxon lanceolatus***
6. ***Bothriochloa pertusa***
7. ***Capillipedium huegelii***
8. ***Chrysopogon fulvus***
9. ***Cymbopogon martini***
10. ***Dichanthium annulatum***

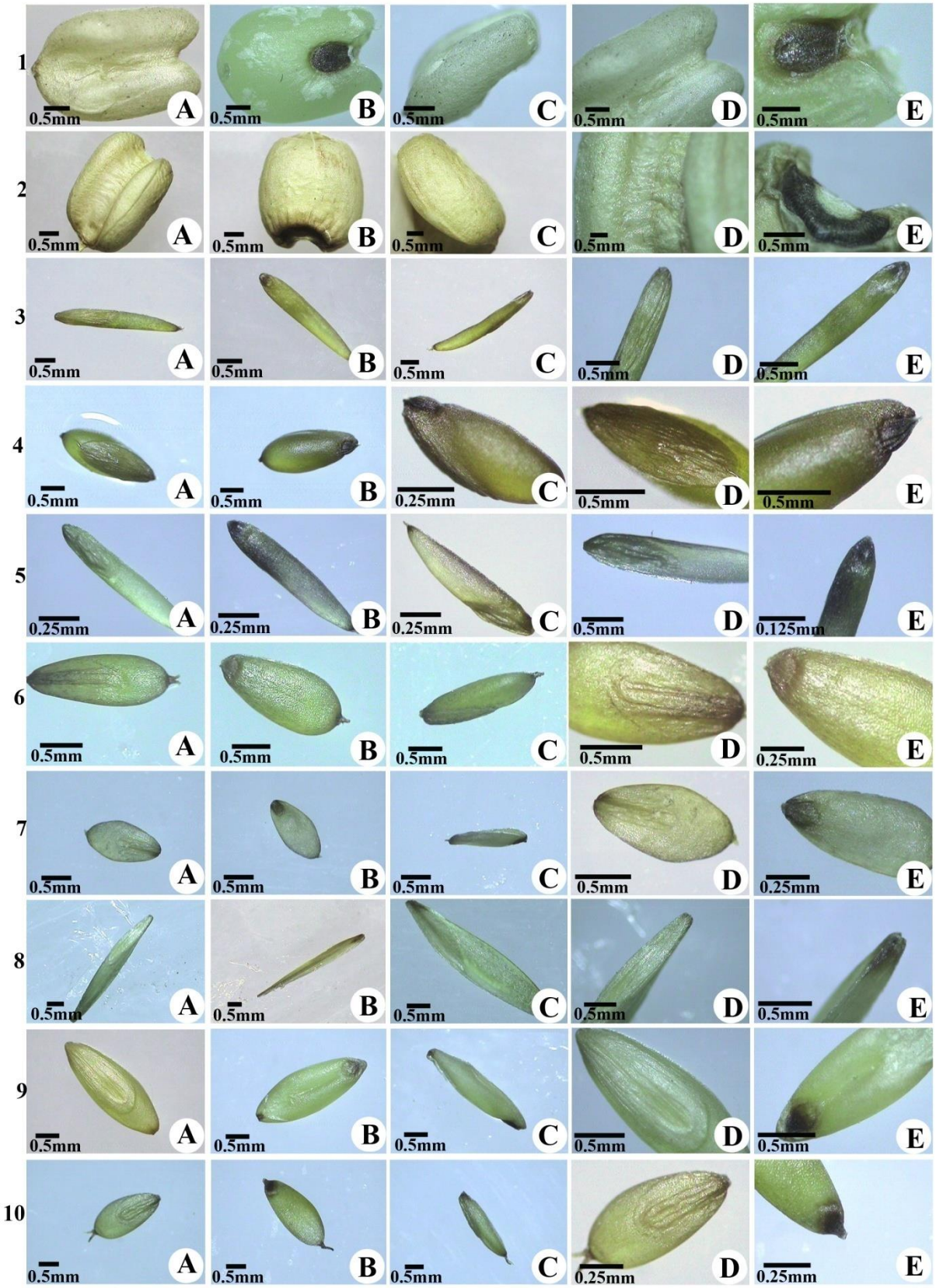


Fig. 58

Fig. 59 Micromorphological features of caryopses

F- Dorsal surface

G- Ventral surface

H- Lateral surface

I- Embryo

J- Hilum

11. *Dichanthium caricosum*

12. *Hackelochloa granularis*

13. *Heteropogon contortus var. genuinus sub var. typicus*

14. *Heteropogon contortus var. genuinus sub var. hispidissimus*

15. *Heteropogon ritchiei*

16. *Heteropogon triticeus*

17. *Imperata cylindrica*

18. *Ischaemum indicum*

19. *Ischaemum molle*

20. *Ischaemum pilosum*

Fig. 59

Fig. 60 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

21. *Ischaemum rugosum*

22. *Iseilema laxum*

23. *Ophiuros exaltatus*

24. *Rottboellia exaltata*

25. *Saccharum spontaneum*

26. *Sehima ischaemoides*

27. *Sehima nervosum*

28. *Sehima sulcatum*

29. *Sorghum halepense*

30. *Thelepogn elegans*

Fig. 60

Fig. 61 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

31. *Themeda cymbaria*

32. *Themeda laxa*

33. *Themeda triandra*

34. *Themeda quadrivalvis*

35. *Triplopogon ramosissimus*

36. *Vetivaria zinzanoides*

37. *Alloteropsis cimicina*

38. *Brachiaria distachya*

39. *Brachiaria eruciformis*

40. *Brachiaria ramosa*

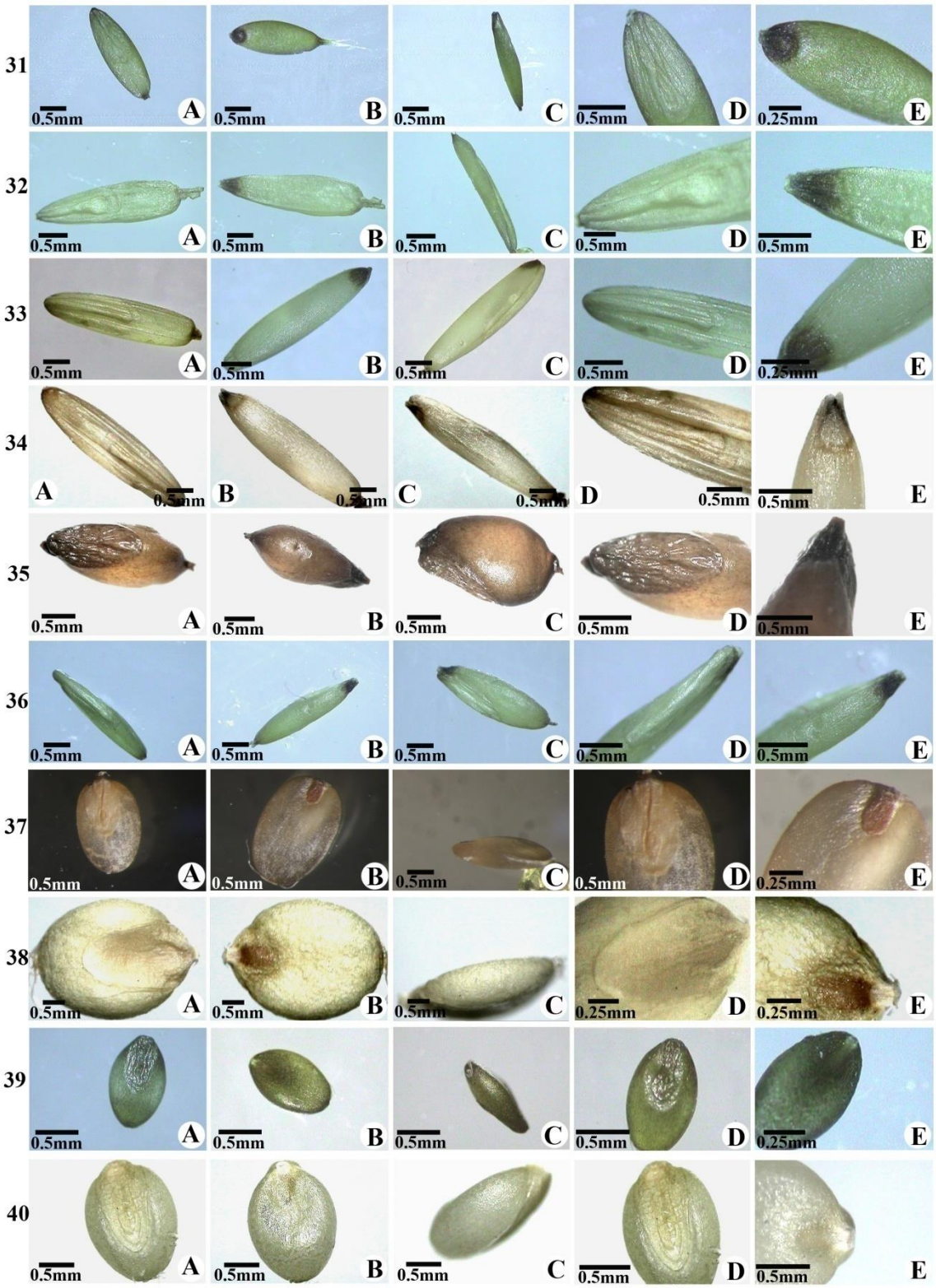


Fig. 61

Fig. 62 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

41. *Brachiaria reptans*

42. *Cenchrus biflorus*

43. *Cenchrus ciliaris*

44. *Cenchrus setigerus*

45. *Digitaria ciliaris*

46. *Digitaria granularis*

47. *Digitaria longiflora*

48. *Digitaria stricta*

49. *Echinochloa colona*

50. Echinochloa crusgalli

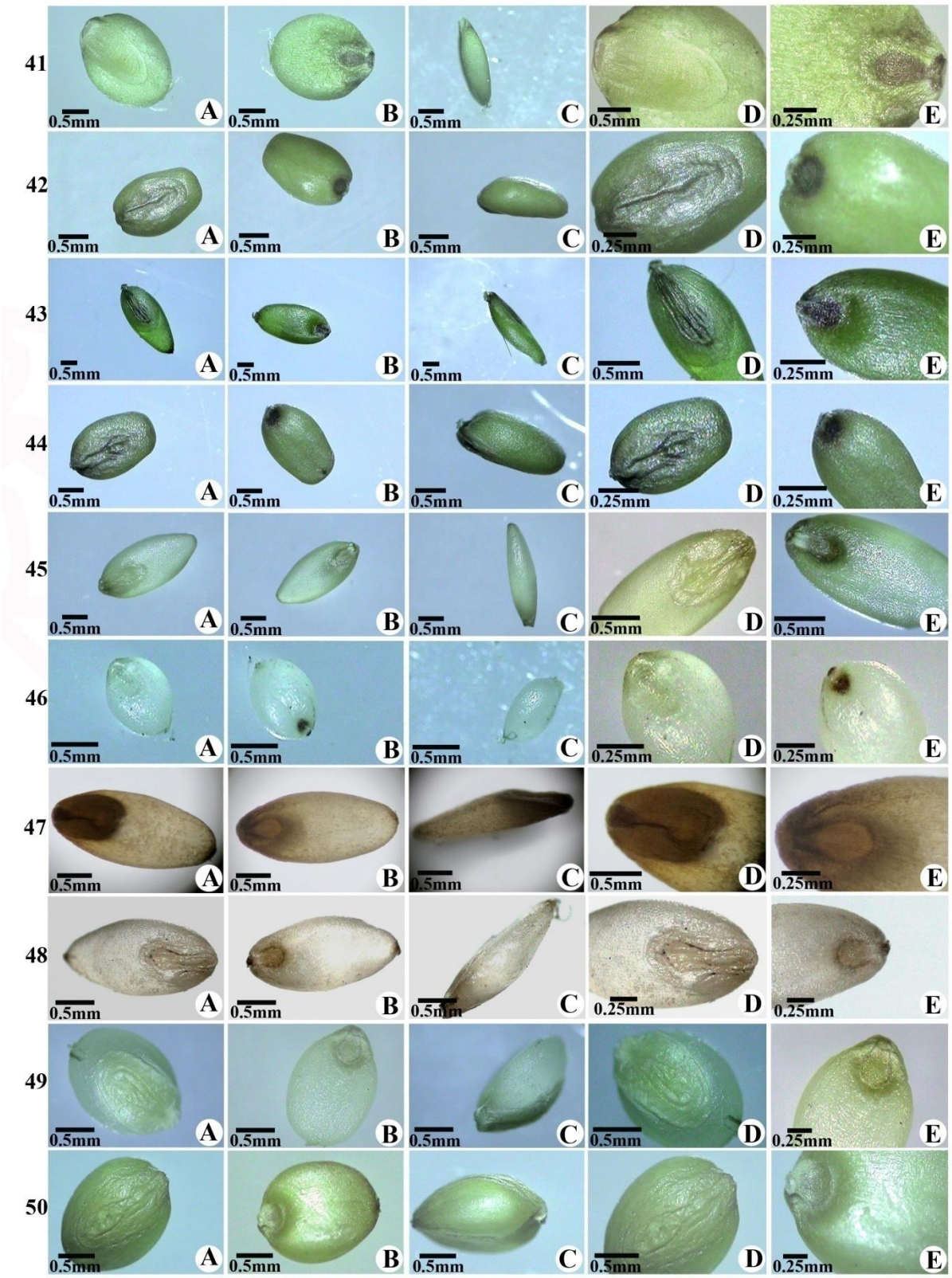


Fig. 62

Fig. 63 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

51. *Echinochloa stagnina*

52. *Eremopogon foveolatus*

53. *Eriochloa procera*

54. *Oplismenus burmannii*

55. *Oplismenus composites*

56. *Panicum antidotale*

57. *Panicum maximum*

58. *Panicum miliaceum*

59. *Panicum trypheron*

60. *Paspalidium flavidum*

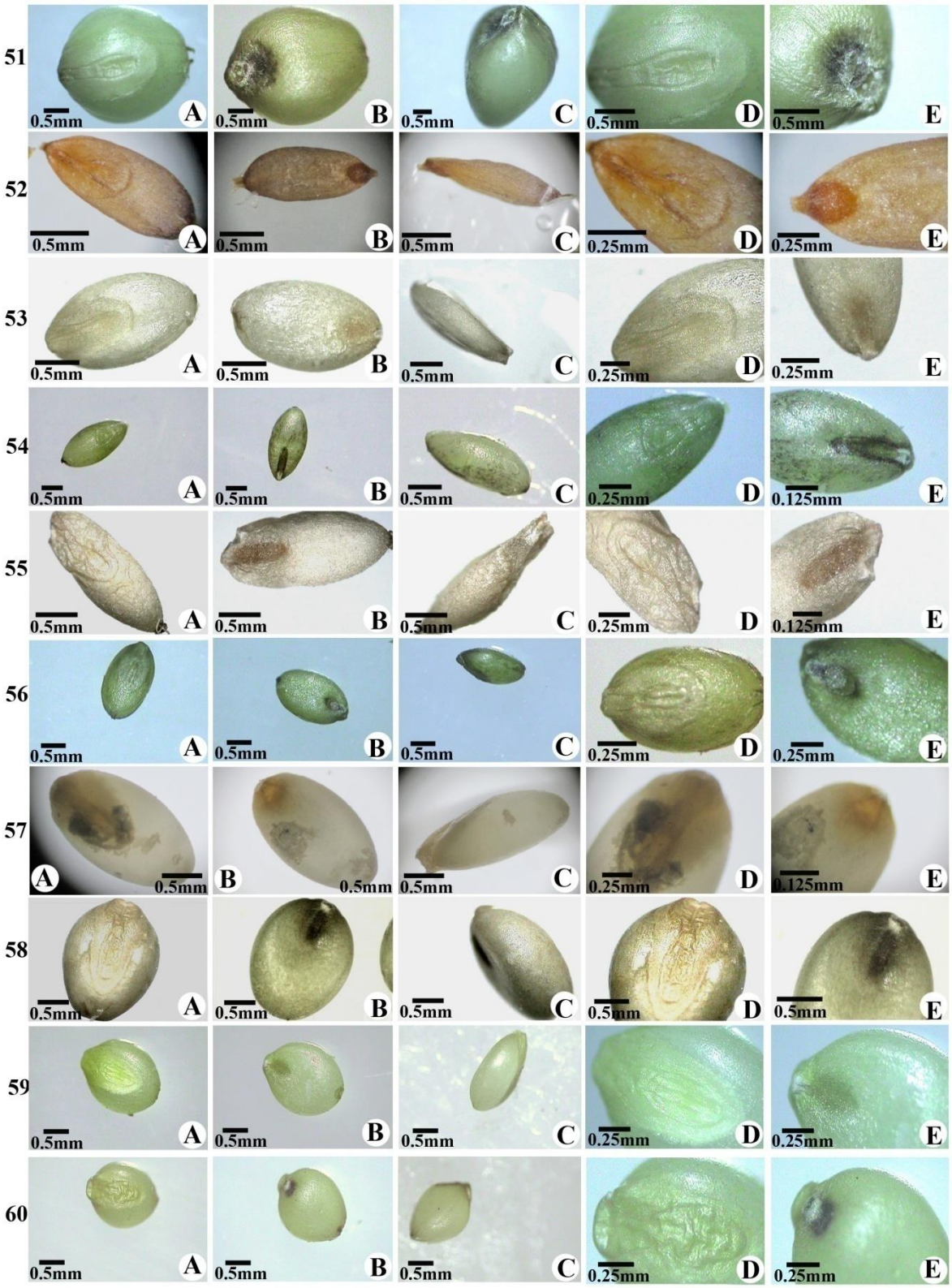


Fig. 63

Fig. 64 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

61. *Paspalidium geminatum*

62. *Paspalum scrobiculatum*

63. *Pennisetum setosum*

64. *Setaria glauca*

65. *Setaria tomentosa*

66. *Setaria verticillata*

67. *Isachne globosa*

68. *Aristida adscensionis*

69. *Aristida funiculata*

70. *Perotis indica*

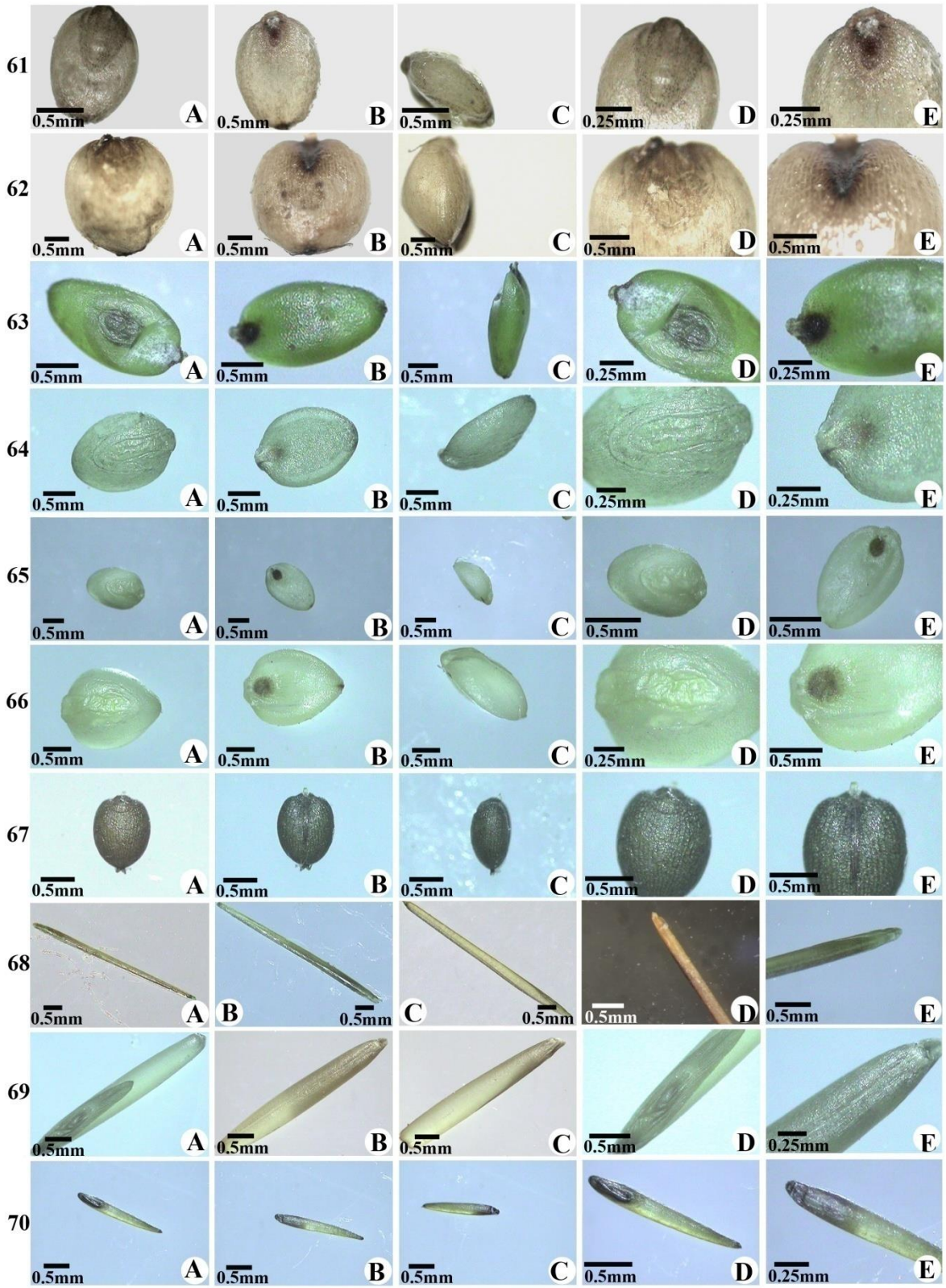


Fig. 64

Fig. 65 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

71. *Chloris barbata*

72. *Choris montana*

73. *Chloris virgata*

74. *Cynodon dactylon*

75. *Melanocenchris jaequemontii*

76. *Oropetium villosulum*

77. *Schoenefeldia gracilis*

78. *Tetrapogon tenellus*

79. *Tetrapogon villosus*

80. *Acrachne racemosa*

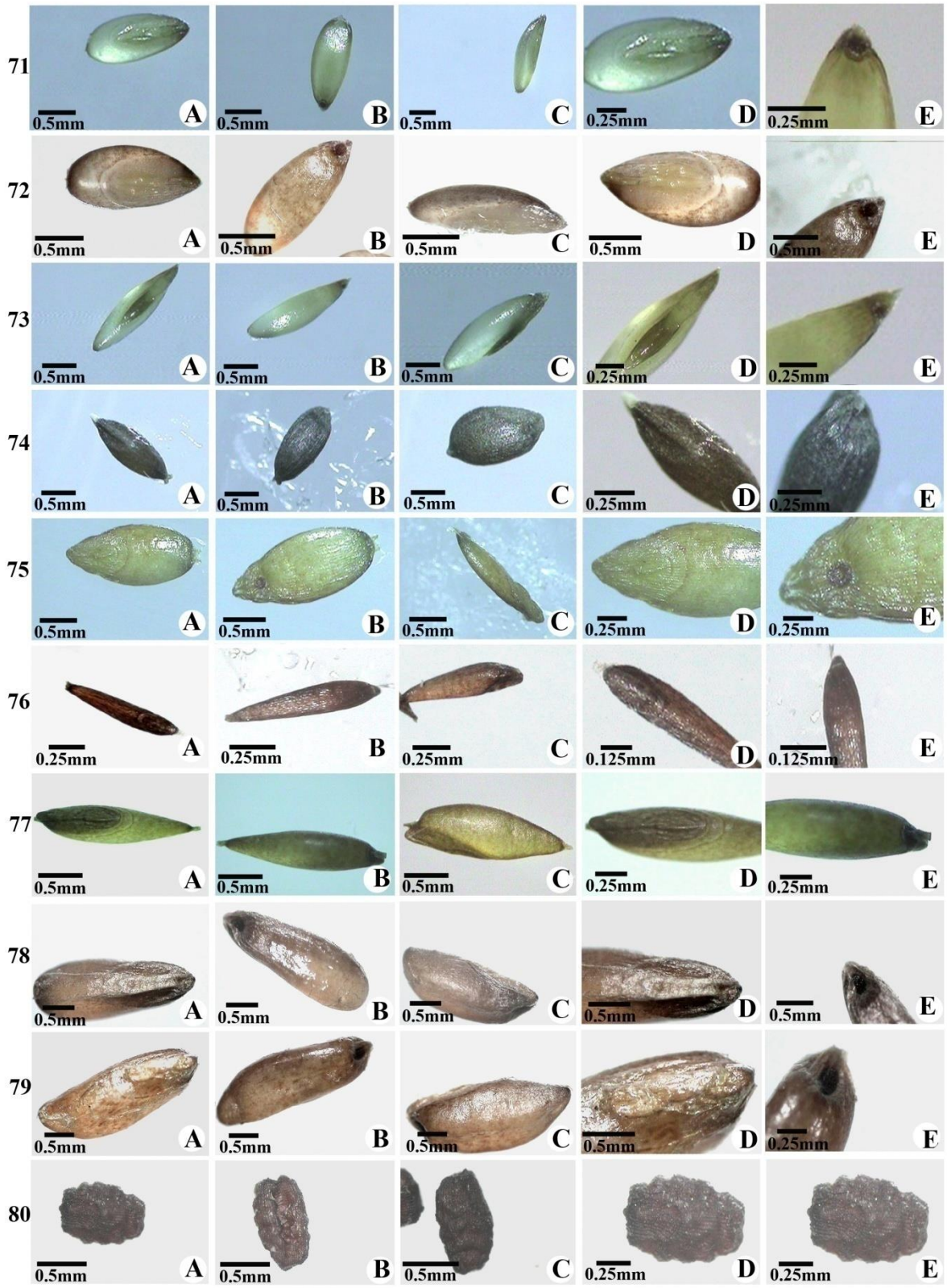


Fig. 65

Fig. 66 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

81. *Dactyloctenium aegyptium*

82. *Dactyloctenium scindicum*

83. *Desmostachya bipinnata*

84. *Dinebra retroflexa*

85. *Eleusine indica*

86. *Eragrostiella bachyphylla*

87. *Eragrostiella bifaria*

88. *Eragrostis cilianensis*

89. *Eragrostis ciliaris*

90. *Eragrostis japonica*

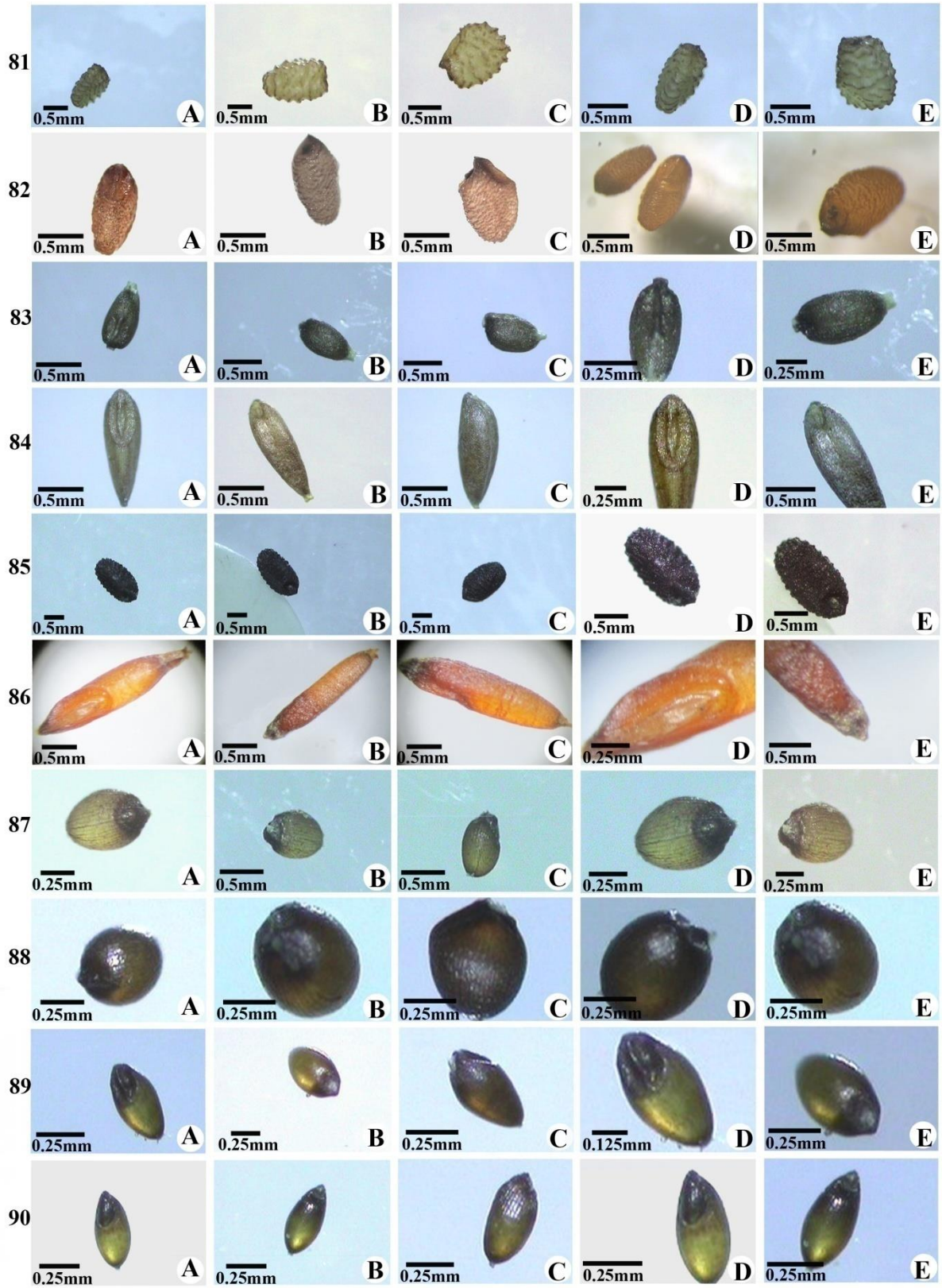

81
0.5mm A
0.5mm B
0.5mm C
0.5mm D
0.5mm E
82
0.5mm A
0.5mm B
0.5mm C
0.5mm D
0.5mm E
83
0.5mm A
0.5mm B
0.5mm C
0.25mm D
0.25mm E
84
0.5mm A
0.5mm B
0.5mm C
0.25mm D
0.5mm E
85
0.5mm A
0.5mm B
0.5mm C
0.5mm D
0.5mm E
86
0.5mm A
0.5mm B
0.5mm C
0.25mm D
0.5mm E
87
0.25mm A
0.5mm B
0.5mm C
0.25mm D
0.25mm E
88
0.25mm A
0.25mm B
0.25mm C
0.25mm D
0.25mm E
89
0.25mm A
0.25mm B
0.25mm C
0.125mm D
0.25mm E
90
0.25mm A
0.25mm B
0.25mm C
0.25mm D
0.25mm E

Fig. 66

Fig. 67 Micromorphological features of caryopses

A- Dorsal surface

B- Ventral surface

C- Lateral surface

D- Embryo

E- Hilum

91. ***Eragrostis nutans***

92. ***Eragrostis pilosa***

93. ***Eragrostis tenella***

94. ***Eragrostis tremula***

95. ***Eragrostis unioloides***

96. ***Eragrostis viscosa***

97. ***Sporobolus coromandelianus***

98. ***Sporobolus diander***

99. ***Sporobolus indicus***

100. ***Tragrus biflorus***

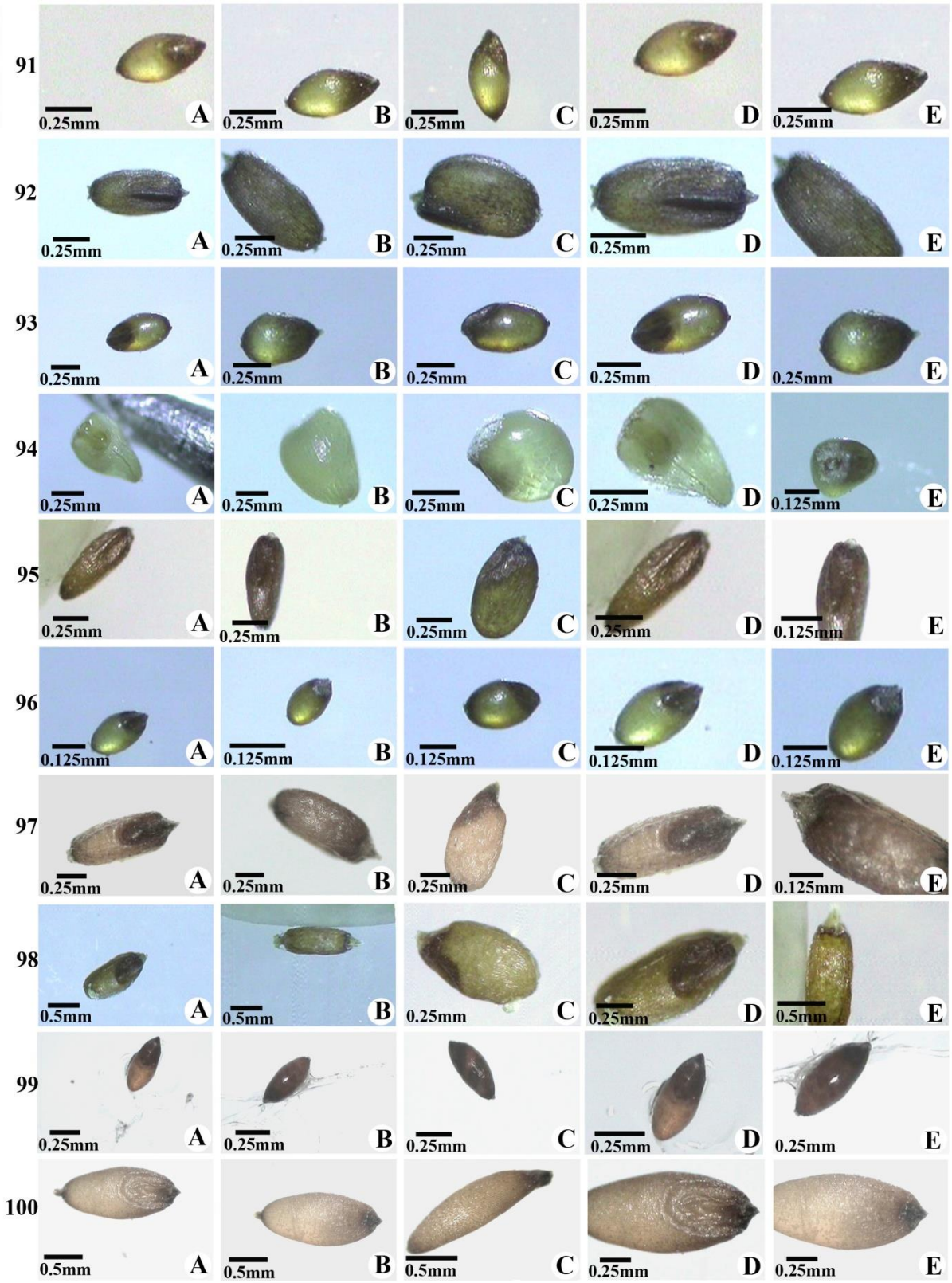


Fig. 67

Fig. 68 Surface topograpic study of *Coix lachrymal-jobi*

A,B- Ventral view (low magnification)

C,D- Dorsal surface (high magnification)

E- Ventral surface

A- Lateral surface

G, H- Embryo surface (proximal end)

I, J- Embryo surface (distal end)

K- Hilum

L- Hilum end portion

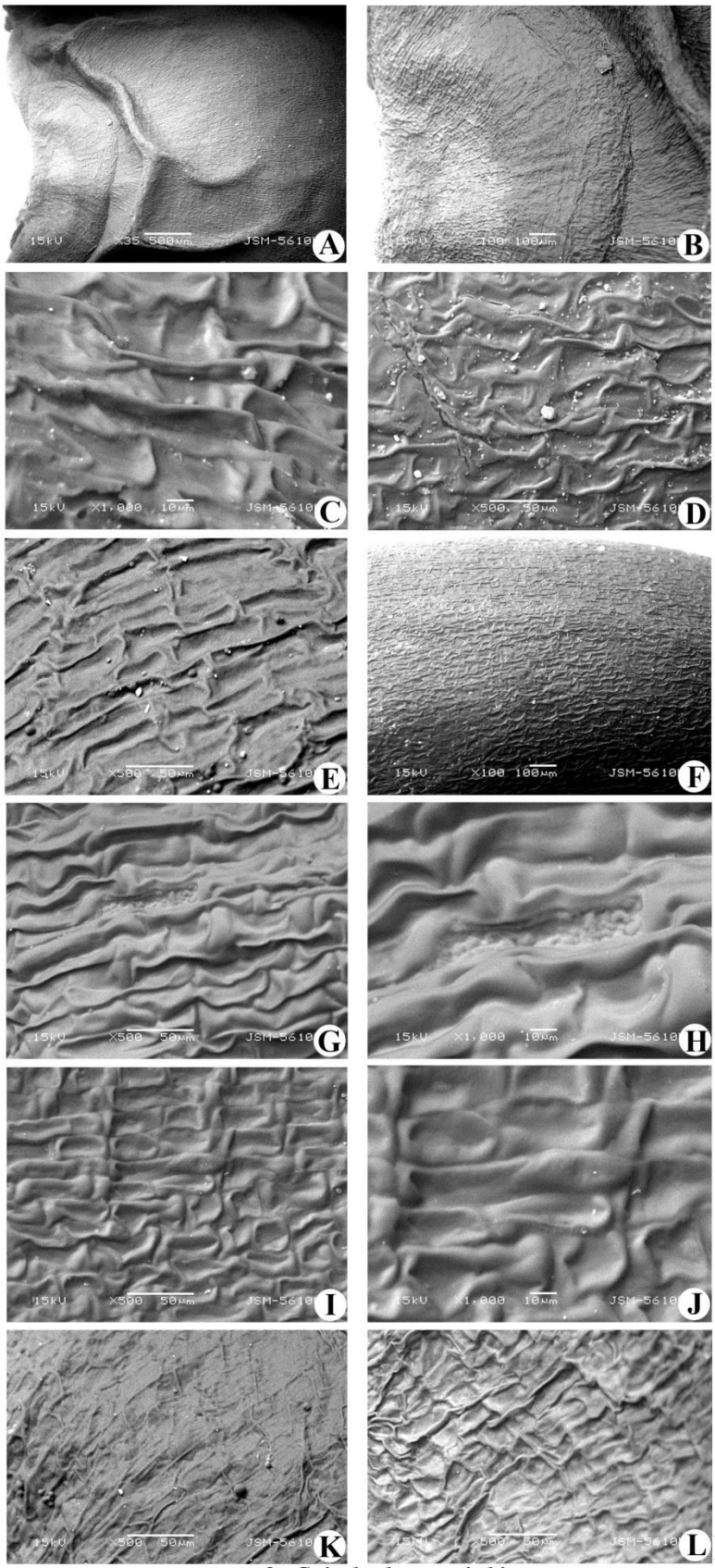


Fig. 68

2. *Coix lachryma-jobi*

Figs. 69-101 Surface topograpic study of caryopses

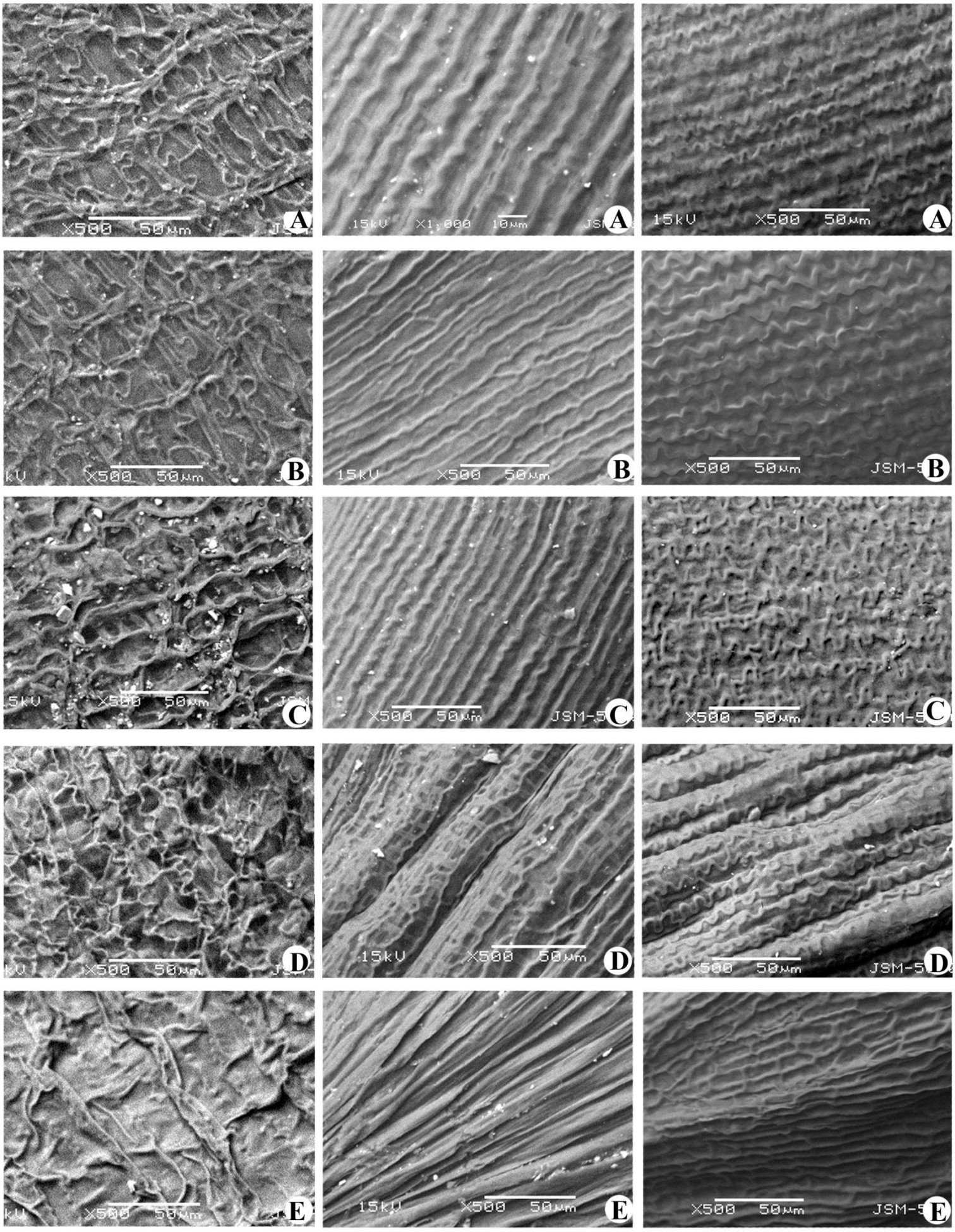
A- Dorsal surface

B- Ventral surface

C- Lateral surface

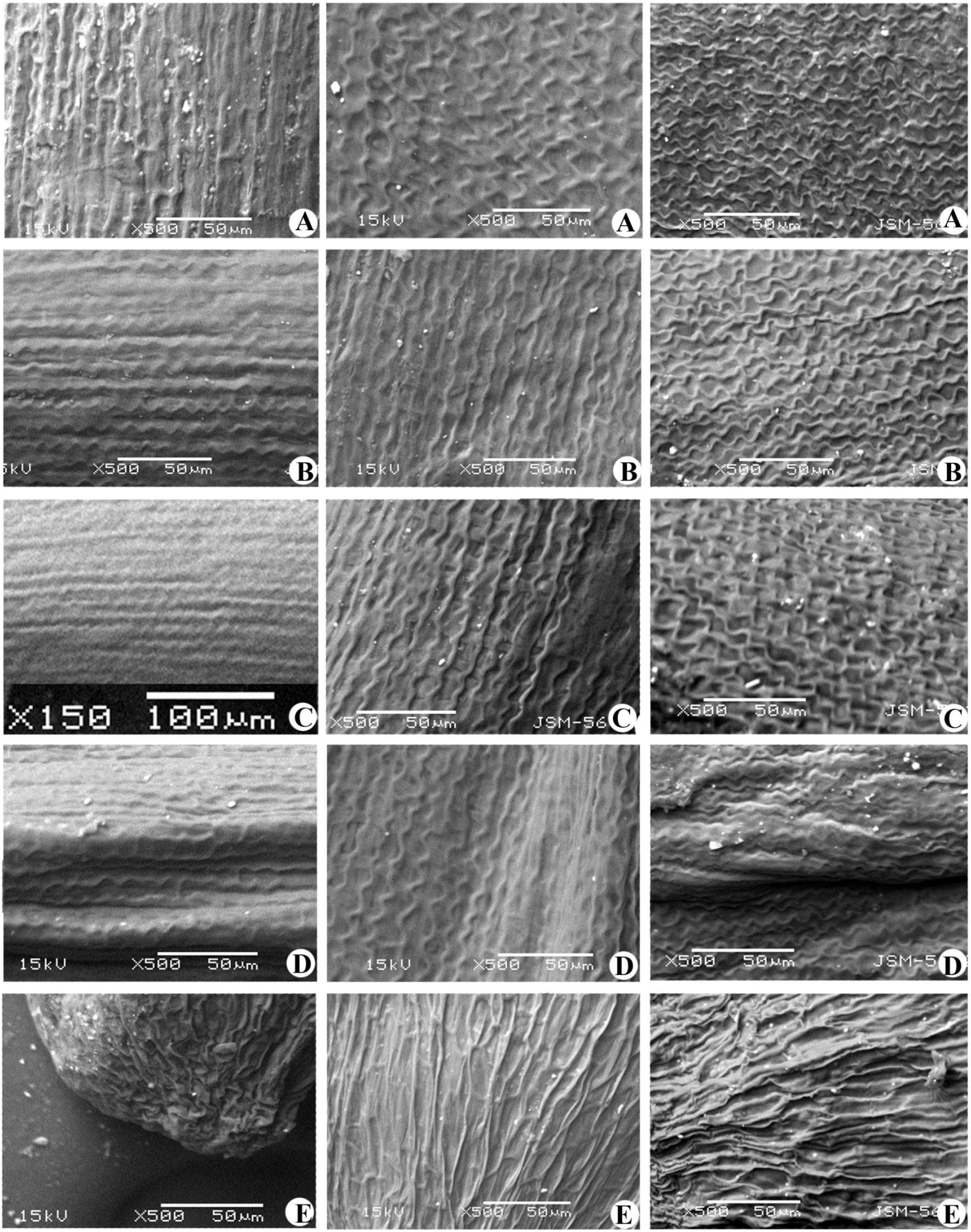
D- Embryo

E- Hilum



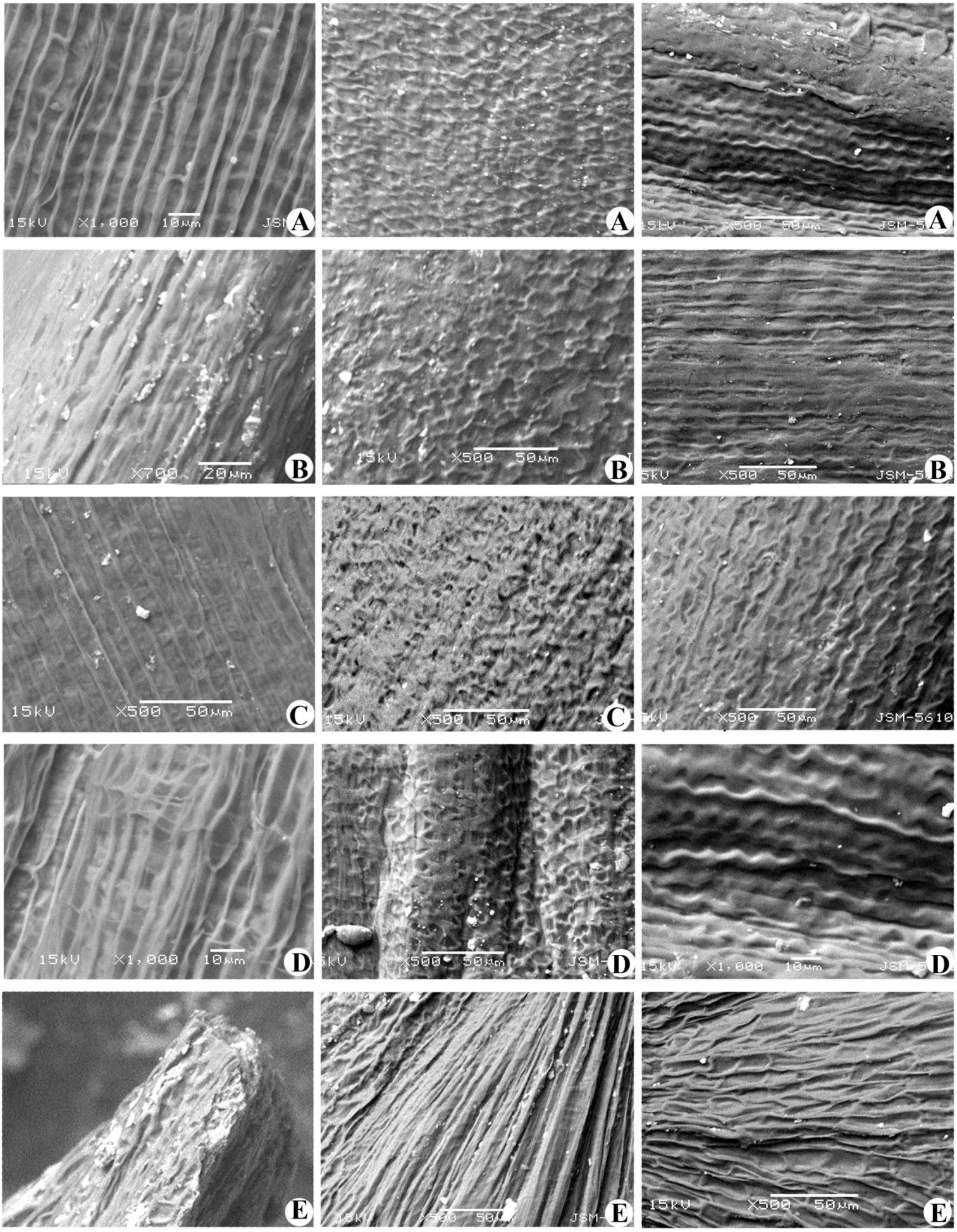
1. *Chionachne koenigii* 3. *Andropogon pumilus* 4. *Apluda mutica*

Fig. 69



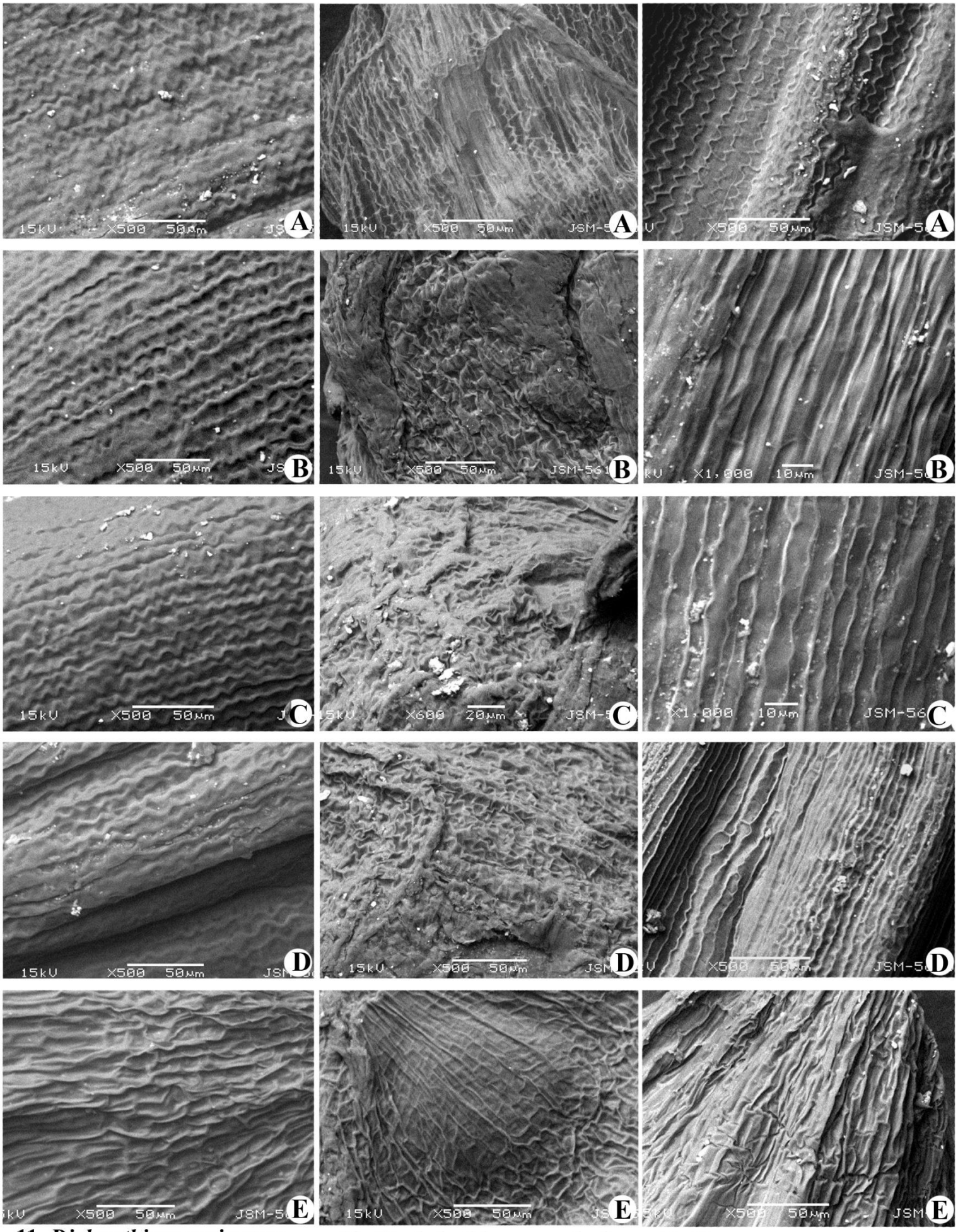
5. ***Arthraxon lanceolatus*** **6.** ***Bothriochloa pertusa*** **7.** ***Capillipedium hugelii***

Fig. 70



8. *Chrysopogon fulvus* 9. *Cymbopogon martinii* 10. *Dichanthium annulatum*

Fig. 71

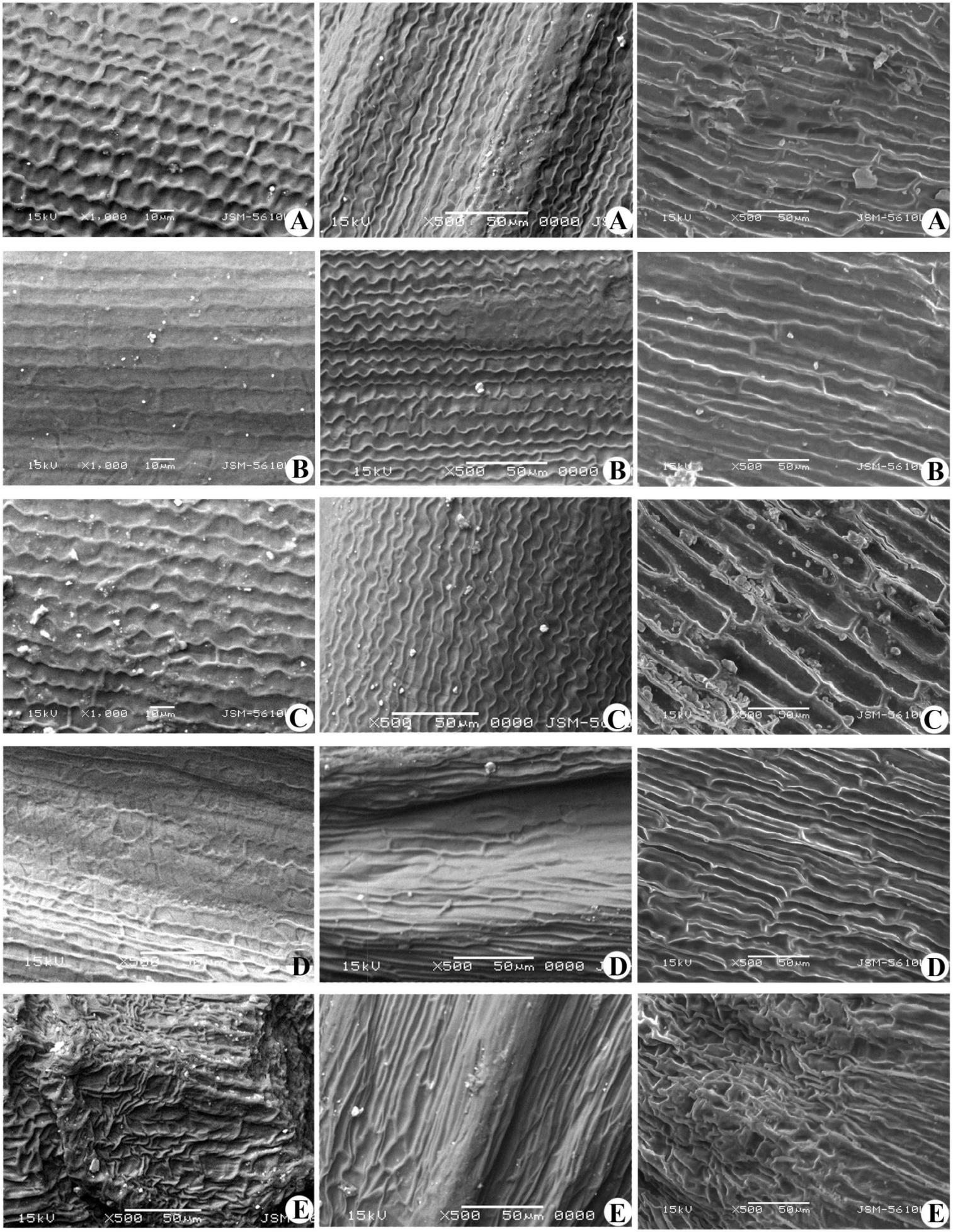


11. ***Dichanthium caricosum***

12. ***Hackelochloa granularis***

13. ***Heteropogon contortus*** **var. *genuinus* sub var. *typicus***

Fig. 72

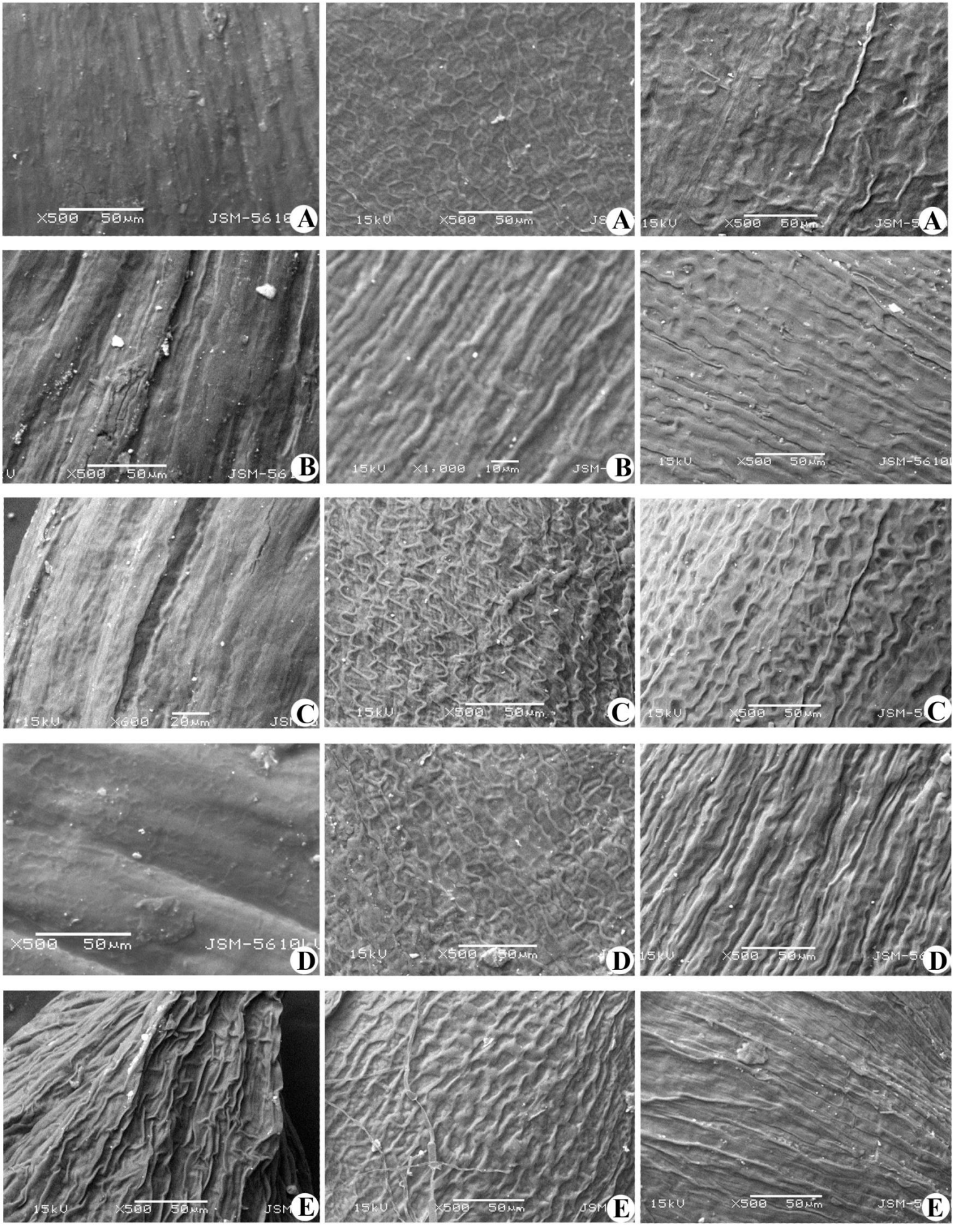


14. ***Heteropogon contortus*** **var.** ***genuinus*** **sub var.** ***hispidissimus***

15. ***Heteropogon ritchiei***

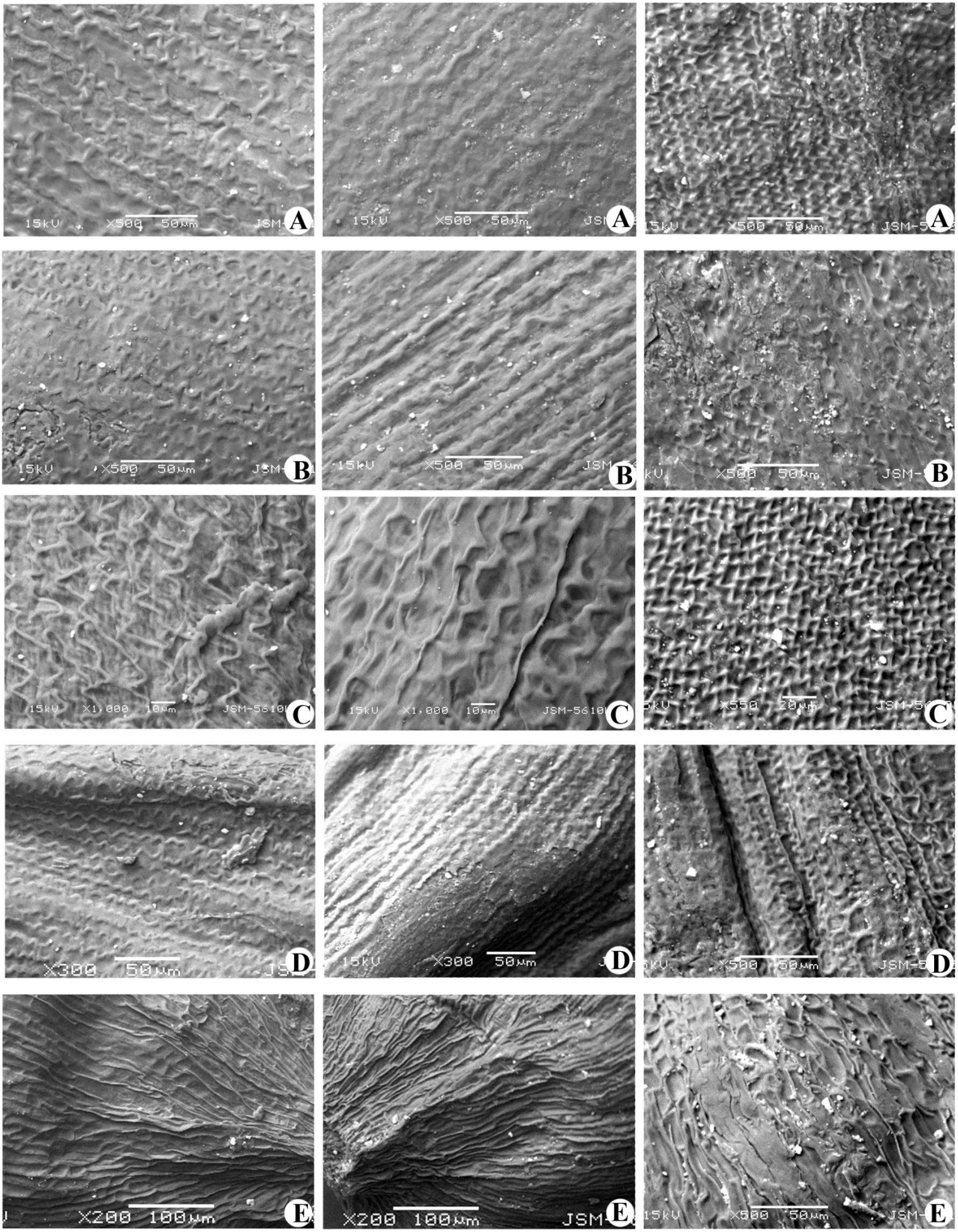
16. ***Heteropogon triticeus***

Fig. 73



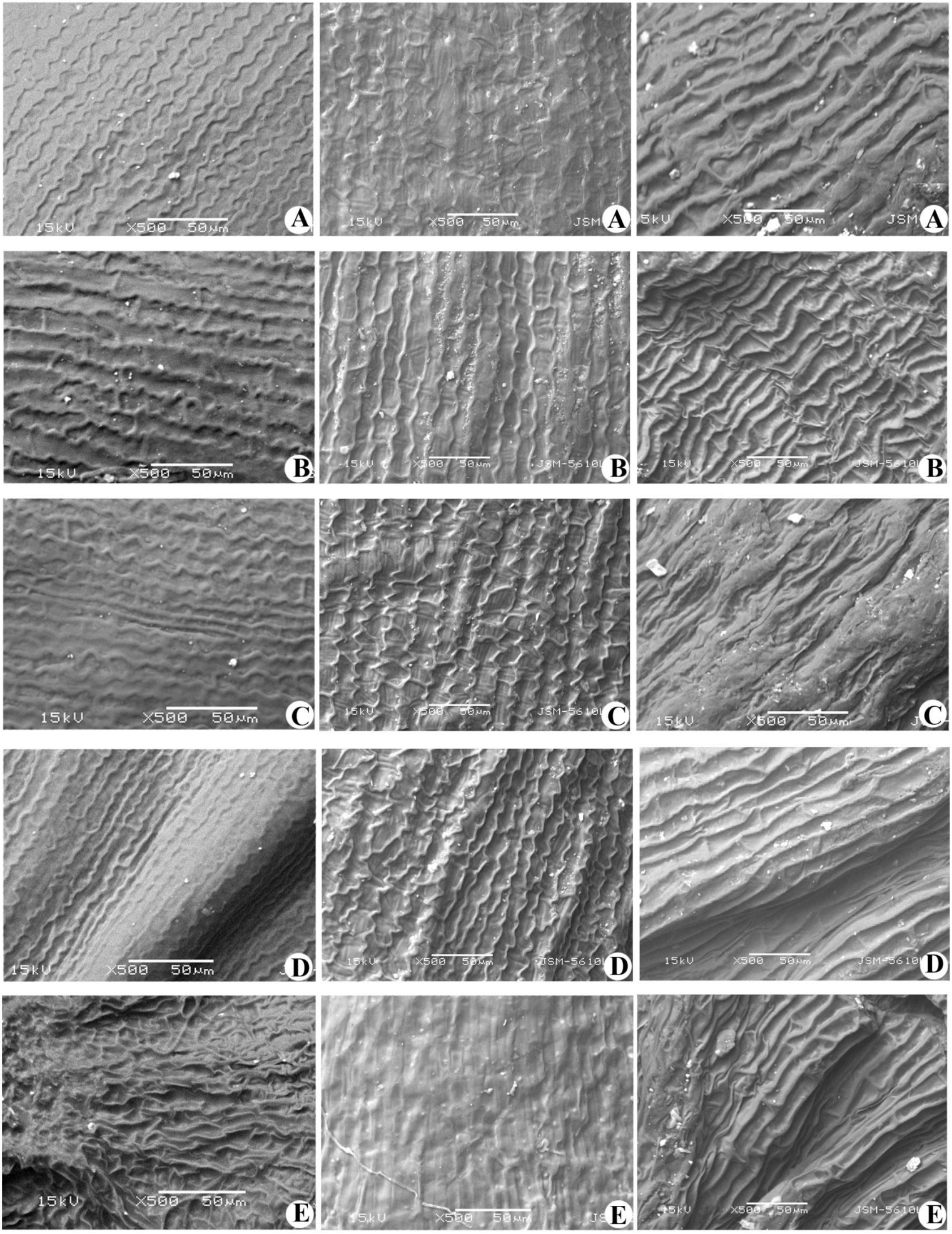
17. ***Imperata cylindrica*** **18.** ***Ischaemum indicum*** **19.** ***Ischaemum molle***

Fig. 74



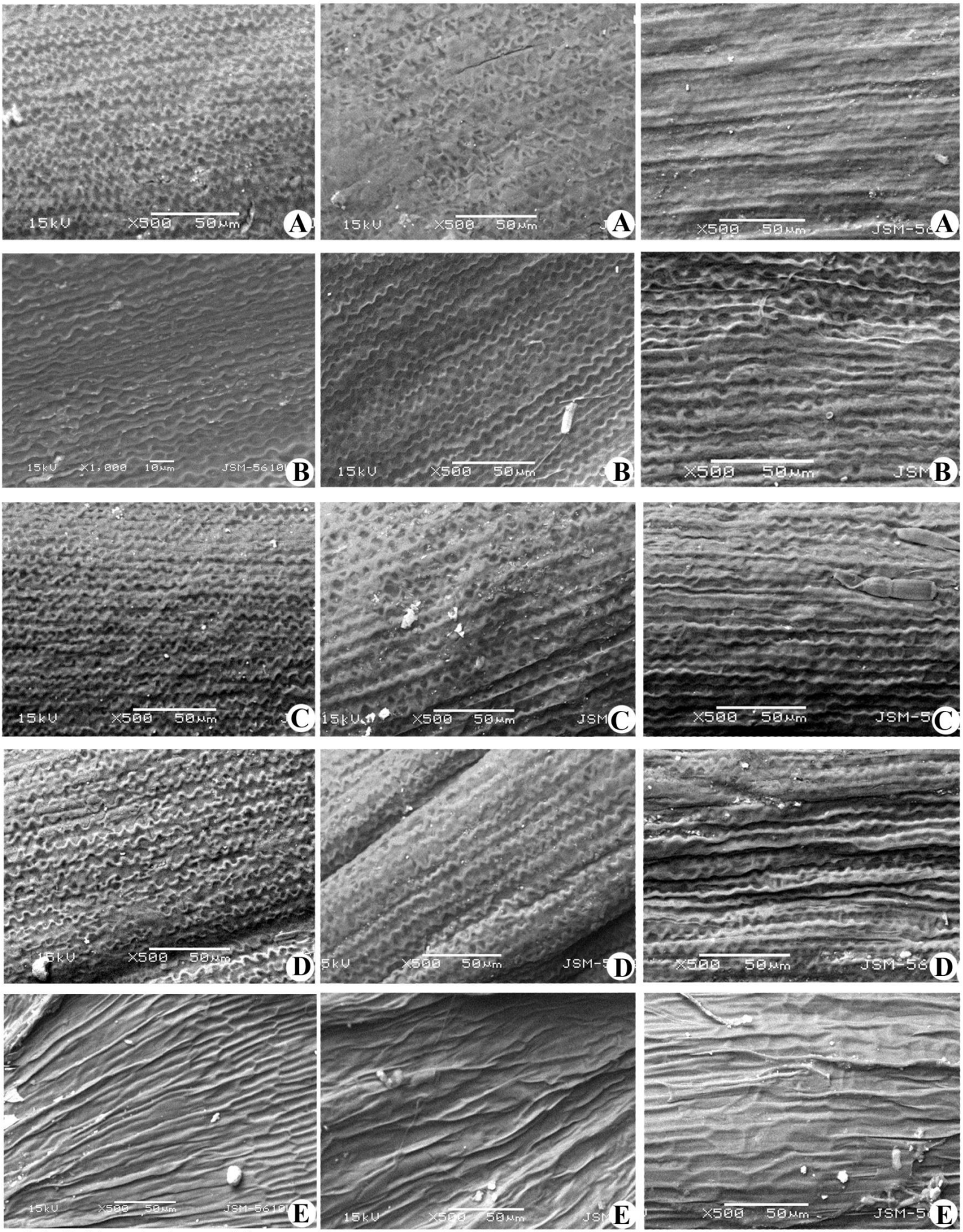
20. ***Ischaemum pilosum*** **21.** ***Ischaemum rugosum*** **22.** ***Iseilema laxum***

Fig. 75



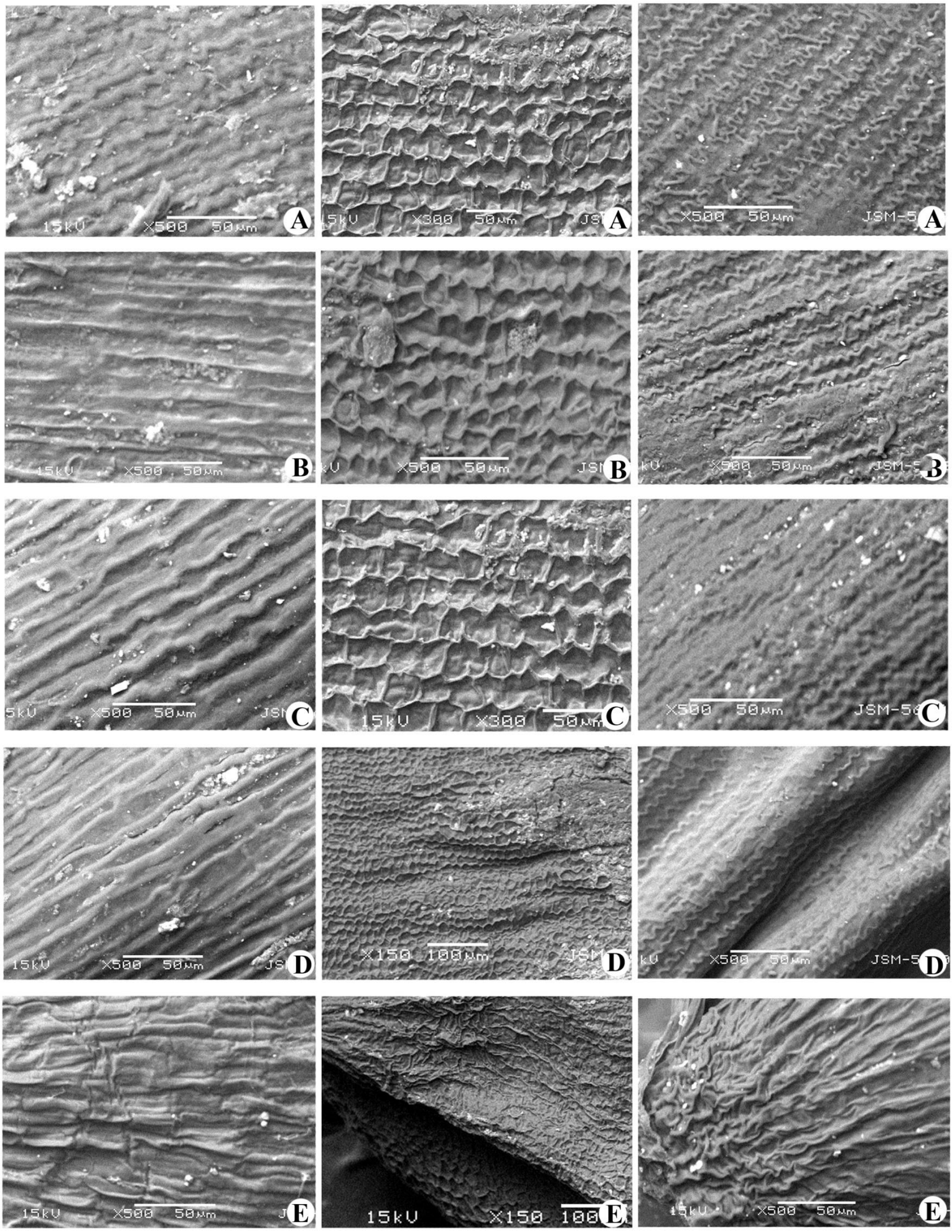
23. ***Ophiuros exaltatus*** **24.** ***Rottboellia exaltata*** **25.** ***Saccharum spontaneum***

Fig. 76



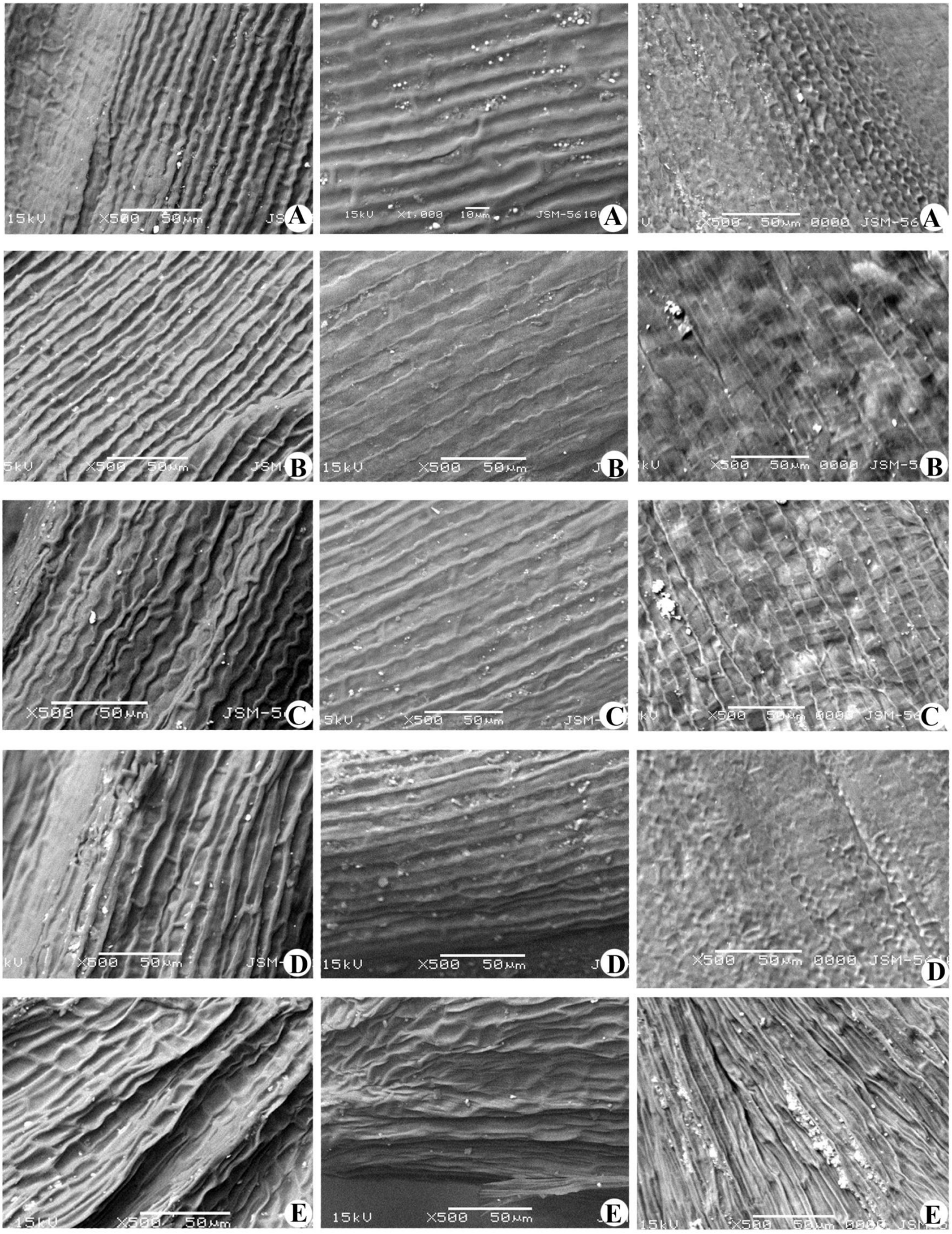
26. ***Sehima ischaemoides*** **27.** ***Sehima nervosum*** **28.** ***Sehima sulcatum***

Fig. 77



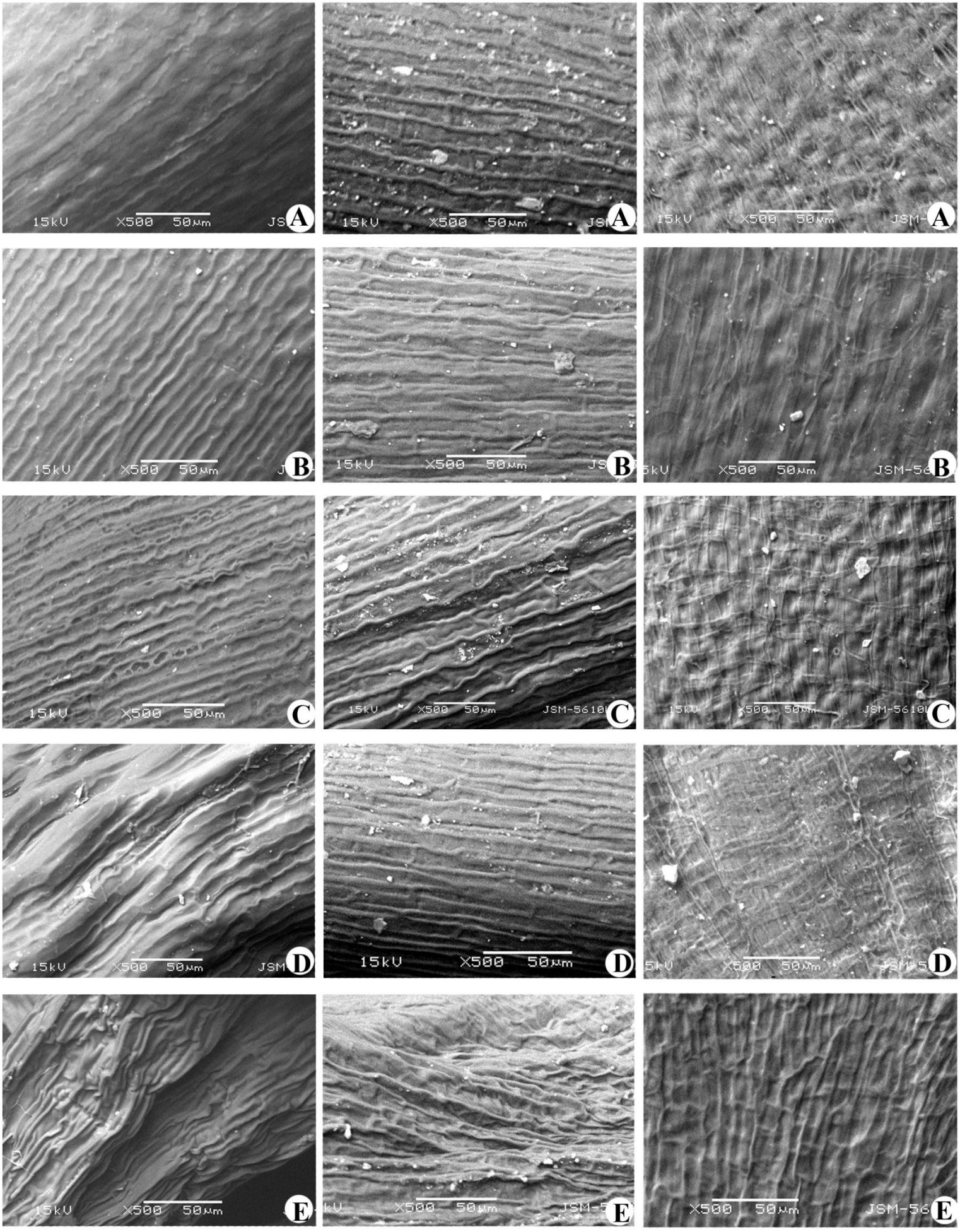
29. ***Sorghum halepense*** **30.** ***Thelepogn elegans*** **31.** ***Themeda cymbaria***

Fig. 78



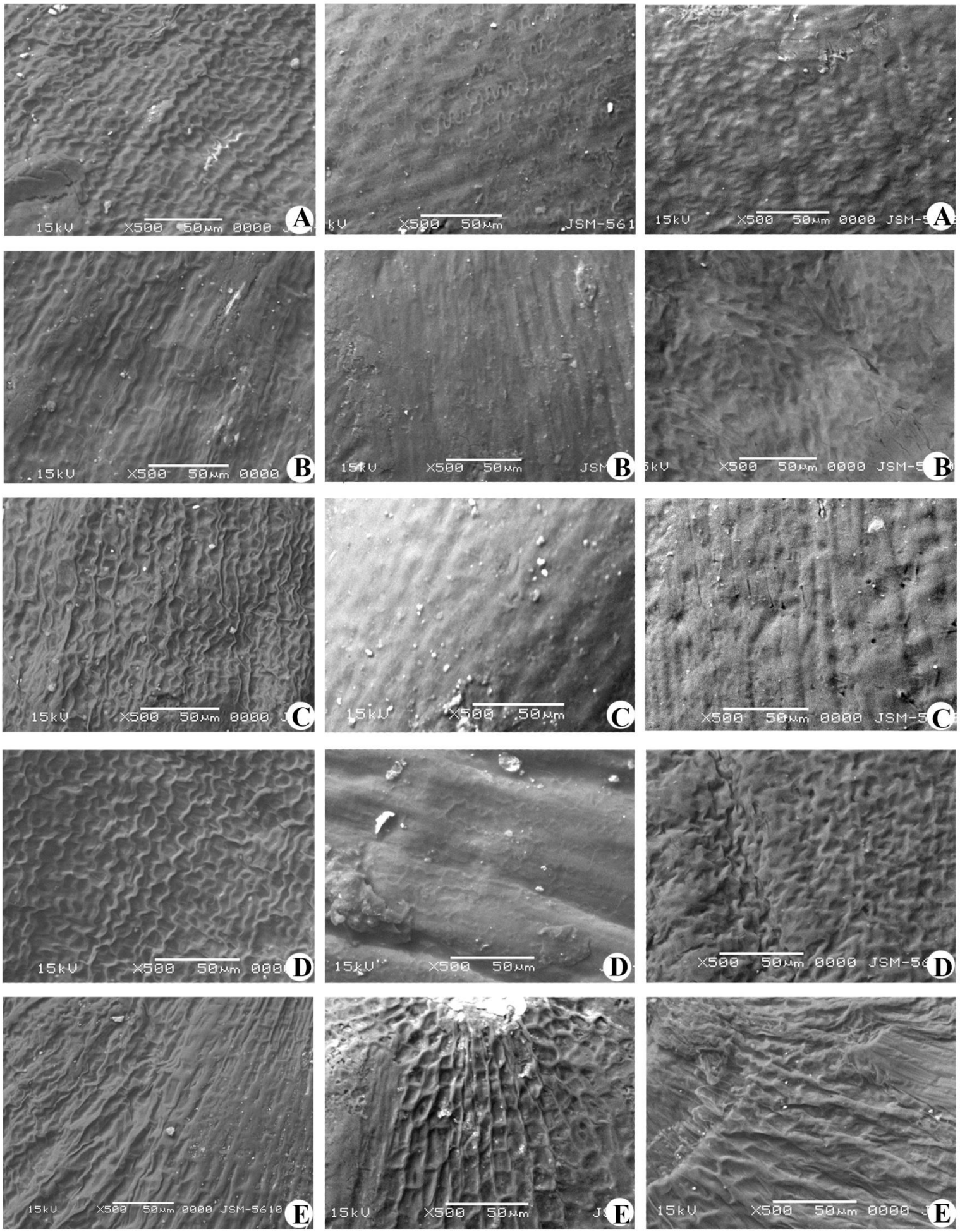
32. *Themeda laxa* 33. *Themeda triandra* 34. *Themeda quadrivalvis*

Fig. 79



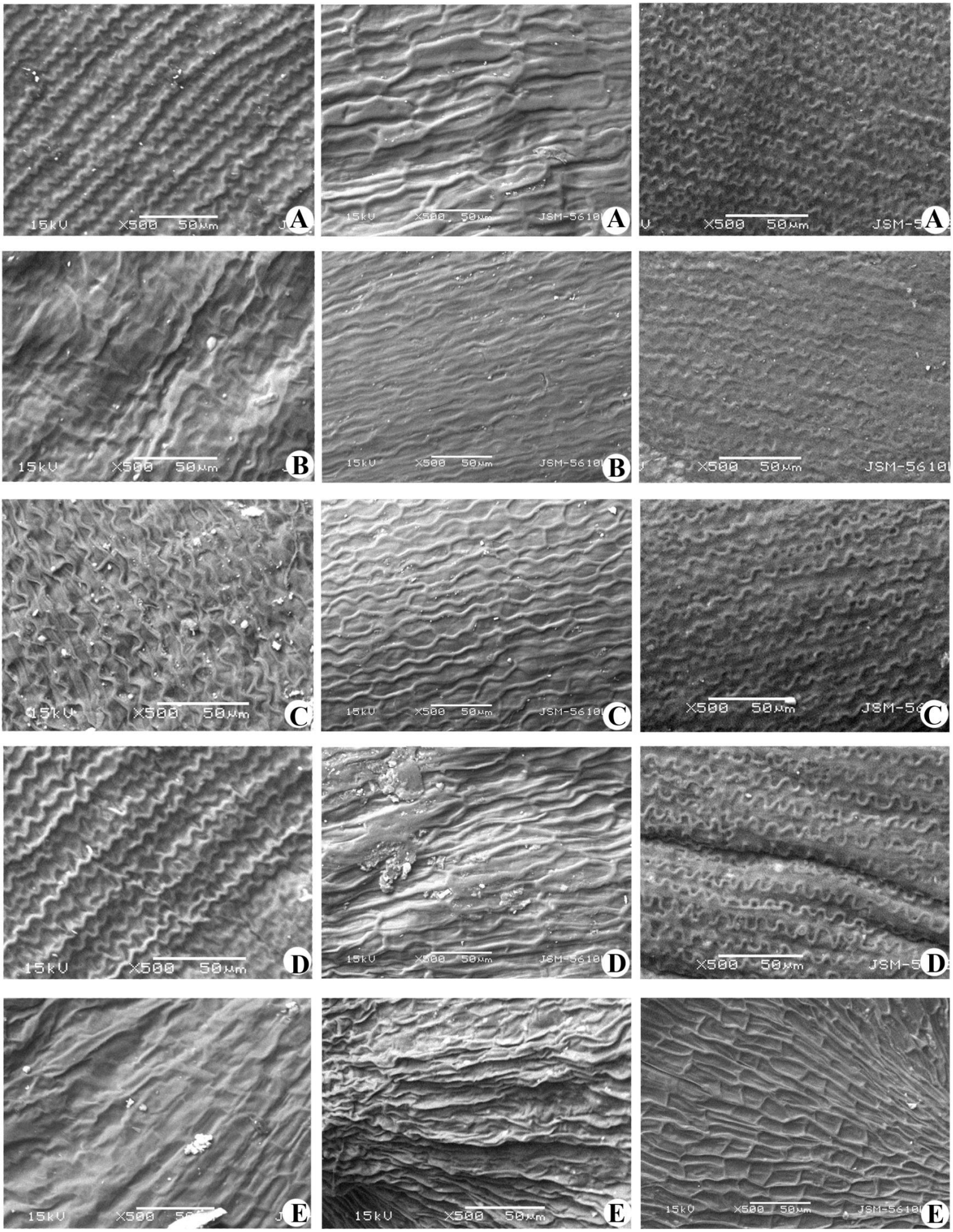
35. *Triplopogon ramosissimus* 36. *Vetivaria zizanioides* 37. *Alloteropsis cimicina*

Fig. 80



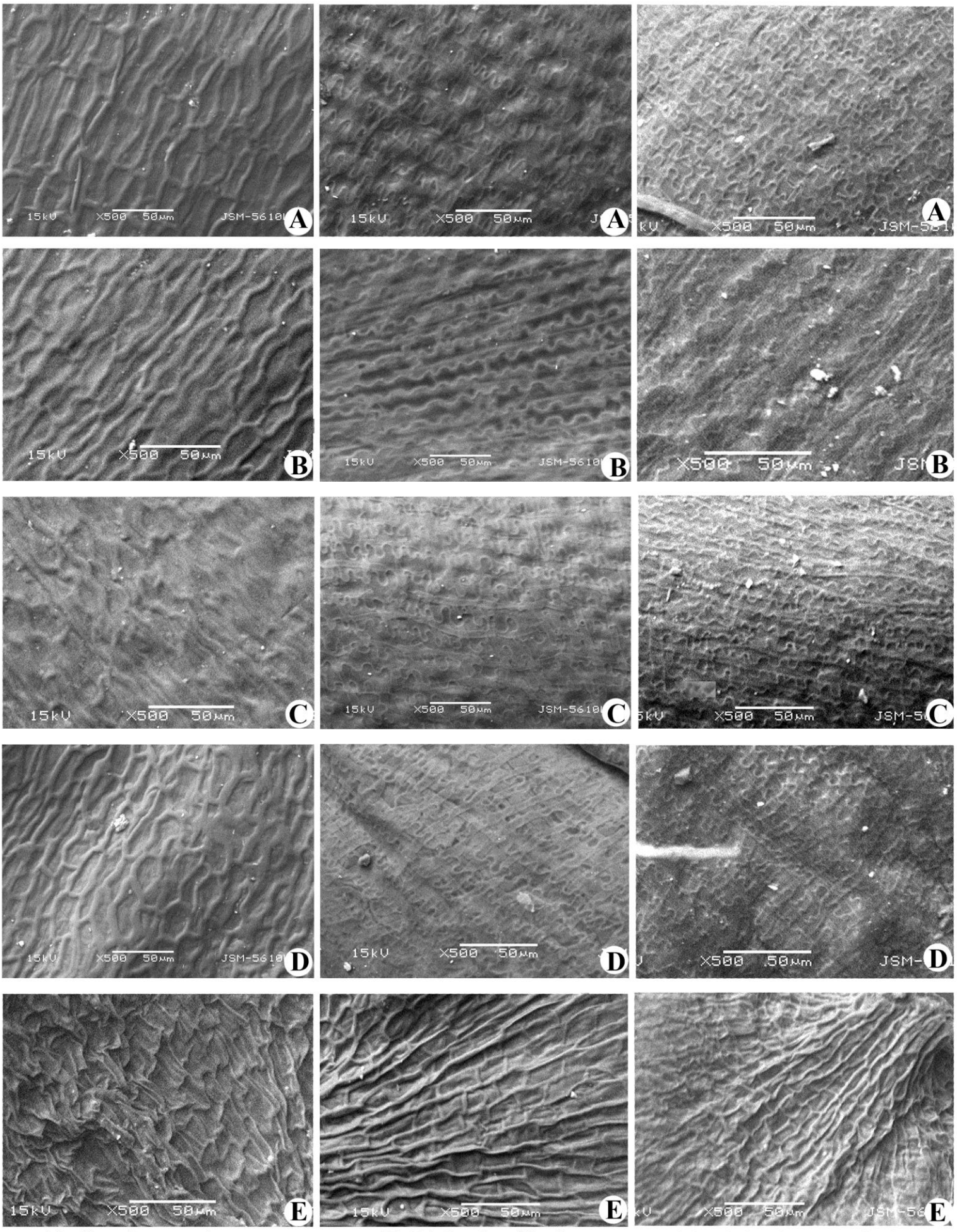
38. ***Brachiaria distachya*** **39.** ***Brachiaria eruciformis*** **40.** ***Brachiaria ramosa***

Fig. 81



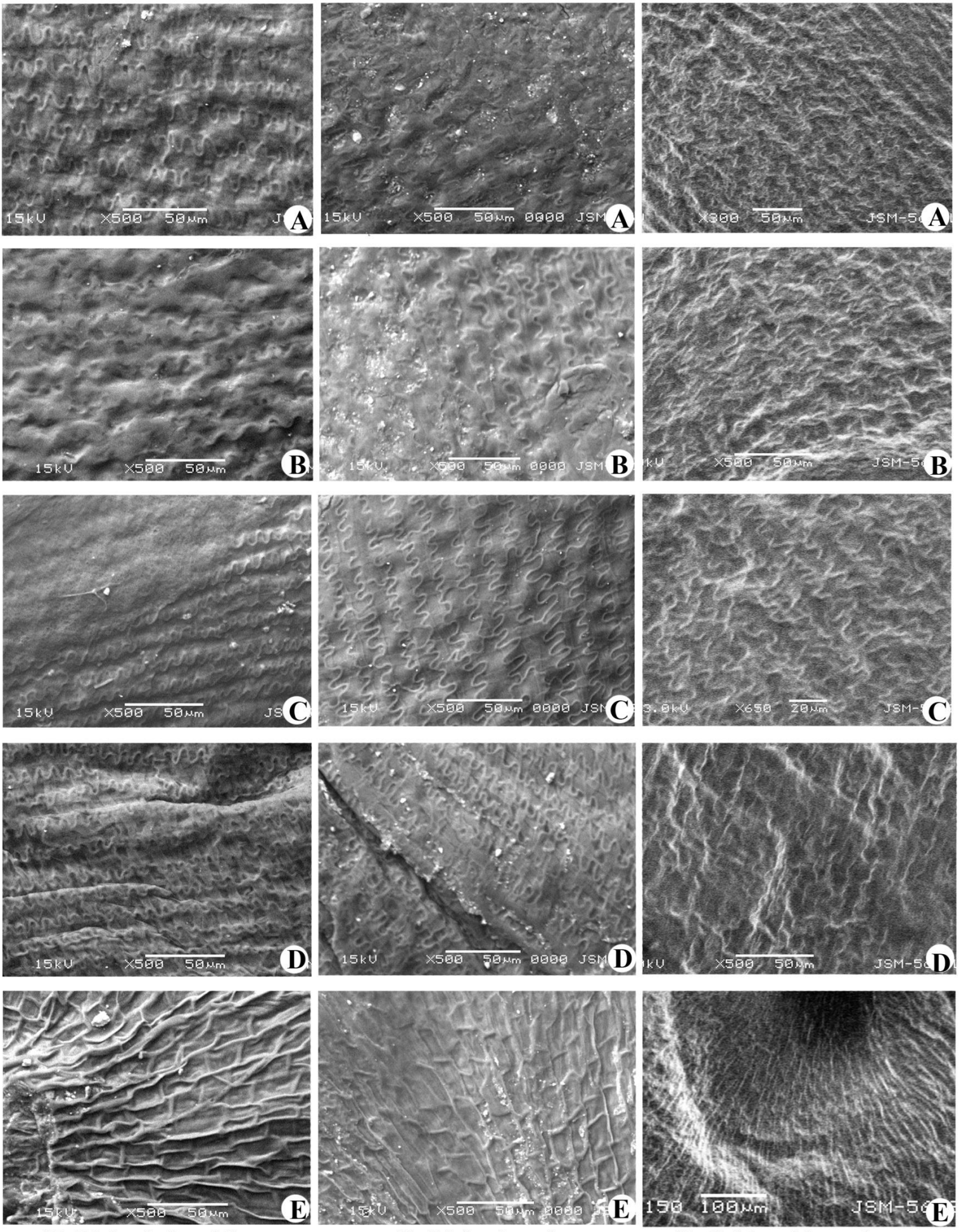
41. ***Brachiaria reptans*** 42. ***Cenchrus biflorus*** 43. ***Cenchrus ciliaris***

Fig. 82



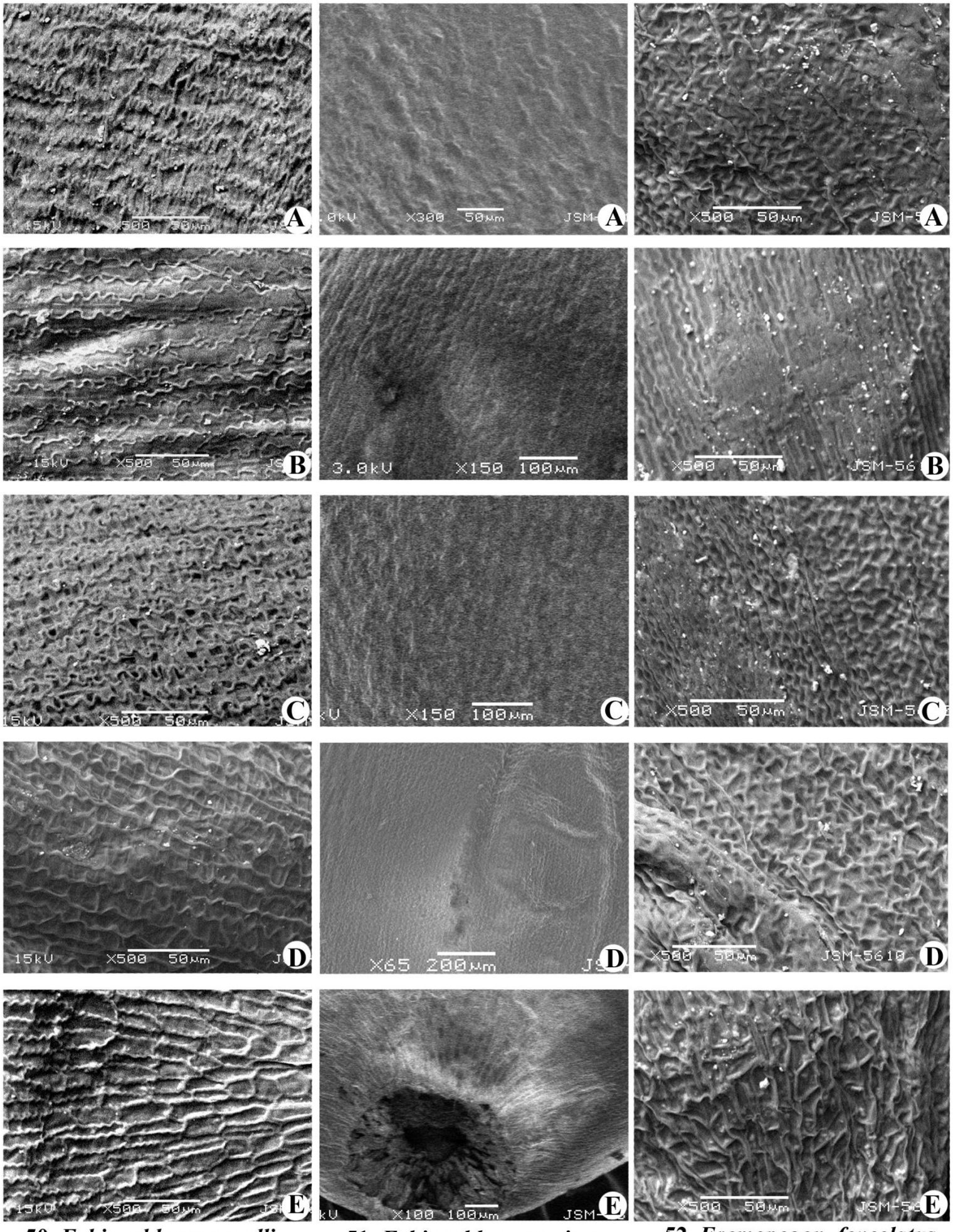
44. ***Cenchrus setigerus*** **45.** ***Digitaria ciliaris*** **46.** ***Digitaria granularis***

Fig. 83



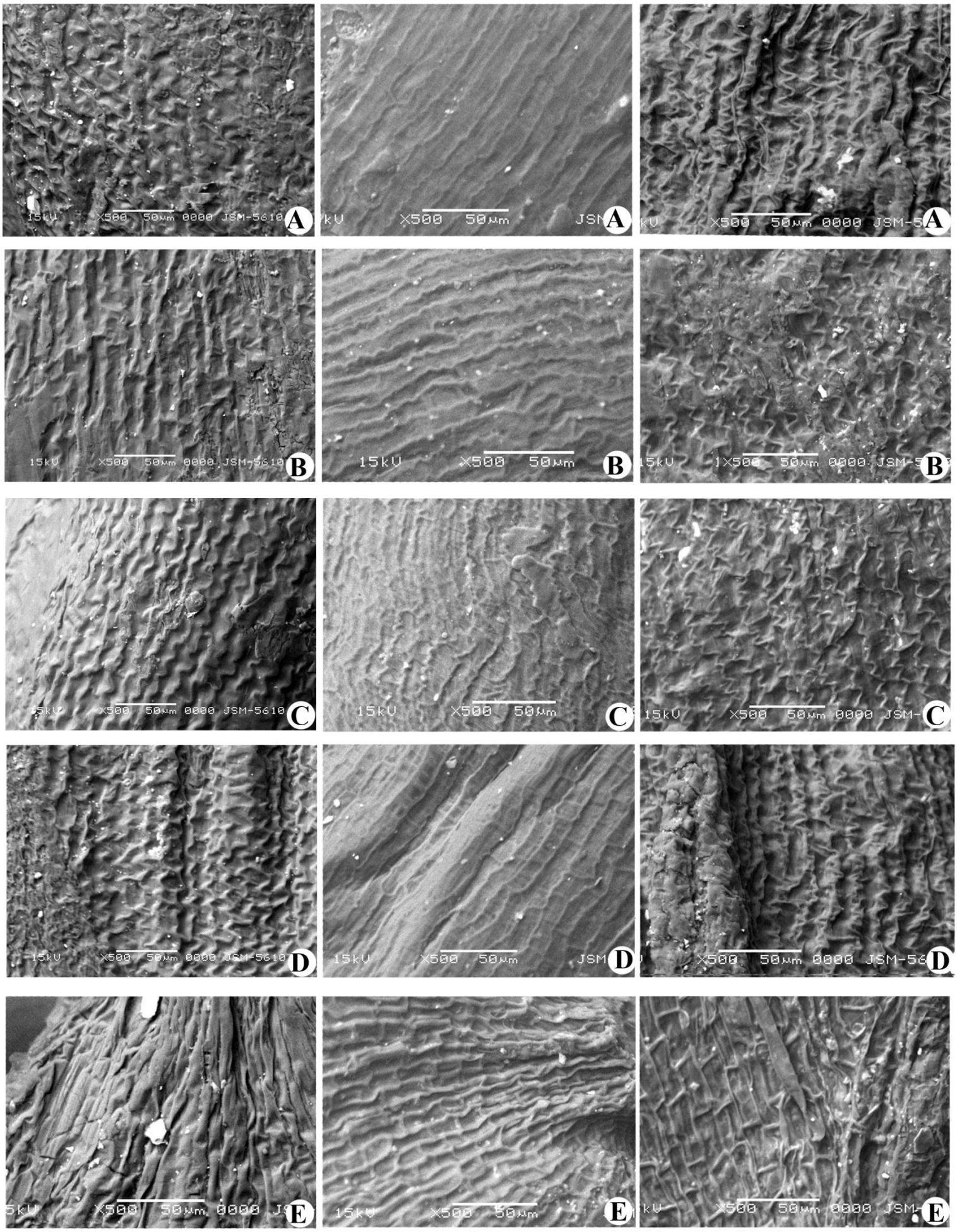
47. ***Digitaria longiflora*** **48.** ***Digitaria stricta*** **49.** ***Echinochloa colonum***

Fig. 84



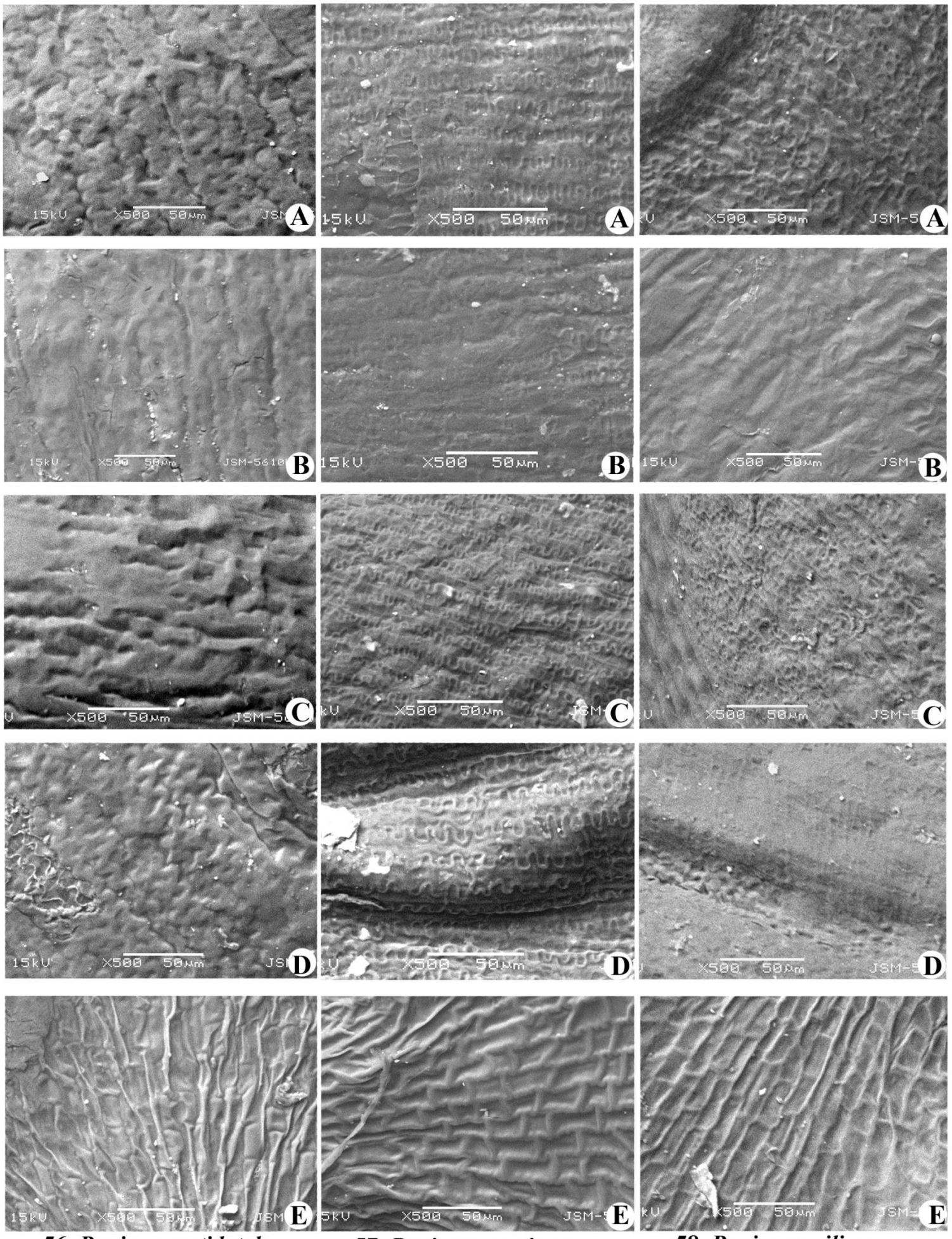
50. ***Echinochloa crusgalli*** **51.** ***Echinochloa stagnina*** **52.** ***Eremopogon foveolatus***

Fig. 85



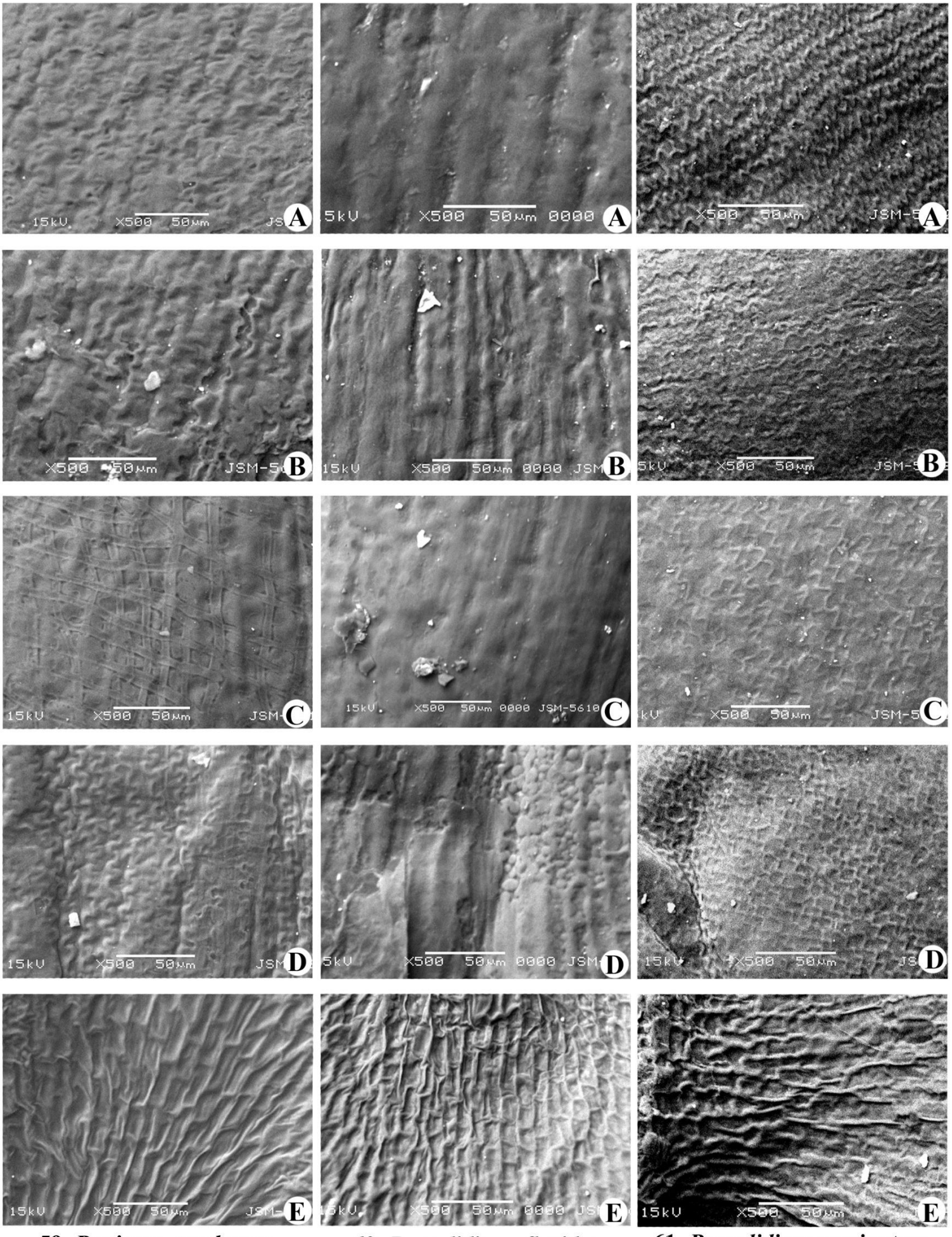
53. ***Eriochloa procera*** **54.** ***Oplismenus burmannii*** **55.** ***Oplismenus compositus***

Fig. 86



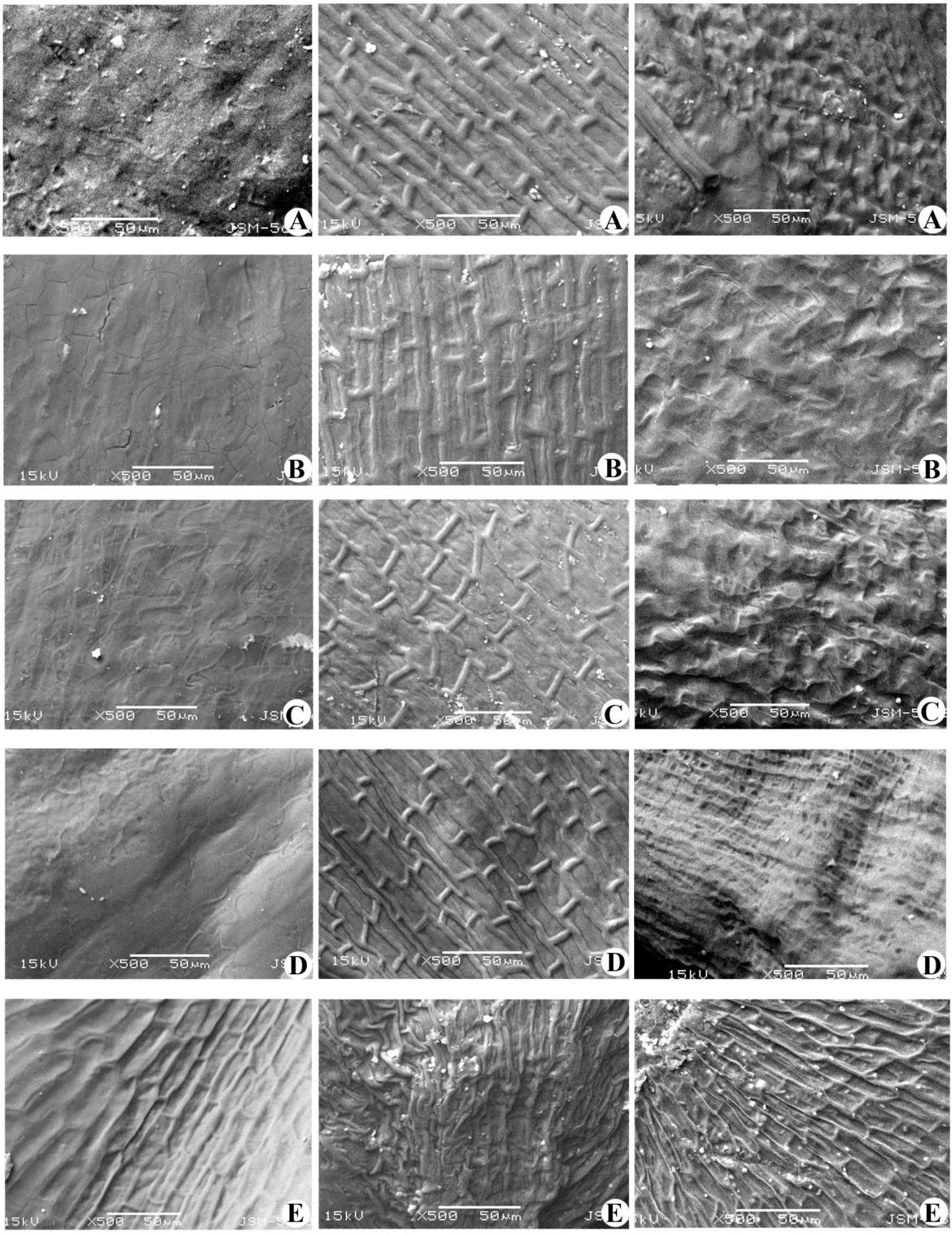
56. ***Panicum antidotale*** **57.** ***Panicum maximum*** **58.** ***Panicum miliaceum***

Fig. 87



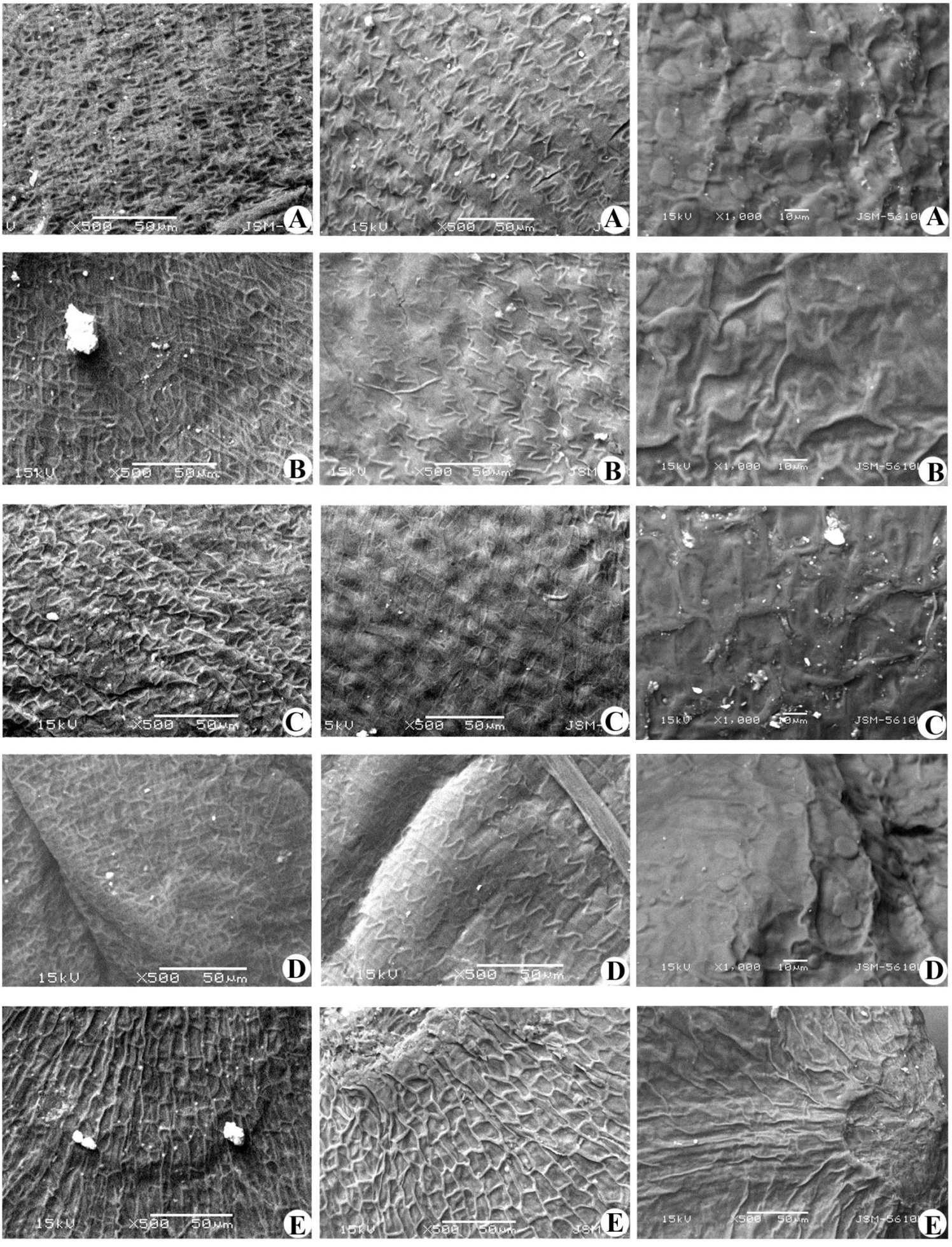
59. ***Panicum trypheron*** **60.** ***Paspalidium flavidum*** **61.** ***Paspalidium geminatum***

Fig. 88



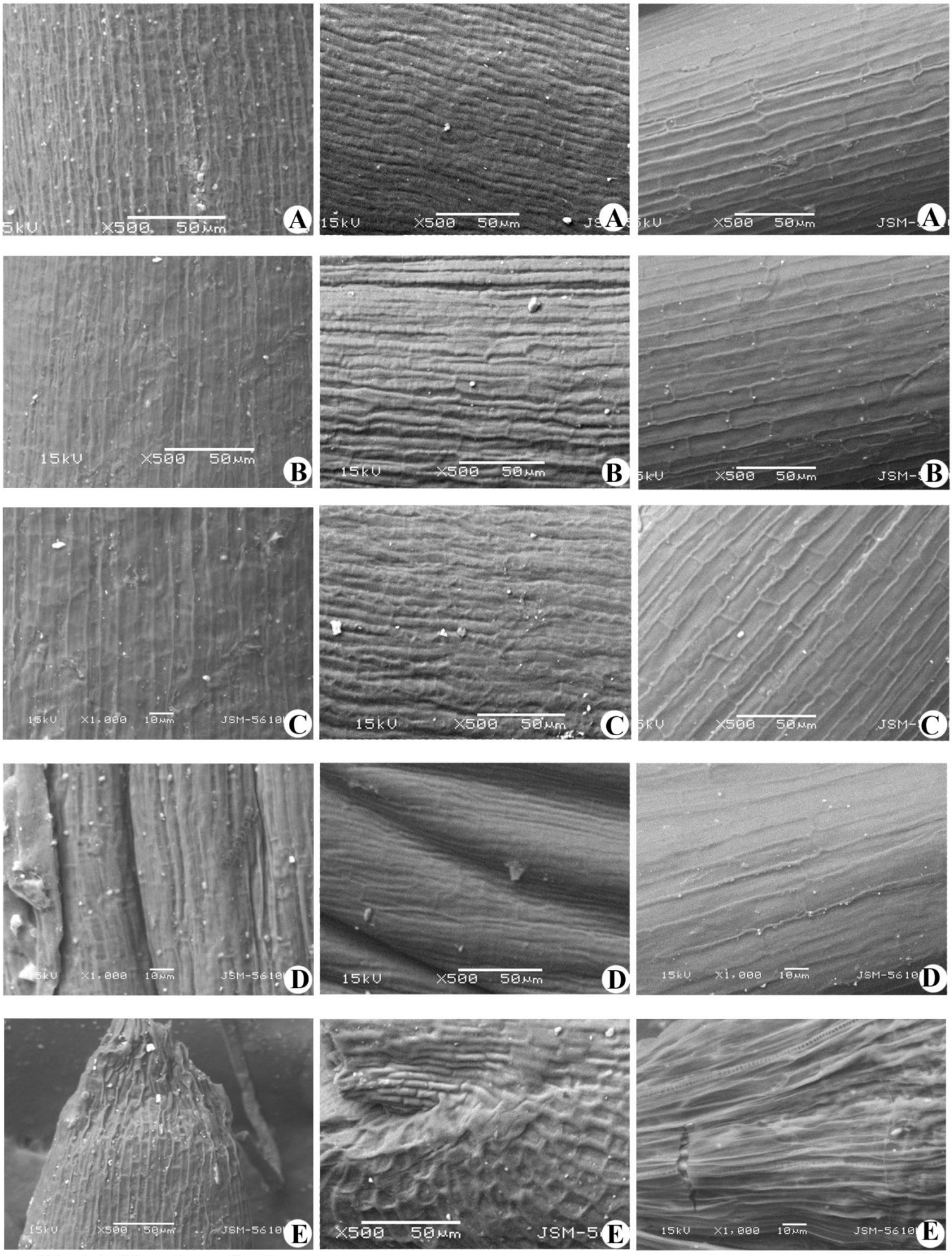
62. *Paspalum scrobiculatum* 63. *Pennisetum setosum* 64. *Setaria glauca*

Fig. 89



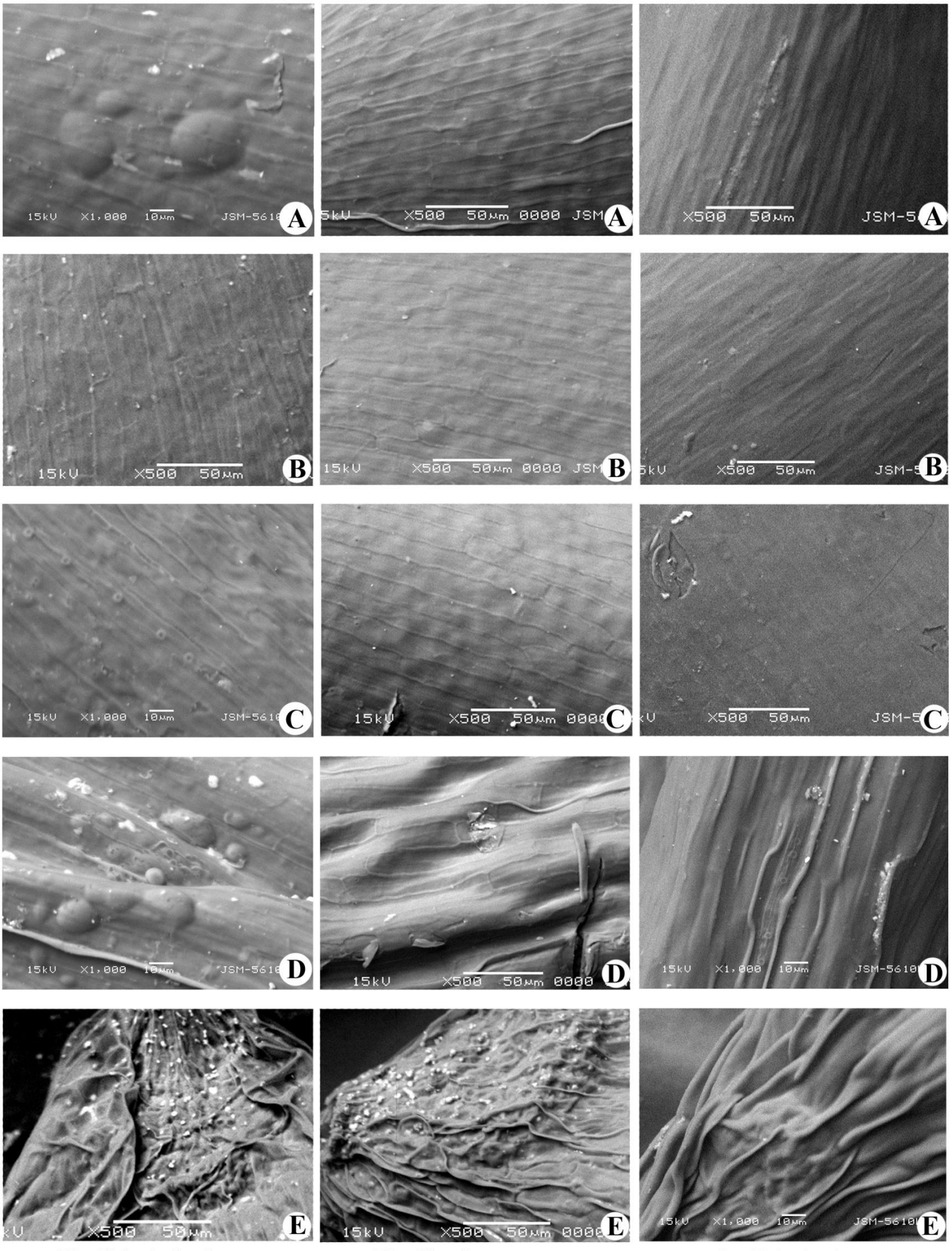
65. ***Setaria tomentosa*** **66.** ***Setaria verticillata*** **67.** ***Isachne globosa***

Fig. 90



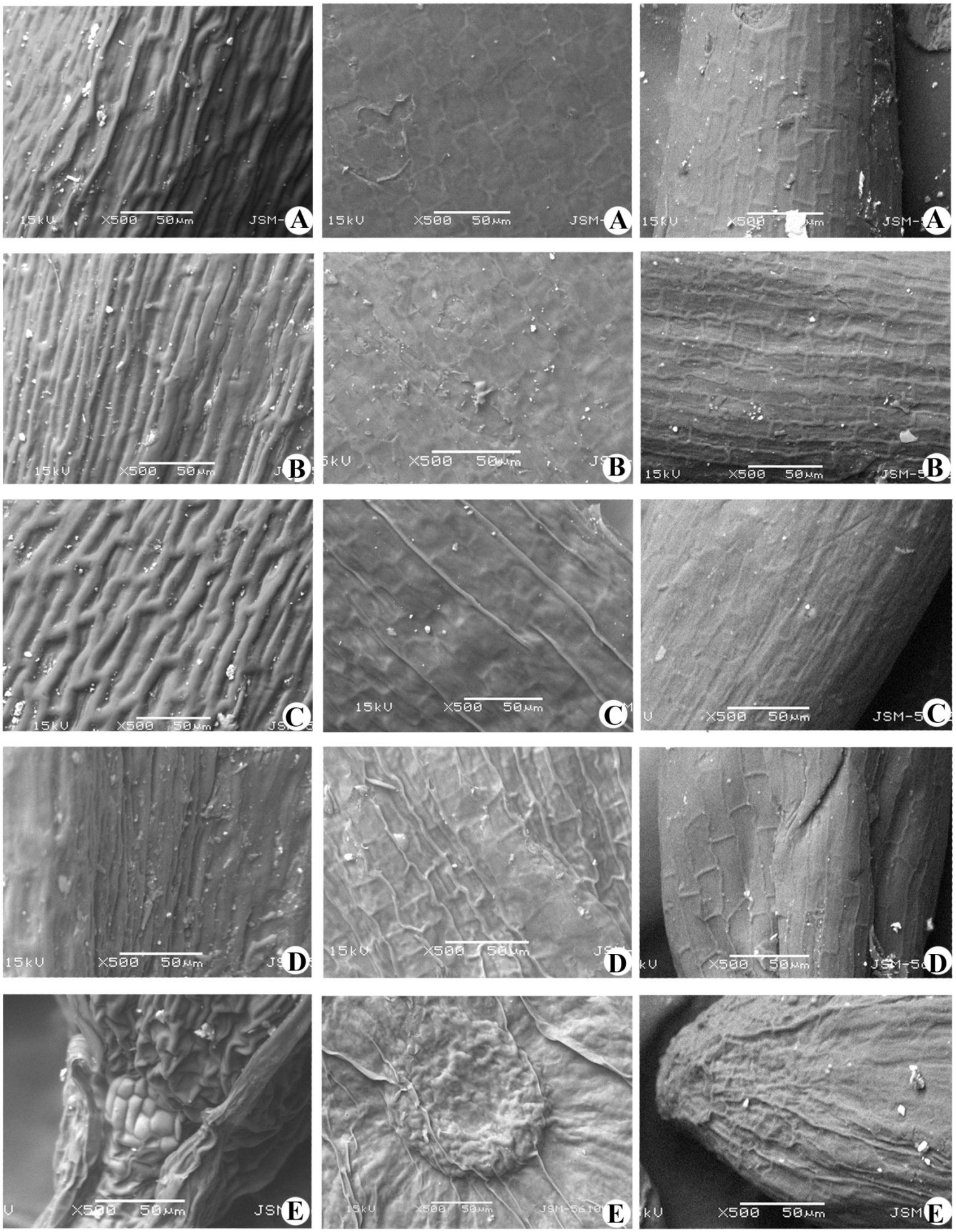
68. ***Aristida adscensionis*** **69.** ***Aristida funiculata*** **70.** ***Perotis indica***

Fig. 91



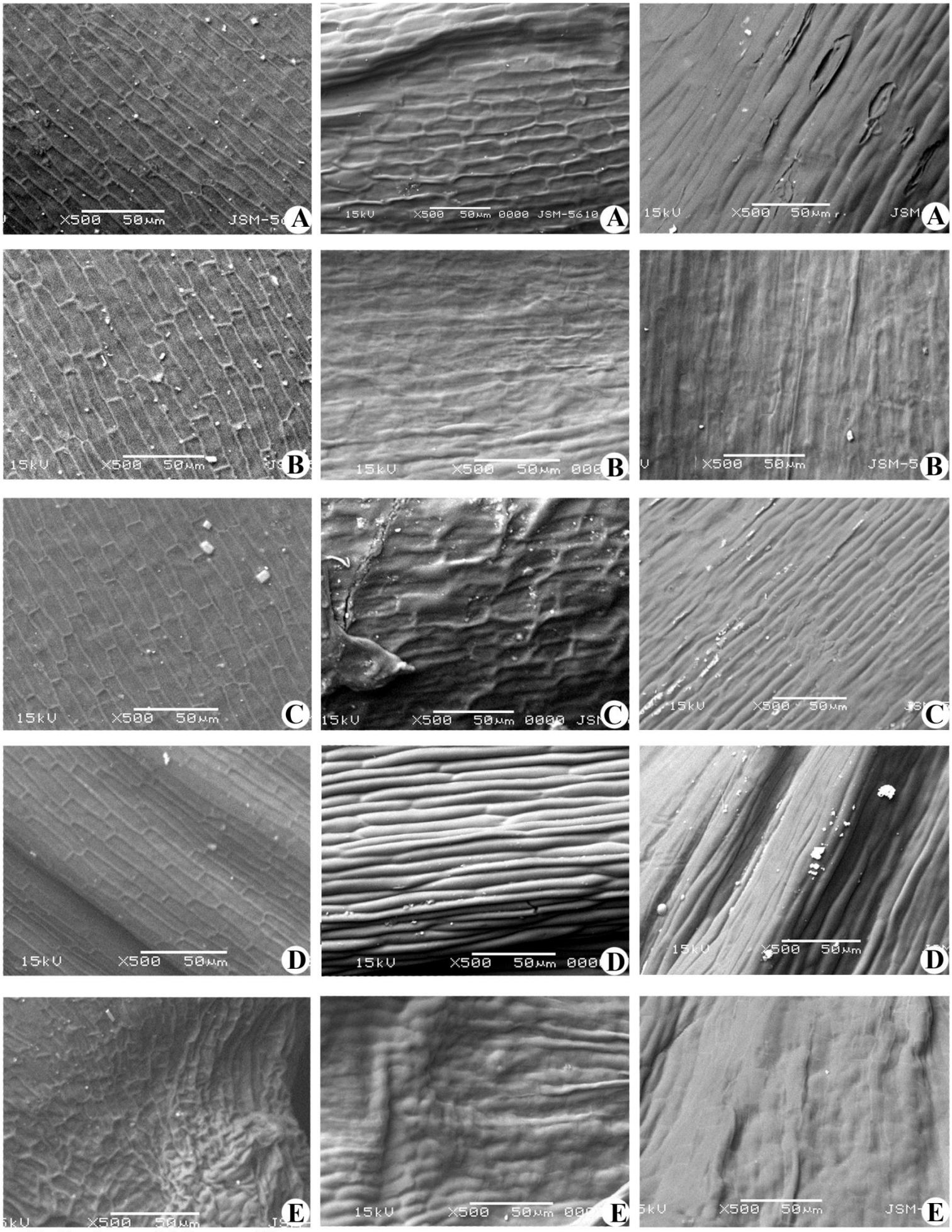
71. ***Chloris barbata*** **72.** ***Choris montana*** **73.** ***Chloris virgata***

Fig. 92



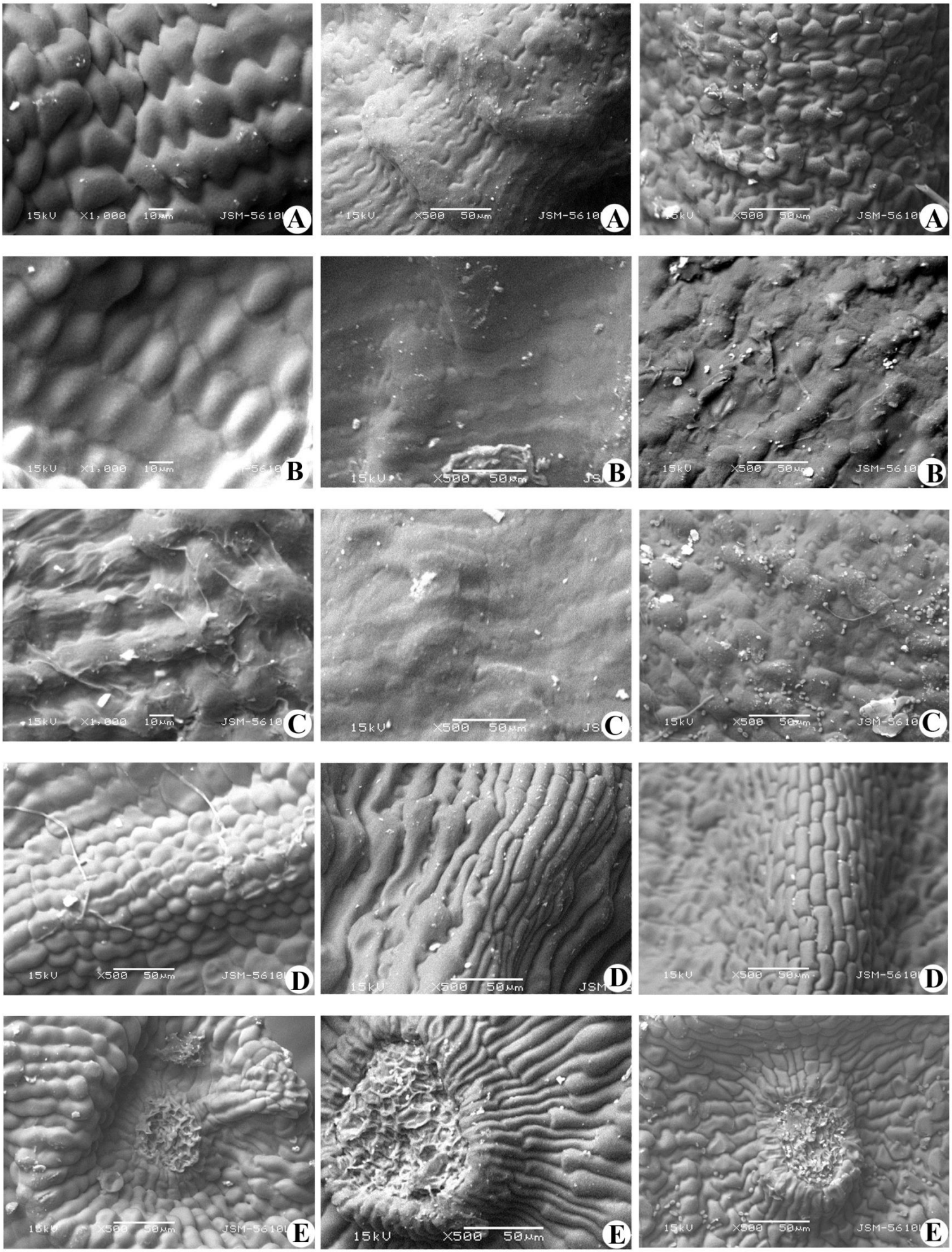
74. *Cynadon dactylon* 75. *Melanocenchris jaequemontii* 76. *Oropetium villosulum*

Fig. 93



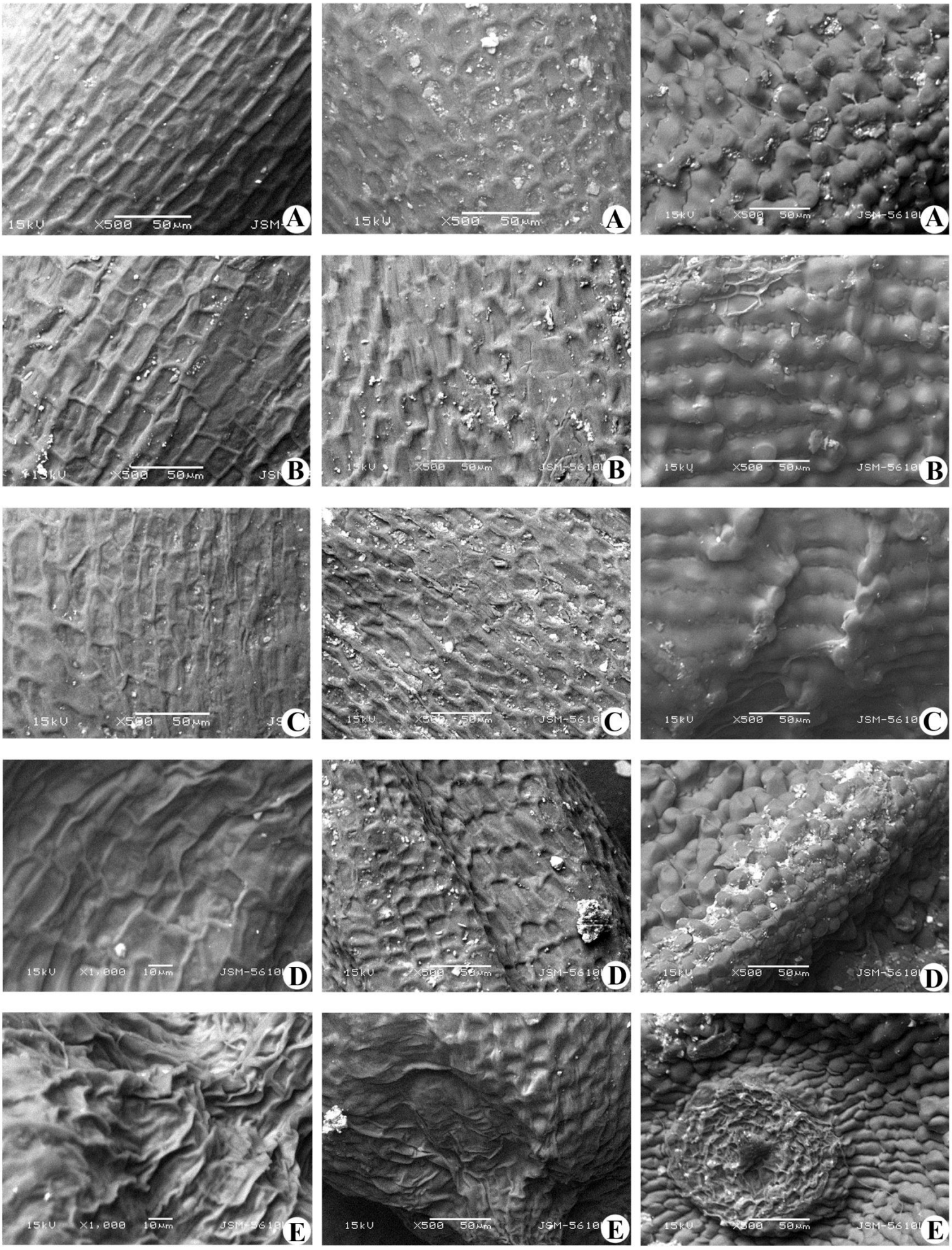
77. *Sachoenefeldia gracilis* 78. *Tetrapogon tenellus* 79. *Tetrapogon villosus*

Fig. 94



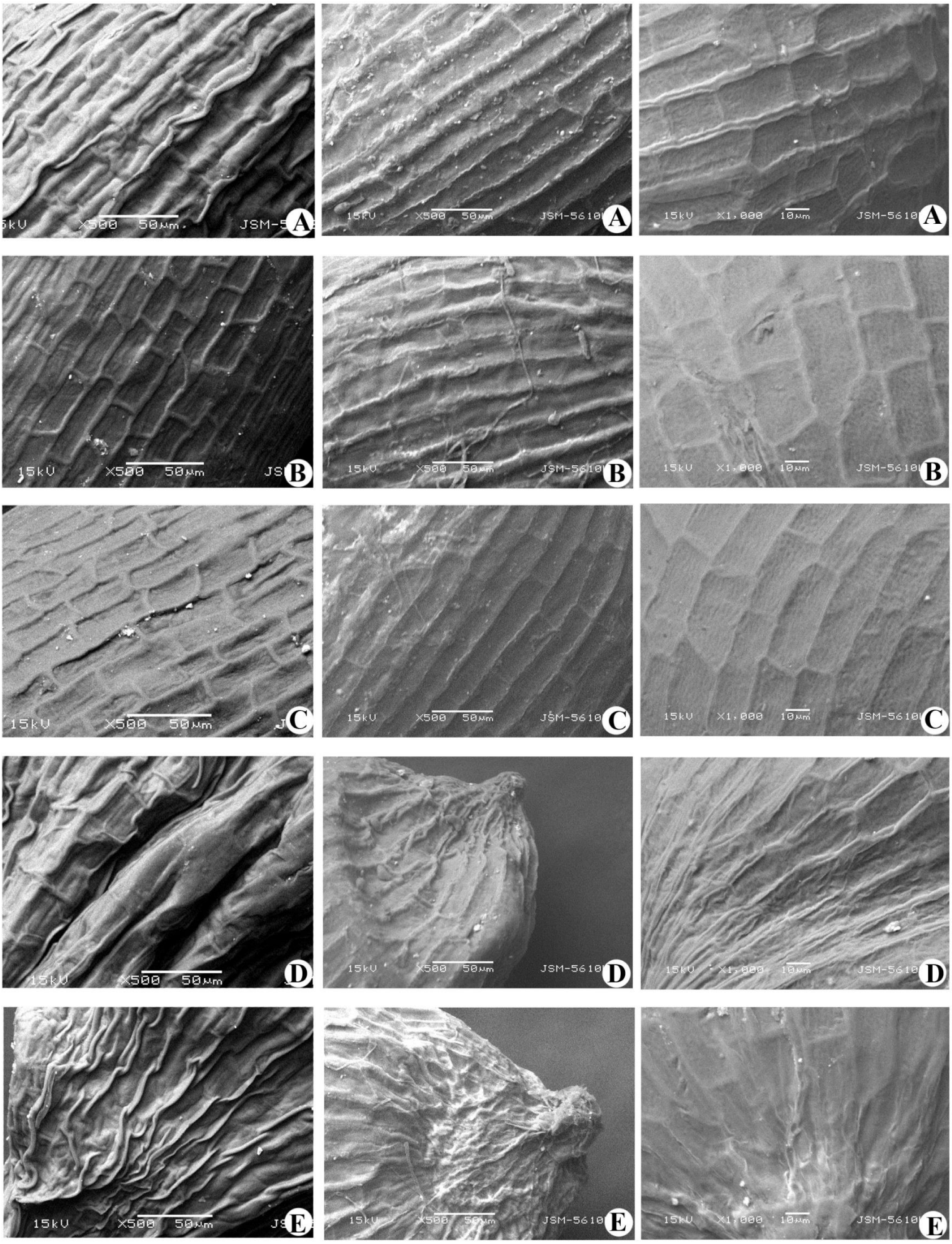
80. ***Acrachne racemosa*** **81.** ***Dactyloctenium aegyptium*** **82.** ***Dactyloctenium sindicum***

Fig. 95



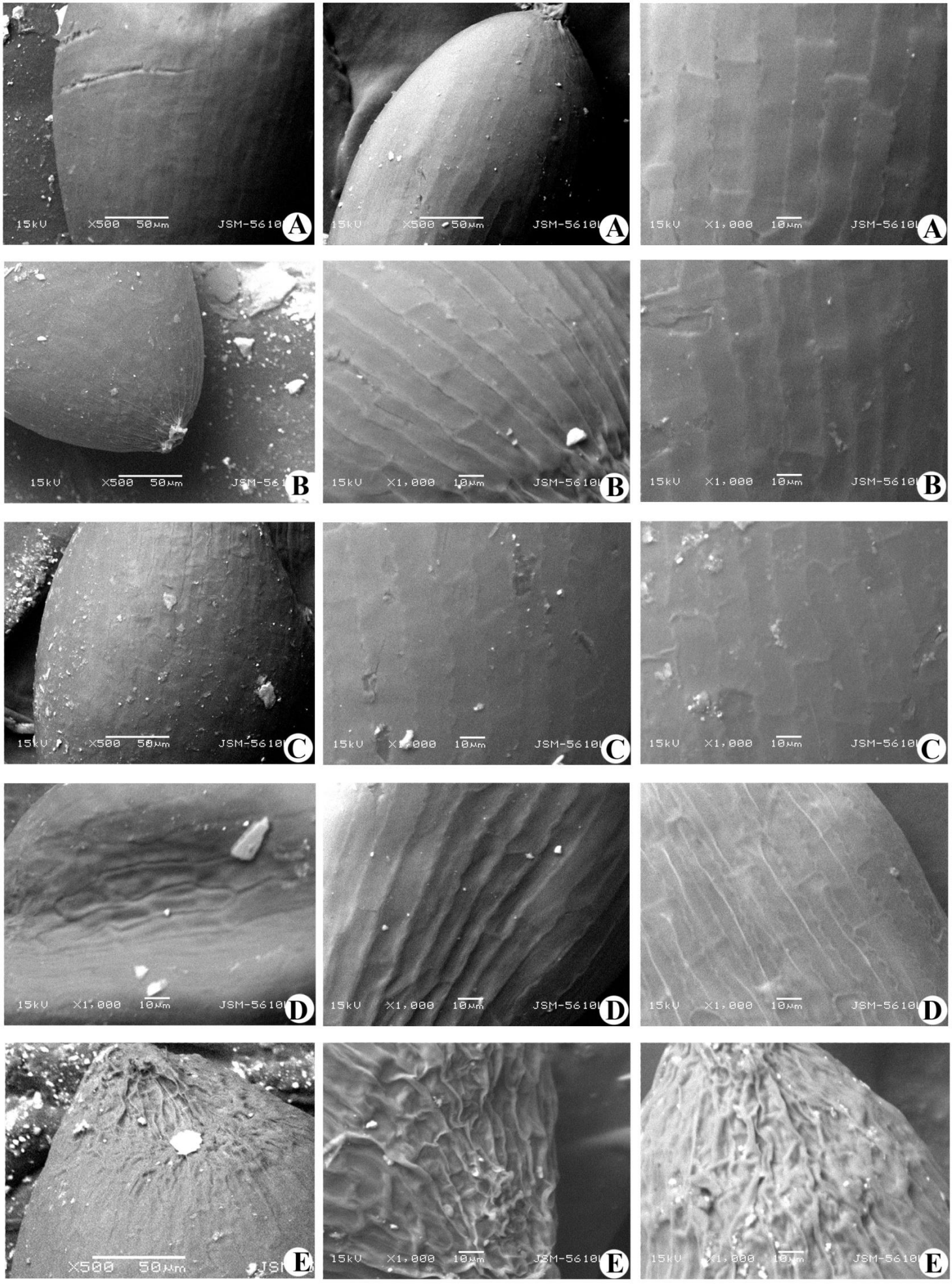
83. ***Desmostachya bipinnata*** **84.** ***Dinebra retroflexa*** **85.** ***Eleusine indica***

Fig. 96



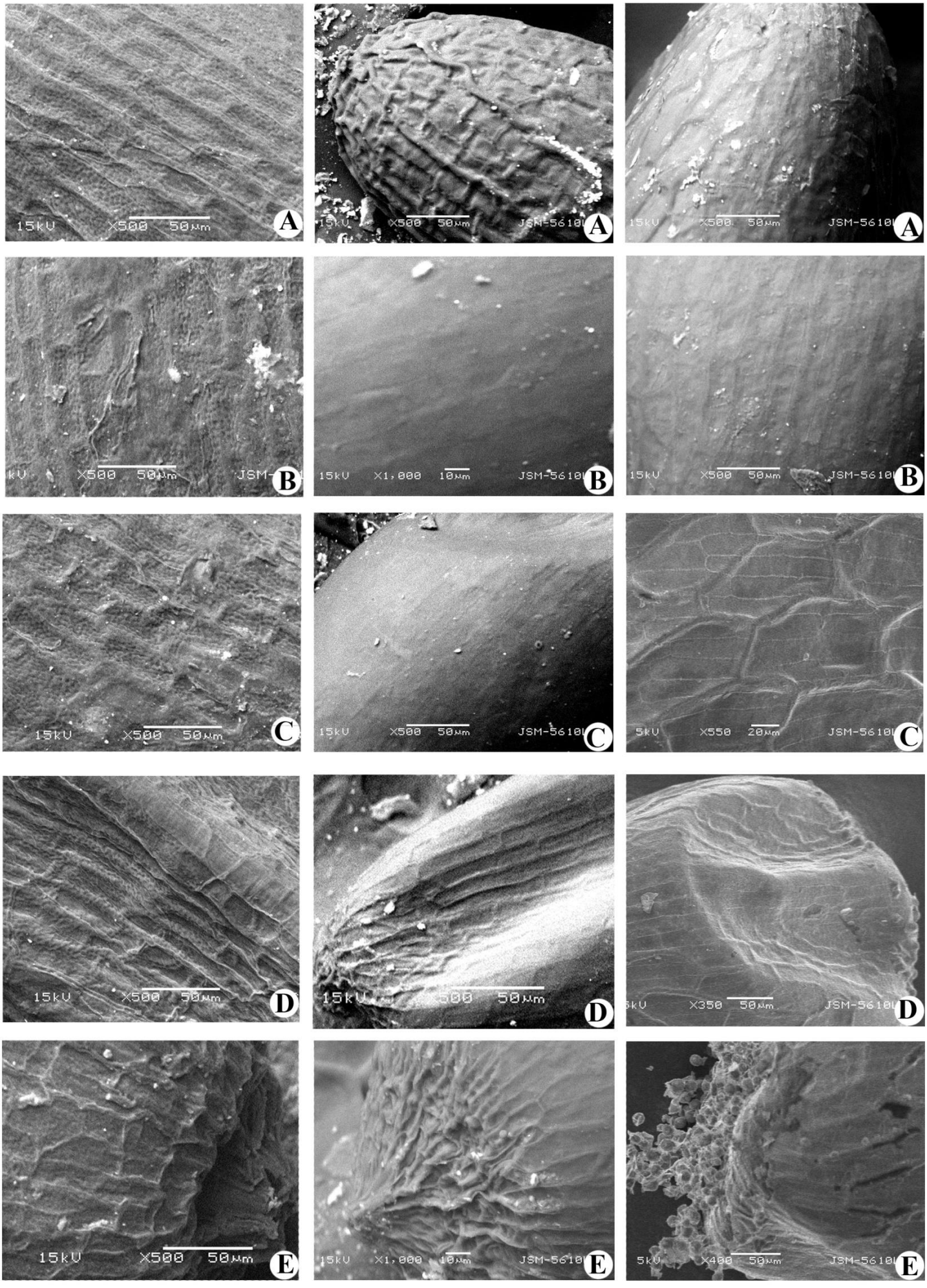
86. ***Eragrostiella bachyphylla*** **87.** ***Eragrostiella bifaria*** **88.** ***Eragrostis cilianensis***

Fig. 97



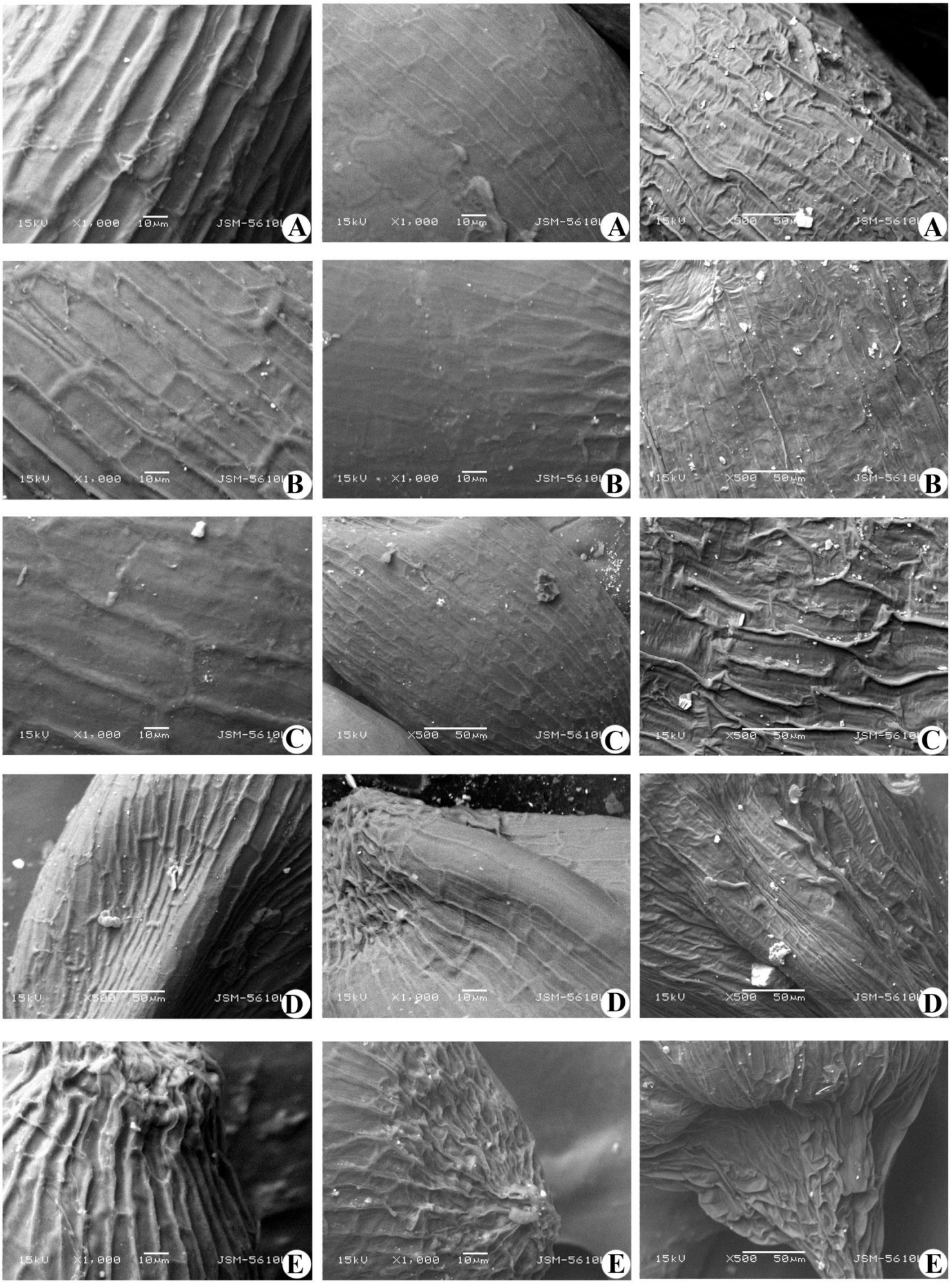
89. ***Eragrostis ciliaris*** **90.** ***Eragrostis japonica*** **91.** ***Eragrostis nutans***

Fig. 98



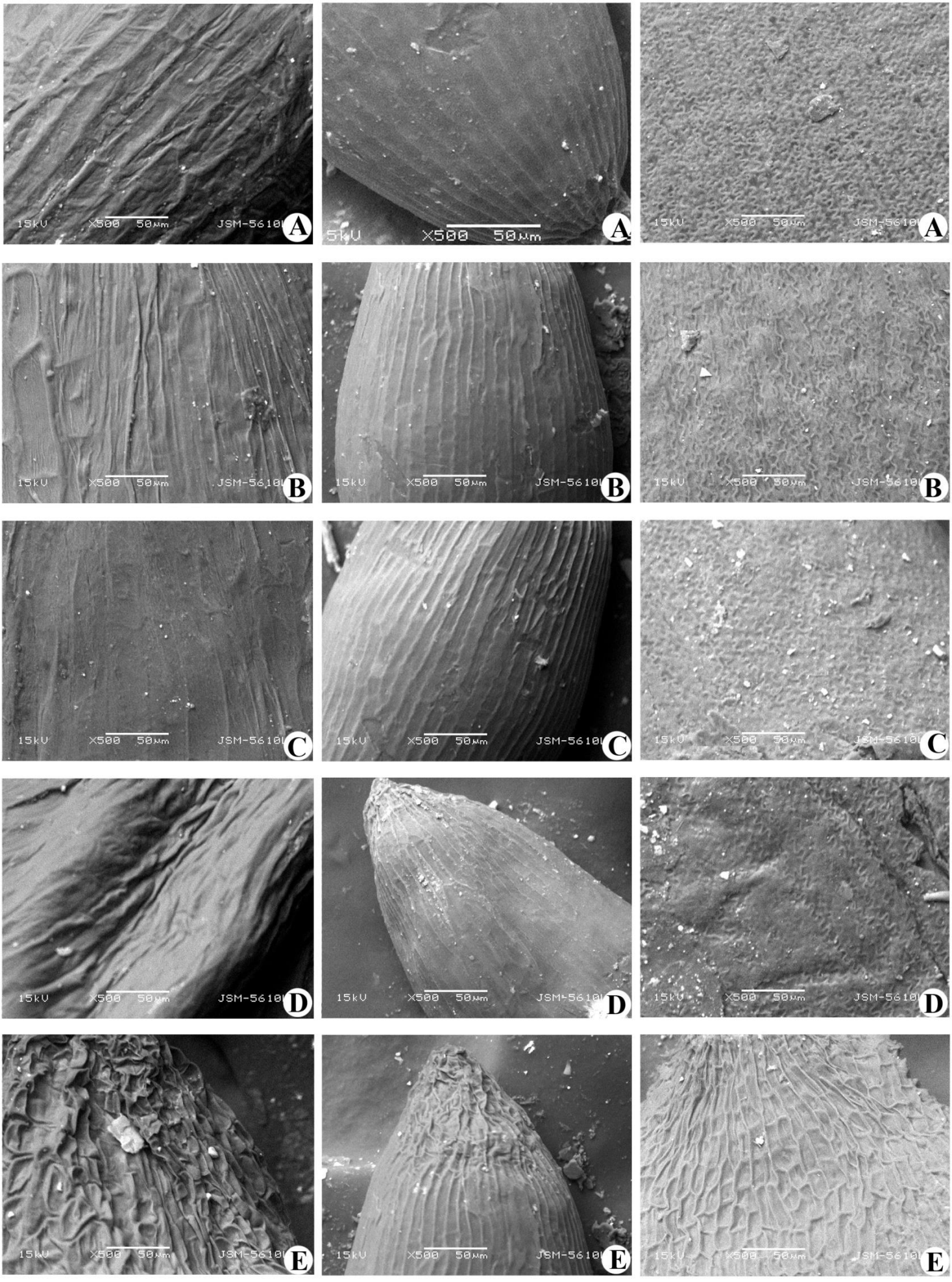
92. ***Eragrostis pilosa*** **93.** ***Eragrostis tenella*** **94.** ***Eragrostis tremula***

Fig. 99



95. ***Eragrostis unioloides*** **96.** ***Eragrostis viscosa*** **97.** ***Sporobolus coromardelianus***

Fig. 100



98. ***Sporobolus diander*** **99.** ***Sporobolus indicus*** **100.** ***Tragrus biflorus***

Fig. 101

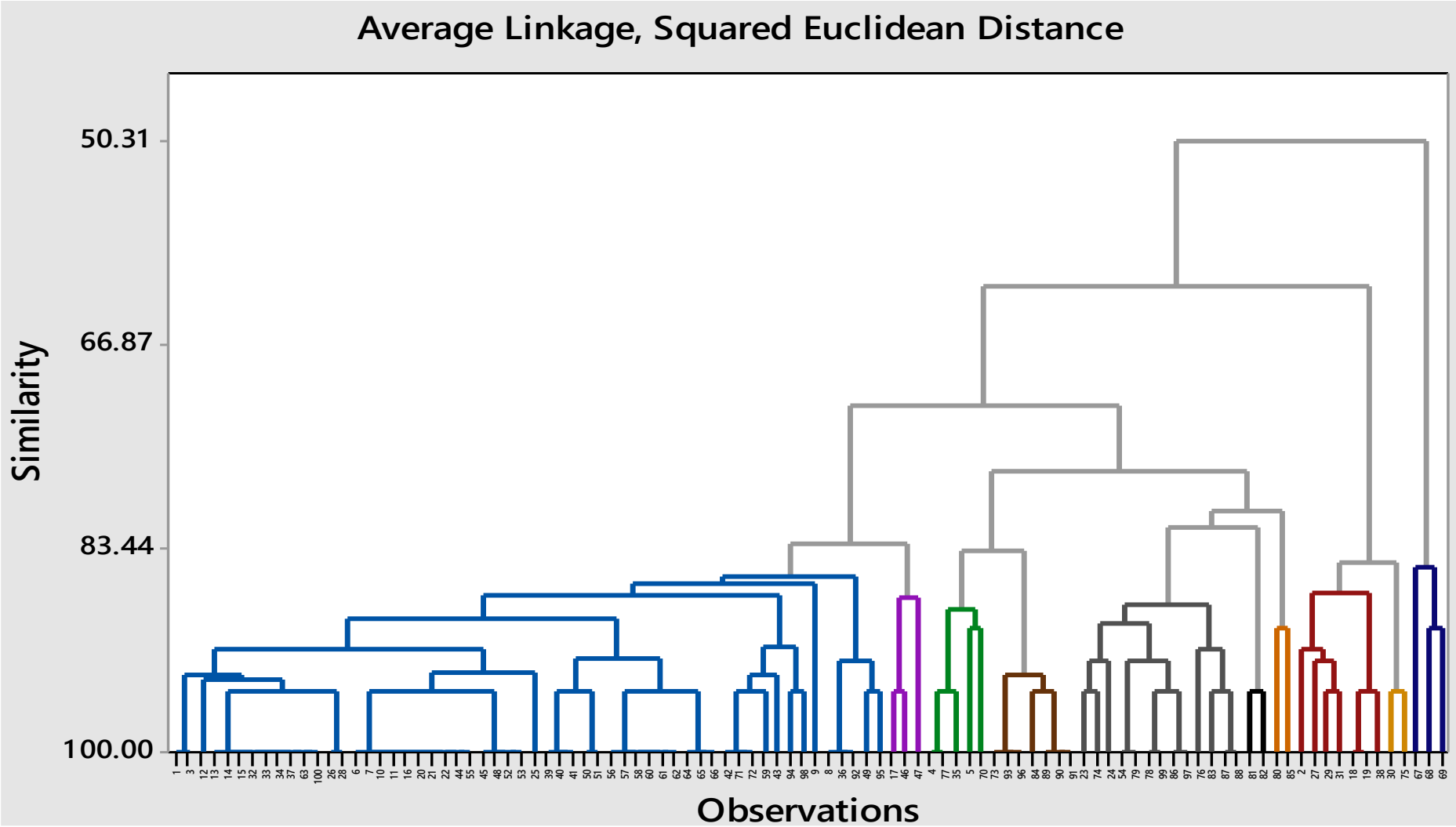


Fig. 102 A dendrogram showing clustering of grass caryopses

DISCUSSION

The morphological types of fruits and seeds provide valuable data about the evolutionary classification of flowering plants (Corner, 1976). Our study of epidermal surfaces reveals a number of important micromorphological characters exhibiting interspecific variation that is of significance for identification.The micromorphological characters obtained from rachillas, calluses and palea apices were found to be taxonomically informative.

The variations in caryopses size can also differe in populations of a species as reocorded by other investigators (Harper, 1977; Stanon, 1984; Venable, 1985and Ellison, 1987).Caryopses surface of the Gramineae represent highly variable types of the surface sculpturing which can be identifying characters for some taxa even at the specific level and sometimes it works as diagnostic significance for the species (Brissson and Peterson, 1976). In present study characteristic features of caryopses differed from species to species. The members of tribe Maydeae have dorsally compressed caryopses. In this tribe shapeof *Coix lachryma-jobi* is suborbicular and hilum shape is semicircular.Under the SEM the surface shows rugose to ruminate pattern with undulating wall. Scanning electron microscopic study was used to depict surface features of dorsal, ventral and lateral surfaces, features of embryo and hilum. Most of the members of grass caryopses have reticulate type of pattern on their surface. This reticulate pattern has either undulating or straight wall. Pattern of undulations also varied: wavy or '∩' shaped, '**Ω**' shaped or 'ʌ' shaped. The undulating wall may be either smooth angled, sharp angled, broadly undulated or narrowly undulated. Between the reticulum interspace is present which is shallow, concave or sunken, depending upon the elevation of the wall. Apart from reticulate pattern, ruminate, blister or rugose patterns are also seen. Hilum of most of species have ruminate pattern with folded walls traversing in same or different directions.

Seed characteristics, particularly exomorphic features, revealed through scanning electron microscopy have been used in resolving problems of systematics (Karihaloo and Malik, 1994; Koul *et al.*, 2000; Kumar *et al*, 2012; Shahi Shavvon *et al.*, 2012; Akcin *et al.*, 2013) and evolutionary relationships (Segarra and Mateu, 2002).SEM analysis of conspecific varieties is a novel aspect of the morphological study of closely related plants. Both light and scanning electron microscopic studies when correlated helped in obtaining a perfect differentiation in the studied species.Presence of undulating lines on the seed surface was a common feature observed under SEM. A marked difference was also observed on dorsal and ventral surface of the caryopses.Wang and Henwood (1999) studied the florets of the 54 species of *Elymus* including rachilla but the caryopses study was not done. They observed that calluses were observed to vary in a range of attributes including the shape and curvature of their abaxial surfaces, the extent of thickening along the adaxial margins and in the details of their indumentum. The genera *Elymus*visually appeared similar to*Heteropogon*but a clear demarcation could be features to under SEM. Species of *Heteropogon* shows dorsally compressed caryopses with sickle shaped scutellum, N-embryo type, basal fan shaped hilum, and a reticulate pattern of surface. *Heteropogon contortus* has W shaped undulation and ruminate pattern of the hilum surface.

Heteropogon ritchiei have undulating wall but specific undulation type was not observed and hilum surface also show reticulate pattern. *Heteropogon triticeus* also show reticulate pattern but walls were straight and hilum surface show ruminate pattern with rugose surface.

In a comparative study coleoptiles of red rice and their commercial varieties using SEM,Hoagland and Paul (1978)observed different architectures on the abaxial and adaxial surfaces. Terrell and Peterson (1993) studied 35 different species belonging to 18 genera of tribe Triticeae. They studied caryopses morphology included features like shape, length, apical hairs, embryo%, but surface topographical features in detailed not done by SEM. Based on the micromorphological features they divided Triticeae tribe into two major subtribes and one monogeric subtribe.

Among the studied species members of tribe Ischneae and Aristideae shows close relationship in characters. They were non compressed caryopses with smooth surface. They have L-type of embryo with short embryo class. They also have linear type of hilum which is differentiate character from the others. Under the SEM they shows reticulate pattern with undulating walls. *Isachne globosa* have '∩'shaped, smooth angled and broad undulation while *Aristida funiculata* have 'ʌ' shaped, smooth angled and broad undulation. Osman *et al.* (2012) reported that *Aristida funiculata* caryopses have reticulate pattern with undulated cell walls and *Aristida adscensionis* have straite to scabrate pattern. But in present study noticed that*Aristida adscensionis* have reticulate pattern with straight walls and lines present in interspace.

Acrachne r*acemosa* and *Eleusine indica* show similar characters like non compressed caryopses with sickle shaped scutellum, sub basal raised circular hilum but the embryo class was different, short in one and large in other respectively. Even SEM observations were also different for both. *Acrachne* r*acemosa* have compound reticulate pattern with blister while *Eleusine indica* have reticulate pattern with Ω shaped undulations. These two species shows close relationship with genus *Dactyloctenium.* They all were belongs to the same tribe Eragrosteae. They have rough surface of caryopses with ridges which was regularly or irregularly arranged and brown to dark brown colour, which was also one of the distinguished character. Three species of *Dactyloctenium* was studied; all have reticulate pattern with different type of undulations. The colour of mature caryopses in *Eragrostis* varied from light to dark brown with a smooth shining surface. Shape of the caryopses in the studied species viz.*E. japonica, E. nutans, E. tenella, E. unioloides* and *E. viscosa* varied from oblong to ovate. A common feature noted in all the 9 species of *Eragrostis* was the absence of the ventral groove/sulcus on the caryopses. Diagnostic feature dorsal/lateral striations was observed only in *E. cilianensis, E. tremula* and *E. unioloides*while in the other species triations were absent. Of the studied species, the caryopses of *E. pilosa, E. tremula* and *E. unioloides*were compressed laterally while caryopses of the *E. cilianensis, E. ciliaris, E. japonica, E. nutans, E. tenella* and *E. viscosa* were terete. Peterson and Sanchez (2007) reported *E. japonica, E. pilosa* and *E. ciliaris* to have dorsally compressed caryopses but in the present study caryopses of *E. ciliaris* and *E. japonica* were terete and*E. pilosa* was laterally compressed.Caryopses in most of the species were sticky (Kreitschitz *et al*., 2009)

because of the presence of surface slime cells, giving the surfaces a shiny and translucent appearance that was difficult to observe under a light microscope but very apparent under SEM. *Eragrostis cilianensis* and *E. tremula* both had a sickle-shaped scutellum whereas all other species had a 'V'-shaped scutellum. *Eragrostis pilosa* showed a contrasting feature in having a reticulate-foveate surface with thick rugae. Two unique diagnostic features were observed in *E. tremula* namely superimposed rows of reticulum were present on the lateral surfaceand globular slimy glands were present at the proximal end on ventral surfaces. The upper reticulum was pentagonal to hexagonal with a smooth, thick, and elevated tangential wall in *E. tremula*, while the reticulum was elongated rectangular with smooth thin undulating walls in *E. pilosa*.

Qing *et al.* (2005) studied 45 genera and 58 species of grasses from the Tribe Chlorideae and revealed that Chlorideae allows recognition of three major types of caryopses by differences in ventral surface and hilum morphology. They confirm that the convex ventral face occurs in the most primitive tribe, while the flat or concave ventral face occurs in more advanced tribes. In the present study*Chloris* had variation in fusiform to ellipsoid caryopses with smooth and shiny surface. Hilum was located basally and a prominent ventral groove was noted.Qing *et al.* (2005) reported straite pattern (without pubescence) in *Chloris barbata* but a reticulate pattern was noted in the studied *Chloris* species.

All the members of tribe Paniceae dorsally compressed caryopses except *Oplismenus burmannii* which had non compressed caryopses. *Panicum* and *Setaria* species have 'V' shaped scutellum with large embryo class. Hilum is basal in *Panicum*and oval sub basal hilum in*Setaria.* Costea *et al.*(2002) reported *Echinochloa colona*to have 'W'-shaped or 'S'-shaped undulation and *Echinochloa crusgalli* with'Ω' shaped undulations. In present study*Echinochloa colona*'∩' and 'ʌ' shaped undulation on dorsal, ventral and lateral surface while *Echinochloa crusgalli* show 'Ω' shaped undulations on ventral surface, '∩' and 'ʌ' shaped and narrow undulation with smooth angle on the dorsal and ventral surface. *Echinochloa stagnina* had reticulate pattern with indistict undulating walls and a pitted surface.

Zhang *et al.* (2014) studied caryopsis morphology of *Themeda* and their allied spathaceous genera. They recognise of two types of caryopses based on ventral face and embryo shape. CG type of caryopsis had a concave ventral face with a grooved embryo and FK type of caryopsis had a flat ventral face with a keel shpaed embryo. In present study four species of *Themeda* (*Thmeda cymbaria, Themeda laxa, Themeda triandra, Themeda quadrivalvis*) were studied. According to Zhang *et al.* (2014) *Thmeda cymbaria, Themeda triandra, Themeda quadrivalvis* belongs to the FK type of caryopsis. But in present study, *Themeda cymbaria* and *Themeda laxa* belongs to the Fk type while *Themeda triandra* and *Themeda quadrivalvis* belongs to the CG type. With respect to the surface topographical pattern acooring to the Zhang *et al.* (2014) *Thmeda cymbaria, Themeda triandra, Themeda quadrivalvis* showed straight reticulate pattern. But in present study *Thmeda cymbaria* and *Themeda quadrivalvis*

showed undulating reticulate pattern and *Themeda triandra* showed straight reticulate pattern.

So a variation in the architectural pattern of undulations in some of the studied species were observed to differ from the same species studied by other authors. May be because of climatic conditions or enviormental factors. Because the study which did by other authors they are not from India.

Cluster analysis was done to see the relationship between different groups of species. Cluster analysis using Square Euclidean distance showed good resolution of the taxa based on the qualitative characters. Dendrogram clearly depects two main groups. The species show similar characters were close to each other in the dendrogram and it also showed similarity with the dichotomus key which was prepared by using morphological and morphometric characters.

Species of cluster 2 shows 'V' shaped scutellum, 'N'type of embryo, basal hilum and absence of dorsal/lateral straitions. Cluster 3 has five numbers of species and it shows similariy at 88%. Species of cluster 3 shows basal type of hilum. Out of these five species *Arthraxon lanceolatus* only shows prescence of dorsal/lateral striations. *Apluda* and *Perotis* shows fan shaped hilum while others have 'V' shaped hilum. Cluster 5 has thirteen species and it shows similarity at about 85% and it have maximum value from centroid is 1.25.

A dichotomous key to identify the caryopses on the basis of characteristics features has been prepared.

1. Laterally compressed caryopses with rough surface……..……..……...**2**
1. Dorsally compressed or not compressed caryopses, if laterally compressed than with smooth surface……..……...……**4**
2. Ventral groove present…….……...……***Isachne globosa***
2. Ventral groove absent……..……...…….……**3**
3. Short embryo class……...……..***Aristida adscensionis***
3. Large embryo class……..……..……..……. ***Aristida funiculata***
4. Not compressed caryopses……..……..……...……**5**
4. Dorsally or laterally compressed caryopses, if not compressed than with L-embryo type and V-shaped hilum……...……..……..**26**
5. V-shaped scutellum, if sickle shaped than with L-embryo type with short embryo class……**6**
5. Sickle shaped scutellum, if V-shaped than with linear hilum…...……...……..**13**
6. L-embryo type……...……...…***Perotis indica***
6. N-embryo type…….……..……**7**
7. Large embryo class……..…….……**8**
7. Short embryo class...……...……..……..……**10**
8. Oval shaped hilum……..…….....……....***Chloris virgata***
8. Circular shaped hilum……...……..…..……**9**
9. Reticulate ruminate hilum surface (under SEM)…...……***Eragrostis tenella***
9. Reticulate rugose hilum surface (under SEM)…...……...***Eragrostis viscosa***
10. Ventral groove present……...…….....***Dinebra retroflexa***
10. Ventral groove absent…….……**11**

11. Dorsal surface have reticulate pattern (under SEM)……***Eragrostis nutans***
11. Smooth dorsal surface, superficial features seen (under SEM)…….…….**12**
12. Ventral surface smooth (under SEM)…...…….……..***Eragrostis ciliaris***
12. Ventral surface have reticulate pattern (under SEM)…..…..…***Eragrostis japonica***
13. V-shaped scutellum……...…….……**14**
13. Sickle shaped scutellum……...…….……**15**
14. Large embryo class..…….……..……..***Dactyloctenium aegyptium***
14. Short embryo class…...……...……... ***Dactyloctenium sindicus***
15. Ventral groove absent…….....……..……..**16**
15. Ventral groove present……...……...……..……..**17**
16. Large embryo class……..……..…….…..***Acrachne racemosa***
16. Short embryo class……...……...….***Eleusine indica***
17. Short embryo class……...……...……...……**18**
17. Large embryo class……...……..**21**
18. Rough surface of caryopses……....……..***Oropetium villosulum***
18. Smooth surface of caryopses…….……...……..**19**
19. Oval shaped hilum……..…….……***Desmostachya bipinnata***
19. Circular shaped hilum……...…….……**20**
20. Ovoid to sub globose, hilum surface ruminate (under SEM)..***Eragrostiella bifaria***
20. Orbicular, hilum surface reticulate (under SEM)....….…….***Eragrostis cilianensis***
21. Dorsal/lateral striations present……..……...……..……..**22**
21. Dorsal/lateral striations absent……...……...…….……**23**
22. Sub basal type of hilum……..……...…***Rottboellia exaltata***
22. Basal type of hilum……...……...…….. ***Ophiuros exaltatus***
23. L-embryo type……...……...……..……**24**
23. N-embryo type……...….……**25**
24. Linear shaped hilum...…...…….…….***Oplismenus burmannii***
24. Oval shaped hilum……...…...…….…….***Tetrapogon villosus***
25. Oval shaped hilum……...……***Tetrapogon tenellus***
25. V-shaped hilum……...…….……..***Sporobolus indicus***
26. Caryopses surface either smooth dull or rough ...……...……..….**27**
26. Caryopses surface either smooth or smooth shiny …….…..….**37**
27. Dorsal/lateral striations absent……...……...…….……**28**
27. Dorsal/lateral striations present……...……...……...……**30**
28. L-embryo type…...……...……...…..***Coix lachryma-jobi***
28. N-embryo type……...……...……..**29**
29. Ventral groove present…...…….…….***Sehima nervosum***
29. Ventral groove absent……...……...…… ***Themeda cymbaria***
30. L-embryo type……...……...……..**31**
30. N-embryo type……...……...……..**32**

31. V-shaped hilum…..……..……..***Thelepogn elegans***
31. Circular shaped hilum……..……***Melanocenchris jaequemontii***
32. Sub basal type of hilum……...……...……..……..**33**
32. Basal type of hilum…….……..……..**35**
33. V-shaped scutellum……...…...……***Brachiaria distachya***
33. Sickle shaped scutellum……...…...…….……..**34**
34. Fan shaped hilum……..…….……..***Ischaemum indicus***
34. Oval shaped hilum…...……...……***Imperata cylindrica***
35. Linear shaped hilum……...…...……...……***Saccharum spontaneum***
35. V-shaped/fan shaped hilum……...……...……..**36**
36. 'V' shaped hilum…….…...……..***Sorghum halepense***
36. Fan shaped hilum……...……..…***Ischaemum molle***
37. Dorsally compressed carryopses havc striations with L-embryo type……...
……***Digitaria granularis***
37. Dorsally/laterally/not compressed, if dorsally compressed have presence of striations with N-embryo type……..…….……..….**38**
38. Laterally compressed caryopses or not compressed…..……...…….**39**
38. Dorsally compressed caryopses……...……...……**50**
39. Not compressed caryopses…...……...…….***Arthraxon lanceolatus***
39. Laterally compressed caryopses……...……..……**40**
40. Dorsal/lateral striations absent……...…….....……..**41**
40. Dorsal/lateral striations present……...……...……**45**
41. N-embryo type……...…….....**42**
41. L-embryo type……...……...……..……**43**
42. Hilum not prominent and having reticulate rugose surface (under SEM)…….....……...***Sporobolus coromardelianus***
42. Hilum prominently visible and having reticulate surface (under SEM)…….....
……..***Sporobolus diander***
43. V-shaped scutellm……...……..……***Triplopogon ramosissimus***
43. Sickle shaped scutellum……...……..……..……**44**
44. Oval shaped hilum…….....…….……..……***Apluda mutica***
44. V-shaped hilum……...……..…….***Sachoenefeldia gracilis***
45. Smooth shiny surface of caryopses……...……..…….……**46**
45. Smooth normal or dull surface of caryopses……....……**47**
46. Sickle shaped scutellum…….....……...……***Eragrostis tremula***
46. V-shaped scutellum……..…….……***Eragrostis unioloides***
47. Sickle shaped scutellum…….....……...…….***Cynodon dactylon***
47. V-shaped scutellum……...……..……...……**48**
48. Caryopses shape is lanceolate…....……..……***Vetivaria zizanioides***
48. Caryopses shape is ovoid to oblong to elliptic……...…...……**49**

49. Linear shaped hilum……..……..*Chrysopogon fulvus*
49. Circular shaped hilum…...……...……..*Eragrostis pilosa*
50. Sub basal circular shaped hilum……...…..*Cymbopogon martini*
50. Linear or basal shaped hilum, if sub basal than either oval, circular or fan shaped hilum…….**51**
51. V-shaped scutellum with smooth dull surface……...……...…….……**52**
51. Sickle shaped scutellum, if v shaped than have smooth shiny surface….……**64**
52. Dorsal/lateral striations present……..……...……**53**
52. Dorsal/lateral striations absent……..…….**57**
53. Fan shaped hilum……...……...……..**54**
53. Oval shaped hilum……...……...……**55**
54. '**Ω**' shaped undulations on ventral surface (under SEM)….*Echinochloa crusgalli*
54 Straite to rugose pattern, no undulation on ventral surface (under SEM)……...…….……..*Echinochloa stagnina*
55. Reticulate 'ʌ' shaped reticulum on dorsal surface (under SEM)…….……..*Brac hiaria reptans*
55. Reticulate '∩' shaped reticulum on dorsal surface (under SEM)……...…….….**56**
56. Feeble straite pattern on ventral surface (under SEM)...… *Brachiaria eruciformis*
56. Reticulate pitted pattern on ventral surface (under SEM)……*Brachiaria ramosa*
57. Sub basal type of hilum……...……...……...……..**58**
57. Basal type of hilum……...…….……**60**
58. Dorsal surface have '∩' shaped undulation (under SEM)...……*Setaria tomentosa*
58. Dorsal surface have 'ʌ' shaped undulation (under SEM) ….…….……...……**59**
59. Rugose dorsal surface (under SEM)…..……*Setaria glauca*
59. Pitted dorsal surface (under SEM)……..……*Setaria verticillata*
60. Linear shaped hilum…….……...……..*Panicum miliaceum*
60. Oval shaped hilum……...…...……**61**
61. Rugose pattern on dorsal surface ..……..……*Paspalum scrobiculatum*
61. Reticulate pattern on dorsal surface…….....……...……..**62**
62. Periclinal walls- straight or slightly wavy on ventral surface (under SEM)……...……..……*Paspalidium geminatum*
62 Periclinal walls- 'ʌ' shaped undulation on ventral surface (under SEM)…...……**63**
63. Dorsal surface have '∩' shaped undulation (under SEM)…….*Panicum antidotale*
63. Dorsal surface have 'ʌ' shaped undulation (under SEM)....*Paspalidium flavidum*
64. Smooth shiny surface of caryopses……...……...……..**65**
64. Only smooth surface of caryopses……..……...……..**70**
65. V-shaped scutellum……...……...……..**66**
65. Sickle shaped scutellum……...……...……...……**67**
66. Fan shaped hilum……..…….……..….*Echinochloa colona*

66. Oval shaped hilum……..……..……..***Panicum trypheron***
67. Dorsal/lateral striations present……..…….…….***Cenchrus ciliaris***
67. Dorsal/lateral striations absent……...……...…….**68**
68. Circular shaped hilum…...…….……***Choris montana***
68. Oval shaped hilum…….....……**69**
69. Fusiform shape of caryopses.....…….***Chloris barbata***
69. Ovate to suborbicular shape of caryopses…...…...……...…..***Cenchrus biflorus***
70. Dorsal/lateral striations absent……...……...…….**71**
70. Dorsal/lateral striations present……...……...…...……**87**
71. L-embryo type……...…….....……..**72**
71. N-embryo type……...……**73**
72. Oval shaped hilum…...……..…….....……***Chionachne koenigii***
72. Fan shaped hilum……...…….……***Andropogon pumilus***
73. Ventral groove present……...……...……**74**
73. Ventral groove absent…….**75**
74 Reticulate ribbed, penta to hexagonal reticulum on hilum surface (under SEM)…... ……..…….***Sehima ischaemoides***
74. Reticulate rugose, uneven sized reticulum on hilum surface (under SEM)……..…..……***Sehima sulcatum***
75. Oval shaped hilum……...……..…….**76**
75. Fan or V-shaped hilum……...……...…….……**81**
76. Greenish to white colour caryopses…....……...…..**77**
76. Light brown to brown colour caryopses……...…..……**78**
77. Undulating reticulum wall with '∩' and '**Ω**' shaped undulation (under SEM) …….....***Panicum maximum***
77. Straight, thick and elevated reticulum wall (under SEM)..… ***Pennisetum setosum***
78. Sub basal hilum……..……***Digitaria longiflora***
78. Basal hilum……...……..**79**
79. Short embryo class……...……...……***Hackelochla granularis***
79. Large embryo class……**80**
80. Oblong, rugose ruminate dorsal surface with flat walls (under SEM)……..…….…..***Alloteropsis cimicina***
80. Ellipsoid to oval, dorsal surface with reticulate with strongly elevated undulating elevated walls (under SEM)..……..…….……***Tragrus biflorus***
81. Circular shaped hilum……..…...….***Eragrostiella bachyphylla***
81. Fan or V-shaped hilum……...……...……**82**
82. Fan shaped hilum……**83**
82. 'V' shaped hilum……...……**85**
83. Reticulate pattern on hilum surface (under SEM)…….. ***Heteropogon ritchiei***

83. Ruminate pattern on hilum surface (under SEM)…….....……..……..**84**
84. Feebly undulations on lateral surface (under SEM)…….……..
……..……..……..... ***Heteropogon contortus var. genuinuss sub var. typicus***
84. 'W' shaped, sharp undulations on lateral surface (under SEM)…….
……***Heteropogon contortus var. genuinus sub var. hispidissmus***
85. Caryopses shape is ovate……....……...……***Themeda laxa***
85. Caryopses shape is lanceolate of oblong…….……..……..…….....**86**
86. Reticulate ruminate rugose pattern on hilum surface (under SEM)……..……
……....***Themeda triandra***
86. Straite pattern on hilum surface (under SEM)…..……***Themeda quadrivalvis***
87. Sub basal type of hilum……..……**88**
87. Basal type of hilum……...…….……**91**
88. Linear shaped hilum……...……..…….……**89**
88. Oval shaped hilum……...…….…..**90**
89. Hilum indistinct, 'ʌ' shaped undulations on dorsal surface (under SEM)…….***Eremopogon foveolatus***
89. Hilum prominent, '∩' shaped undulations on dorsal surface (under SEM)……....***Erichloa procera***
90. Caryopses shape is oblong……..…….……..***Digitaria ciliaris***
90. Caryopses shape is ellipsoid.……...……***Digitaria stricta***
91. Linear shaped hilum……...…….***Oplismenus composites***
91. Oval or fan or V-shaped hilum……...…...……**92**
92. V-shaped hilum……..…….……..***Capillipedium hugelii***
92. Oval or fan shaped hilum……...……...……...……..**93**
93. Oval shaped hilum…...……...……***Cenchrus setigerus***
93. Fan shaped hilum……...……**94**
94. Caryopses shape is obovate……..…….……***Bothriochloa pertusa***
94. Caryopses shape is oblong or ovate……...……...…...……..**95**
95. Caryopses length is 10.20 mm…...……***Heteropogon triticeus***
95. Caryopses length in between 1.8-2.47 mm……...……...…..……**96**
96. Hilum have straite pattern (under SEM) …..…….…..***Ischaemum pilosum***
96. Hilum have reticulate or ruminate pattern (under SEM)……...……**97**
97. Hilum have ruminate pattern (under SEM)……..……..**98**
97. Hilum have reticulate pattern (under SEM)……...……...……**99**
98. Caryopses thickness is 0.41mm, ventral surface with 'W' shaped undulations (under SEM)……..……...……..…..***Dicanthium caricosum***
98. Caryopses thickness is 0.81mm, ventral surface with smooth undulation (under SEM)…. ……...……...…***Ischaemum rugosum***
99. Dorsal surface have ʌ shaped undulation (under SEM)…….……..***Iseilema laxum***
99. Dorsal surface not show clearly reticulum but slightly undulating wall seen (under SEM)……..……...……..***Dicanthium annulatum***

3.5. Seedling

A total of 100 different grass species belonging to group Panicoideae and Pooideae have been morphologically characterized for its diagnostic features of identification. Most of the species belongs to the tribe Andropogoneae and Paniceae. Characters defined by Nowosad *et al* (1942) and Phillips (1962) have been used for describing the seedlings. From vernation to ligule the vegetative characteristic feature of mature grass species have been well documented by Nowosad *et al* (1942) and Phillips (1962) and so has not been represented in the present study. These features were found to be differing from species to species. The characteristic parts of a grass seedling and the features considered are represented in Figures 103, 104 and 105.

Growth habit: The term is used most often to describe the general appearance, growth form, or architecture of a plant.

Growth habit may be

(1) Annual: A plant that completes its life cycle and dies within one year.

(2) Perennial: A plant whose life span extends over several years.

Vernation: Vernation means the arrangement of the leaves in the bud-shoot. It is used as a first point for the identification of grasses. This arrangement of the leaves in the bud shoot was identified by cutting the shoot across below the ligule of the uppermost leaf and examining the sections.

Accordingly the vernation may be

(1) Folded (Conduplicate): Which is generally formed in a laterally compressed or flattened shoot. In this the margins meet but do not overlap. It appears elliptical in cross section.

(2) Rolled (Convolute): Which is generally formed in a round or cylindrical shoot. In this the margins meeting overlap. It appears round in cross section and the successive leaves are rolled alternately in clockwise and counter clockwise manner.

Node: The part of a stem where leaves or branches arise.

Node may be

(1) Glabrous: Without surface ornamentation such as hairs, scales or bristles.

(2) Pubescent:Downy; covered with short, soft, erect hairs.

(3) Bearded: Small appendages that project from the base of the leaf blade and appear to wrap the culm, at least partially.

Internode: The portion of a stem between two nodes.

(1) Glabrous: Without surface ornamentation such as hairs, scales or bristles.

(2) Pubescent:Downy; covered with short, soft, erect hairs.

Leaf Blade: An outgrowth of a stem, usually flat and green; its main function is food manufacture by photosynthesis.

The terms which are use for the explanation of leaf blade are follows:

- Surface:

(1) Glabrous: Without surface ornamentation such as hairs, scales or bristles.

(2) Pubescent:downy; covered with short, soft, erect hairs.

- Midvein: The central, and usually most prominent, vein of a leaf or leaf-like organ;
- Leaf lamina: The blade of a leaf or the expanded upper part of a petal, sepal or bract.
  (1) Dorsal surface: The back; in particular, away from the axis in a lateral organ or away from the substratum.
  (2) Ventral surface: The front; in particular, towards the axis in a lateral organ or towards substratum.
- Leaf margin: The edge, as in the edge of a leaf blade
  (1) Serrate margin: Toothed with asymmetrical teeth pointing forward; like the cutting edge of a saw.
  (2) Toothed margin: Margin with a more or less regularly incised margin.
- Tuberculated hairs: Hairs covered in tubercles; warty.
- Amplexicaul: A leaf with its base clapsing the stem.
- Scabrous: Rough to touch.

Termination point: The termination point is nothing but a leaf blade tip. It is of different types but in grasses generally it is acute or acuminate or pointed needle like.

(1) Acute: Sharply pointed; converging edges making an angle of less than 90°.
(2) Acuminate: Tapering gradually to a point.

Rather than shape of leaf tip other features of leaf tip are also very important. If the leaf tip is not folded it is termed as flat termination point and if it is folded then keeled termination point.

Leaf Sheath: Leaf sheath is the basal portion of the leaf enveloping the culm or young growing leaves. It is categorised into different types based on the overlapping of margins.

(1) Open: If the margins of the sheath are not overlapping or not joined to each other then it is termed as open sheath margin.
(2) Splitted with overlapping: When the margins are splitted to downward to some extent and then the margins are overlapped on each other that time the sheath is known as split with overlapping margins.
(3) Close: When the margins of the sheaths are joined together then it is known to be closed. Sometimes the midrib of the lamina extends downward into the sheath and the sheath is said to be keeled.

Ligule: The ligule is a tongue like outgrowth at the junction of the blade and sheath clasping the culm. It may be present or absent. If it is present then it may be membranous or hairy. In membranous, it may be short or long, may be splitted from base or at margin only. Margin of the ligule may be entire or may be toothed. The

membranous ligule tip may be acute, acuminate, and truncate i.e. cut off squarely with an abruptly transverse end or round. When hairy then it may be in a fringe of small and short hairs, long hairs or rudimentary.

(1) Acute: Sharply pointed tip; converging edges making an angle of less than 90°.
(2) Acuminate: Tip tapering gradually to a point.
(3) Truncate: Tip cut off squarely; with an abruptly transverse end.
(4) Ciliate: Hairs more or less confined to the margins of the ligule.
(5) Villous: Abounding in or covered with long, soft, straight hairs; shaggy with soft hairs.
(6) Cirrhose: Mucronate like apex ends in a fine thread like structure.

Auricle: These are appendages projecting from the collar, one on each side. It may be present or absent. When present then it has different types based on the length and shape. It may be it is long and clasping i.e. claw like or it is small and rudimentary.

Collar: It is a growth zone marking the division point between the blade and the sheath, distinctly observed from ventral surface of the blade. It may be broad or narrow. It may be continuous from one margin to the other margin of the leaf. It may be divided by a conspicuous midrib.

Important distinguishing characteristics of the field grown specimens did not differ much from the seedlings grown under the laboratory conditions especially for the annual species. But in the perennial species slight variations in the characters were observed from the laboratory grown seedlings. *Apluda mutica, Chrysopogon fulvus, Cymbopogon martini, Heteropogon triticeus, Ophiuros exaltatus, Rottboellia exaltata, Cenchrus biflorus* and *Themeda triandra* showed differences in their node, internode, leaf and collar hair features. Field collected samples of *Apluda mutica, Chrysopogon fulvus, Cymbopogon martini, Heteropogon triticeus, Rottboellia exaltata* and *Cenchrus biflorus* showed a distinct node and internode which could not be observed in laboratory raised samples. In *Ophiuros exaltatus,* node, internode and collar regions were well developed in field samples while these characters were not prominent in laboratory raised seedlings. In *Themeda triandra,* density of hairs 7at the collar region and on the leaf blade was more in field seedling samples.

Photographs of the characteristics features present in the studied species have been represented in Figures 106 – 155. A dendrogram prepared with the help of software is presented in Figure IV and the numerical data is given in Table 18.

Cluster analysis:

The dendrogram based on analysis of 11 characters were recorded comparatively for 100 grass species. The data was used to perform a preliminary analysis using Minitab software (Version 16) to prepare a dendrogram in order to explore the correspondence between morphological and taxonomic features.Cluster

analysis done by using Square Euclidean distance showed good resolution of the taxa based on the qualitative characters.

The following features are taken into consideration for the preparation of dendrogram:

I. Growth habit (2 criteria)
Annual (1), Perennial (2)

II. Vernation (2 criteria)
Rolled (1), Folded (2)

III. Node (2 criteria)
Pubescent (1), Glabrous (2), Glabrous and angled (3), Glabrous and bearded (4), Pubescent and bearded (5)

IV. Internode (2 criteria)
Pubescent (1), Glabrous (2)

V. Leaf blade (2 criteria)
Pubescent surface (1), Glabrous surface (2)

VI. Termination point (5 criteria)
Acute and flat (1), Acuminate and flat (2), Pointed needle like (3), Acute and keeled (4), Acuminate and keeled (5)

VII. Leaf sheath margin (3 criteria)
Open (1), Split with open margins (2), Close (3)

VIII. Leaf sheath type (2 criteria)
Round (1), Folded (2)

IX. Ligule (10 criteria)
Membranous and truncate (1), Membranous and round off (2), Membranous and ciliate (3), Membranous and acute (4), Fringe of hairs (5), Membranous and obtuse (6), Membranous (7), Absent (8), Fringe of hairs, fused at base (9), Membranous and acuminate (10)

X. Auricle (3 criteria)
Absent (1), Short and rudiment (2), Long and clapsing (3)

XI. Collar (5 criteria)
Divided (1), Continous and broad (2), Continous and narrow (3), Divided and broad (4), Continous (5)

The dendrogram tree was separated into 10 different clusters (Fig. 156) and the distribution of grass seedlings into clusters on the basis of their qualitative characters is shown in Table 19.

The formations of clusters were made on the basis of combination of characters. Two major groups were forms with the similarity about 73%. Clusters 1, 2, 3, 4, 6 and 8 formed the first major group while the other clusters viz. 5, 9, 7 and 10 got clubbed in the second major group.

Clusters 8 and 9 are simplifoilus clusters i.e. they having only a single specie in cluster. Cluster 8 have *Ischaemum pilosum* and showing similarity at around 90% while cluster 9 have *Thelepogon elegans* and showing similarity at around 82% with other clusters. Cluster 10 having only two species, *Digitaria ciliaris* and *Echinochloa stagnina* and they have maximum distance from centroid was 0.71 and showed similarity at around 96%.

Clusters 3,4 and 5 were having 11 species. Cluster 3 had maximum distance from centroid was 2.13 and having similarity with other clusters was around 90%. Likewise cluster 4 had maximum distance from centroid was 2.16 and having similarity with other clusters at around 94%. Most of *Eragrostis* species comes under the cluster 4. Cluster 5 had similairity at around 92% with other clusters and having maximum distance from the centroid was 2.09.

Clusters 6 and 7 were having 6 speices. Both the clusters were belongs to the different major group. Cluster 6 had maximum distance from centroid was 2.03 and similarity with other clusters at around 90.50%. cluster 7 had maximum distance from centroid was 1.62 and similarity with other clusters at around 95%. Cluster 1 was a major cluster, containing 36 species. It has similarity with other clusters was around 93% and maximum distance from centroid was 2.24. Cluster 2 was a second major containing species (15) cluster and having maximum distance from centroid was 2.12 and similarity with other clusters was 91%.

Seedling description of studied species

Photographs of the characteristics features present in the studied species have been represented in Figs. 106-155.

1. ***Chionachne koenigii*(Fig.106 (1))**

   Growth Habit: Perennial
   Vernation: Folded
   Node: Pubescent
   Internode: Smooth
   Leaf Blade: Pubescent surface, single prominent midvein is present
   Termination point: Acuminant, flat
   Leaf sheath margin: Split with overlapping margin
   Leaf sheath type: Flattened
   Ligule: Membranous, truncate
   Auricle: Short, rudiment
   Collar: Divided

2. ***Coix lachryma-jobi*** **(Fig.106 (2))**

   Growth Habit: Annual
   Vernation: Rolled
   Node: Pubescent, purple in tinge

Internode: Glabrous
Leaf Blade: Glabrous surface, single midvein present throughout the lamina
Termination point: Acute, flat
Leaf sheath margin: Open
Leaf sheath type: Flattened
Ligule: Membranous, truncate
Auricle: Absent
Collar: Divided

3. ***Andropogon pumilus*** **(Fig.107 (3))**

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, reddish in colour
Internode: Smooth
Leaf Blade: Glabrous surface, Single midvein with other strongly parallel veins, Few hairs present towards the margin
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margin
Leaf sheath type: Flattened
Ligule: Membranous, truncate
Auricle: Absent
Collar: Divided

4. ***Apluda mutica*** **(Fig.107 (4))**

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, purple colour band at node
Internode: Smooth
Leaf Blade: Glabrous surface, many parallel veins are seen
Termination point: Acuminate, tapering towards the apex, flat
Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Membranous, round
Auricle: Short, rudiment
Collar: Continuous, broad

5. ***Arthraxon lanceolatus*** **(Fig.108 (5))**

Growth Habit: Annual
Vernation: Folded
Node: Pubescent, long hairs present at and above node
Internode: Smooth
Leaf Blade: Pubescent surface Single midvein with other strongly parallel veins, margins is shortd-serrate, lanceolate leaf

Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margin
Leaf sheath type: Round
Ligule: Membranous, round off
Auricle: Long, clapsing
Collar: Continuous, narrow

6. ***Bothriochloa pertusa*(Fig.108 (6))**
Growth Habit: Annual
Vernation: Rolled
DistNode: Glabrous
Internode: Purple to greenish colour with longitudinal lines
Leaf Blade: Pubescent surface, single prominent midvein is present
Termination point: Mucronate, falt
Leaf sheath margin: Close
Leaf sheath type: Flattened
Ligule: Membranous, ciliate
Auricle: Absent
Collar: Divided
7. ***Capillipedium huegelii*(Fig.109 (7))**
Growth Habit: Annual
Vernation: Folded
Node: Pubescent, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present, slightly serret margin
Termination point: Acuminate, flat
Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Absent
Collar: Divided, Long hairs are present at collarregion
8. ***Chrysopogon fulvus* (Fig.109 (8))**
Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present
Termination point: Acute, keeled
Leaf sheath margin: Open
Leaf sheath type: Flattened
Ligule: Membranous, acute
Auricle: Absent
Collar: Divided, slightly hairy

9. ***Cymbopogon martini*** **(Fig.110 (9))**

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein with other parallel vein, subcordate base
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Short, rudiment
Collar: Divided, broad

Dicanthium

10. ***Dicanthium annulatum***

11.***Dicanthium caricosum***

10. ***Dichanthium annulatum*** **(Fig.110 (10))**

Growth Habit: Perennial
Vernation: Rolled
Node: Pubscent, whole node is covered with long hairs
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein with other parallel veins which have dotted structure on dorsal surface
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, obtuse
Auricle: Short, rudiment
Collar: Continuous, broad

11. ***Dichanthium caricosum*****(Fig.111 (11))**

Growth Habit: Perennial
Vernation: Rolled
Node: Pubescent, node is covered with hairs
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein with other parallel veins **Termination point:** Acuminate, falt
Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Absent
Collar: Continuous, broad

Differentiating feature:

Leaf sheath marign is split with overlapping margin, short rudiment auricle……..…..... *D. annulatum*

Leaf sheath marign is open, auricle absent……..……..*D. caricosum*

12. *Hackelochloa granularis*(Fig.111 (12))

Growth Habit: Annual
Vernation: Folded
Node: Pubescent, presence of long hairs which are somewhat sticky in nature
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein with other parallel veins, in between veins and at margin hairs are present
Termination point: Acute, keeled
Leaf sheath margin: Close
Leaf sheath type: Flattened
Ligule: Membranous, divided in to segments
Auricle: Short, rudiment
Collar: Divided

Heteropogon

13. *Heteropogon contortus var. genuinus sub var. typicus*
14. *Heteropogon contortus var. genuinus sub var. hispidissimus*
15. *Heteropogon ritcheii*
16. *Heteropogon triticeus*

13. *Heteropogon contortus var. genuinus sub var. typicus*(Fig.112 (13))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein with other parallel veins, presence of cilia on the ventral surface, margin toothed
Termination point: Acuminate, keeled
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous, splited margin, round off
Auricle: Absent
Collar: Divided, broad

14. *Heteropogon contortus var. genuinus sub var. hispidissimus*(Fig.112 (14))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous, bearded
Internode: Smooth

Leaf Blade: Pubescent surface, single prominent midvein with other parallel veins, presence of hairs towards base at margin
Termination point: Acute, keeled
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous, acute, entire margin
Auricle: Absent
Collar: Divided, broad

15. *Heteropogon ritchieii* (Fig.113 (15))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein with other parallel veins, presence of long cilia on the dorsal surface towards the base only
Termination point: Acute, keeled
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, Short
Auricle: Short, rudiment
Collar: Continuous

16. *Heteropogon triticeus* (Fig.113 (16))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, narrow, single prominent midvein is present, long cilia like hairs are present on the surface and at margin
Termination point: Acuminate, keeled
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous
Auricle: Short, rudiment
Collar: Divided, broad

Differentiating feature:

Leaf sheath type is round……..*H. ritcheii*
Leaf sheath type is flattened
Acute termination point……*H. contortus var. genuinus sub var. hispidissimus*
Acuminate termination point
Auricle absent……..……*H.contortus var. genuinus sub var. typicus*
Short and rudiment auricle…….……..*H. triticeous*

17. *Imperata cylindrica* (Fig.114 (17))

Growth Habit: Perennial
Vernation: Folded
Node: Pubescent, presence of soft hairs
Internode: Smooth
Leaf Blade: Rigid, single prominent midvein with other parallel veins, scabrous
Termination point: Pointed needle like, flat
Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Membranous, round off
Auricle: Absent
Collar: Continous, broad, presence of long hairs at margin

Ischaemum

18. *Ischaemum indicus*
19. *Ischaemum molle*
20. *Ischaemum pilosum*
21. *Ischaemum rugosum*

18. *Ischaemum indicus* (Fig.114 (18))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, narrow, single prominent midvein is present with other parallel vein
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Short, rudiment
Collar: Continuous, broad

19. *Ischaemum molle*(Fig.115 (19))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins
Termination point: Acuminate, keeled
Leaf sheath margin: Open
Leaf sheath type: Flattened
Ligule: Membranous, long, round off

Auricle: Absent
Collar: Continuous, broad

20. *Ischaemum pilosum* (Fig.115 (20))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, angled
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins
Termination point: Acuminate to pointed, keeled
Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Membranous, ciliate
Auricle: Short, rudiment
Collar: Continuous, broad

21. *Ischaemum rugosum* (Fig.116 (21))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, angled
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins, narrow towards the base
Termination point: Acute to Acuminate, flat
Leaf sheath margin: Open
Leaf sheath type: Flattened
Ligule: Membranous, long, round off
Auricle: Absent
Collar: Continuous, narrow

Differentiating feature:

Leaf sheath margin is split with overlapping marigns……..……..*I. indicus*
Leaf sheath margin is open
Short and rudiment auricle…….……*I. pilosum*
Auricle absent
Broad collar region……..……*I. molle*
Narrow collar region…….……..*I. rugosum*

22. *Iseilema laxum*(Fig.116 (22))

Growth Habit: Annual
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present

Termination point: Acute, keeled
Leaf sheath margin: Open
Leaf sheath type: Flattened
Ligule: Membranous, short, ciliate
Auricle: Absent
Collar: Divided, broad

23. *Ophiuros exaltatus* (Fig.117 (23))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins, Short margin
Termination point: Acute, flat
Leaf sheath margin: Close
Leaf sheath type: Round
Ligule: Membranous, short, acute
Auricle: Short, rudiment
Collar: Continuous, broad

24. *Rottboellia exaltata* (Fig.117 (24))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, hairs are present on the dorsal surface
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, short, acute
Auricle: Short, rudiment
Collar: Divided, broad

25. *Saccharum spontaneum* (Fig.118 (25))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins, curved margin
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Flattened
Ligule: Membranous, ciliate
Auricle: Short, rudiment
Collar: Continous

Sehima

26. *Sehima ischaemoides*
27. *Sehima nervosum*
28. *Sehima sulcatum*

26. *Sehima ischaemoides* (Fig.118 (26))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, angled
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein present with other parallel veins
Termination point: Acute, keeled
Leaf sheath margin: Close
Leaf sheath type: Round
Ligule: Membranous, acute, hairy at margin
Auricle: Absent
Collar: Continuous, broad

27. *Sehima nervosum* (Fig.119 (27))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, in between them secondary veins are present, presence of few hairs on dorsal surface
Termination point: Pointed, flat
Leaf sheath margin: Split with overlapping margin
Leaf sheath type: Round
Ligule: Membranous
Auricle: Absent
Collar: Continuous, broad

28. *Sehima sulcatum* (Fig.119 (28))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth

Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, in between parallel veins secondary veins are present, toothed margin
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, Short, cilate
Auricle: Absent
Collar: Continuous, broad

Differentiating feature:

Leaf sheath margin is close…….……*S. ischaemoides*
Leaf sheath margin is split with overlapping margins
Acuminate termination point……...……..*S. sulcatum*
Pointed termination point……..*S. nervosum*

29. *Sorghum halepense*(Fig.120 (29))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein present with other parallel veins
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Short, rudiment
Collar: Continuous

30. *Thelepogon elegans* (Fig.120 (30))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent, bearded
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins; dotted structures are seen on the surface folded, toothed margin
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, short
Auricle: Absent
Collar: Continuous, narrow

Themeda

31. ***Themeda cymbaria***
32. ***Themeda laxa***
33. ***Themeda triandra***
34. ***Themeda quadrivalvis***

31. ***Themeda cymbaria*** **(Fig.121 (31))**

Growth Habit: Perennial
Vernation: Rolled
Node: Pubescent, long hairs present but not in continuous ring form, it is in segments
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein present with other parallel veins
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous, short, ciliate
Auricle: Absent
Collar: Divided

32. ***Themeda laxa*** **(Fig.121 (32))**

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins, slightly toothed margin
Termination point: Acuminated to pointed, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Absent
Collar: Continuous, narrow

33. ***Themeda triandra*** **(Fig.122 (33))**

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins, leaf base is shorted
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Round
Ligule: Membranous, round off
Auricle: Absent
Collar: Continuous, narrow

34. *Themeda quadrivalvis* (Fig.122 (34))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein present with other parallel veins
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Absent
Collar: Divided

Differentiating feature:

Leaf sheath typeis flattened……..*T. cymbaria*
Leaf sheath type is round
Divided collar region……*T. quadrivalvis*
Continuous collar region
Acute termination point……..……*T. triandra*
Pointed termination point…….……*T. laxa*

35. *Triplopogon ramosissimus* (Fig.123 (35))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein, lanceolate shape
Termination point: Acuminate, flat
Leaf sheath margin: Open
Leaf sheath type: Flattened
Ligule: Membranous, round off
Auricle: Absent
Collar: Continuous, narrow

36. *Vetivaria zinzanoides* (Fig.123 (36))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous

Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein, white colour band present at midvein
Termination point: Pointed needle like
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous, ciliate
Auricle: Absent
Collar: Divided

37. *Alloteropis cimiciana* (Fig.124 (37))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent, long hairs are present
Internode: Puescent
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins, toothed margin
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Divided, narrow

Brachiaria

38. *Brachiaria distachya*
39. *Brachiaria eruciformis*
40. *Brachiaria ramosa*
41. *Brachiaria reptans*

38. *Brachiaria distachya* (Fig.124 (38))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present, cilia present on margin, lanceolate
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Continuous, narrow

39. *Brachiaria eruciformis* (Fig.125 (39))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent, nodal region is totally covered with hairs
Internode: Smooth, longitudinal lines are present
Leaf Blade: Pubescent surface, no single prominent midvein is present, hairs are present on both the surface of blade
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Short, rudiment
Collar: Continuous, narrow

40. *Brachiaria ramosa* (Fig.125 (40))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent, few hairs are present
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, cilia present on both the surface even at margin
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs, fused at base
Auricle: Absent
Collar: Continuous, narrow

41. *Brachiaria reptans* (Fig.126 (41))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with all parallel veins, few hairs present on dorsal surface
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Short, rudiment
Collar: Continuous, narrow

Differentiating feature:

Auricle absent

Glabrous node……..……..*B. distachya*

Short hairs present at nodal region……...*B. ramosa*

Short and rudiment auricle

Glabrous node……...……..*B. reptans*

Node completely covered with hairs…...……...……...*B. eruciformis*

Cenchrus

42. *Cenchrus biflorus*

43. *Cenchrus ciliaris*

44. *Cenchrus setigerus*

42. *Cenchrus biflorus* (Fig.126 (42))

Growth Habit: Annual

Vernation: Rolled

Node: Glabrous, slightly bearded

Internode: Smooth

Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, hairs present at the base of leaf blade

Termination point: Pointed needle like, flat

Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Flattened

Ligule: Membranous, acute

Auricle: Absent

Collar: Continuous, narrow

43. *Cenchrus ciliaris* (Fig.127 (43))

Growth Habit: Perennial

Vernation: Folded

Node: Glabrous

Internode: Smooth

Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins

Termination point: Acute, flat

Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Round

Ligule: Fringe of hairs

Auricle: Absent

Collar: Continuous, narrow

44. *Cenchrus setigerus* (Fig.127 (44))

Growth Habit: Annual

Vernation: Rolled

Node: Glabrous

Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Fringe of hairs
Auricle: Absent
Collar: Continuous, narrow, hairy

Differentiating feature:

Folded vernation……..……..*C. ciliaris*
Rolled vernation
Acuminate termination point……..…….*C. setigerous*
Pointed termination point…….……...*C. biflorus*

Digitaria

45. *Digitaria ciliaris*
46. *Digitaria granularis*
47. *Digitaria longiflora*
48. *Digitaria stircta*

45. *Digitaria ciliaris* (Fig.128 (45))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent, numerous long hairs are present
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins, wavy margin
Termination point: Acute, keeled
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acuminate
Auricle: Absent
Collar: Continuous, broad

46. *Digitaria granularis* (Fig.128 (46))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins
Termination point: Acuminate, flat
Leaf sheath margin: Open
Leaf sheath type: Round

Ligule: Membranous, acute
Auricle: Absent
Collar: Divided

47. *Digitaria longiflora* (Fig.129 (47))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, truncate
Auricle: Short, rudiment
Collar: Continuous, broad, hairy

48. *Digitaria stircta* (Fig.129 (48))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, angled
Internode: Smooth
Leaf Blade: Pubescent surface, no single prominent midvein is present, long hairs present on the dorsal surface
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous
Auricle: Absent
Collar: Continuous, narrow

Differentiating feature:

Pubescent node (long cilia present)……..*D. ciliaris*
Glabrous node
Leaf sheath margin is open……...……..*D. granularis*
Leaf sheath margin is split with overlapping margin
Auricle absent……*D. stricta*
Short and rudiment auricle present…..……..……..*D. longiflora*

Echinichloa

49. *Echinichloa colona*
50. *Echinochloa crusgalli*
51. *Echionochloa stagnina*

49. *Echinichloa colona* (Fig.130 (49))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous

Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins
Termination point: Acute, keeled
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Absent
Auricle: Absent
Collar: Continuous, broad

50. *Echinochloa crusgalli* (Fig.130 (50))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein with other parallel veins
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Absent
Auricle: Absent
Collar: Continuous, narrow

51. *Echionochloa stagnina* (Fig.131 (51))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins, margin toothed
Termination point: Acute, keeled
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of short hairs, fused at base
Auricle: Absent
Collar: Continuous, narrow

Differentiating feature:

Hairy ligule……*E. stagnina*
Ligule absent
Acute, keeled termination point……..*E. colona*
Acuminate, flat termination point……..*E. crusgalli*

52. ***Eremopogon foveolatus*****(Fig.131 (52))**

Growth Habit: Perennial
Vernation: Folded
Node: Pubescent, long hairs present
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, few long hairs present at margin, margin is toothed
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of long hairs
Auricle: Absent
Collar: Divided

53. ***Eriochloa procera*****(Fig.132 (53))**

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, no single prominent midvein is present
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of villous hairs
Auricle: Absent
Collar: Continuous, narrow

Oplismenus

54. ***Oplismenus burmannii***
55. ***Oplismenus composites***

54. ***Oplismenus burmanii*****(Fig.132 (54))**

Growth Habit: Annual
Vernation: Folded
Node: Pubescent
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present
Termination point: Acute, flat
Leaf sheath margin: Close
Leaf sheath type: Flattened
Ligule: Fringe of hairs
Auricle: Short, rudiment
Collar: Divided

55. *Oplismenus composites* (Fig.133 (55))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent, slightly hairs
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, dotted structures are present on both surfaces
Termination point: Acute, flat
Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Short, rudiment
Collar: Divided

Differentiating feature:

Folded vernation, close leaf sheath margin, flattened leaf sheath type…....*O. burmanii*
Rolled vernation, open leaf sheath margin, round leaf sheath type……...*O. composites*

Panicum

56. *Panicum antidotale*
57. *Panicum maximum*
58. *Panicum miliaceum*
59. *Panicum trypheron*

56. *Panicum antidotale* (Fig.133 (56))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins; dotted structures are present on both surfaces
Termination point: Acuminate, flat
Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Fringe of minute hairs
Auricle: Absent
Collar: Continuous, narrow

57. *Panicum maximum* (Fig.134 (57))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins

Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, Short, ciliate
Auricle: Absent
Collar: Divided, broad

58. *Panicum miliaceum* (Fig.134 (58))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Ciliated rim
Auricle: Short, rudiment
Collar: Continuous, narrow

59. *Panicum trypheron* (Fig.135 (59))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present, margin folded
Termination point: Acuminate, keeled
Leaf sheath margin: Close
Leaf sheath type: Round
Ligule: Fringe of short hairs, frimbricate
Auricle: Short, rudiment
Collar: Continuous, narrow

Differentiating feature:

Rolled vernation……..…….*P. trypheron*
Folded vernation
Acute termination point…….……..*P. miliaceum*
Acuminate termination point
Leaf sheath margin is close……*P. antidotalae*
Leaf sheath margin is split with overlapping margin…….*P. maximum*

OR

Leaf sheath margin is open……..…….*P. antidotalae*
Leaf sheath margin is close…….*P. trypheron*

Leaf sheath margin is split with overlapping margin

Auricle absent, divided collar, acuminate termination point…….. *P. maximum*

Short, rudiment auricle, continuous collar, acute termination point….

P. miliaceum

OR

Auricle absent

Leaf sheath margin is open……..…….*P. antidotalae*

Leaf sheath margin is split with overlapping margin…….....….*P. maximum*

Short, rudiment auricle

Leaf sheath margin is close…….*P. trypheron*

Leaf sheath margin is split with overlapping margin…….....….*P. miliaceum*

Paspalidium

60. *Paspalidium flavidum*

61. *Paspalidium geminatum*

60. *Paspalidium flavidum* (Fig.135 (60))

Growth Habit: Annual

Vernation: Folded

Node: Glabrous

Internode: Smooth

Leaf Blade: Glabrous surface, single prominent midvein is present

Termination point: Acuminate, flat

Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Flattened

Ligule: Fringe of short hairs

Auricle: Absent

Collar: Divided, broad

61. *Paspalidium geminatum* (Fig.136 (61))

Growth Habit: Perennial

Vernation: Folded

Node: Glabrous

Internode: Smooth

Leaf Blade: Pubescent surface, single prominent midvein is present with minute parallel veins; Short hairs are present on the dorsal surface

Termination point: Acuminate, flat

Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Round

Ligule: Fringe of hairs

Auricle: Absent

Collar: Divided, broad

Differentiating feature:

Annual growth habit, acuminate termination point, flattened leaf sheath type……..

P. flavidum

Perennial growth habit, acute termination point, round leaf sheath type……..

P. geminatum

62. *Paspalum scorbiculatum* (Fig.136 (62))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous
Auricle: Short, rudiment
Collar: Continuous, narrow

63. *Pennisetum setosum* (Fig.137 (63))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with parallel veins
Termination point: Acuminate to tapering, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of long hairs, fused at base
Auricle: Absent
Collar: Continuous, narrow

Setaria

64.*Setaria glauca*
65. *Setaria tomentosa*
66. *Setaria verticillata*

64. *Setaria glauca* (Fig.137 (64))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Short, rudiment
Collar: Divided

65. *Setaria tomentosa* (Fig.138 (65))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, angled
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein present with other parallel veins, presence of minute hairs on all over the surface
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous, acute
Auricle: Short, rudiment
Collar: Divided

66. *Setaria verticillata* (Fig.138 (66))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, presence of hairs on the surface
Termination point: Acute to Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened,
Ligule: Membranous, ciliolate
Auricle: Short, rudiment
Collar: Divided

Differentiating feature:

Leaf sheath type is round…...……*S. glauca*
Leaf sheath type is flattened
Membranous, short,acute ligule…….……*S. tomentosa*
Membranous, ciliate ligule……..…….*S. verticillata*

67. *Isachne globosa* (Fig.139 (67))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent
Internode: Smooth
Leaf Blade: Glabrous surface, no single prominent midvein is present but many parallel veins are present
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous
Auricle: Absent
Collar: Divided, broad

Aristida

68. ***Aristida adscensionis***

69. ***Aristida funiculata***

68. ***Aristida adscensionis*** **(Fig.139 (68))**

Growth Habit: Annual

Vernation: Rolled

Node: Glabrous

Internode: Smooth

Leaf Blade: Pubescent surface, single prominent midvein is present with other parallel veins, presence of hairs on dorsal side, margins are curved

Termination point: Pointed needle like, flat

Leaf sheath margin: Close

Leaf sheath type: Round

Ligule: Fringe of fine, short hairs

Auricle: Absent

Collar: Continuous, narrow

69. ***Aristida funiculata*** **(Fig.140 (69))**

Growth Habit: Annual

Vernation: Rolled

Node: Glabrous, bearded

Internode: Smooth

Leaf Blade: Glabrous surface, no single prominent midvein is present but all parallel veins are present, margins are curved

Termination point: Pointed needle like, flat

Leaf sheath margin: Close

Leaf sheath type: Round

Ligule: Fringe of fine, short hairs

Auricle: Absent

Collar: Continuous, narrow

Differentiating feature:

Simple node, ligule is rim of short hairs……..……*A. adscensionis*

Bearded node, ligule is fringe of hairs……...…..……*A. funiculata*

70. ***Perotis indica*** **(Fig.140 (70))**

Growth Habit: Annual

Vernation: Folded

Node: Glabrous

Internode: Smooth

Leaf Blade: Glabrous surface, single prominent midvein is present

Termination point: Acute, flat

Leaf sheath margin: Close

Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Divided

Chloris

71. *Chloris barbata*
72. *Choris montana*
73. *Chloris virgata*

71. *Chloris barbata* (Fig.141 (71))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present, few long hairs are seen on ventral surface at margin
Termination point: Acuminate, flat
Leaf sheath margin: Open
Leaf sheath type: Flattened
Ligule: Membranous, acute, narrow
Auricle: Absent
Collar: Divided

72. *Chloris montana* (Fig.141 (72))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, thick leaf, single prominent midvein is present
Termination point: Pointed needle like
Leaf sheath margin: Open
Leaf sheath type: Split with overlapping margins
Ligule: Membranous,ciliate
Auricle: Absent
Collar: Divided

73. *Chloris virgata* (Fig.142 (73))

Growth Habit: Annual
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present
Termination point: Acute, flat

Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Membranous, short
Auricle: Absent
Collar: Continuous, narrow

Differentiating feature:

1. Acuminate termination point……*C. barbata*
   Acute termination point
   Leaf sheath margin-split with overlapping margins, Leaf sheath type is flattened, collar is divided, perennial growth habit……..*C. montana*
   Leaf sheath margin-open, leaf sheath type is round, collar is continuous, annual growth habit……*C. virgata*

OR

2. Leaf sheath type is round……...……*C. virgata*
   Leaf sheath type is flattened
   Leaf sheath margin - open, acuminate termination point …...…….*C. barbata*
   Leaf sheath margin-split with overlapping margins, acute termination point….
   C. montana

74. *Cynodon dactylon* (Fig.142 (74))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein with other parallel veins
Termination point: Acuminate, flat
Leaf sheath margin: Open
Leaf sheath type: Round
Ligule: Fringe of fine hairs
Auricle: Absent
Collar: Continuous, broad

75. *Melanocenchris jaequemontii* (Fig.143 (75))

Growth Habit: Annual
Vernation: Rolled
Node: Pubescent
Internode: Smooth
Leaf Blade: Pubescent surface, no single prominent midvein is present but many parallel veins are present
Termination point: Acute, keeled
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, ciliate
Auricle: Absent
Collar: Continuous, narrow, hairy

76. *Oropetium villosulum* (Fig.143 (76))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present, long hairs are present on the surface
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Absent
Collar: Continuous, narrow

77. *Sachoenefeldia gracilis* (Fig.144 (77))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present, long hairs are present on the surface, curved margin
Termination point: Pointed needle like, flat
Leaf sheath margin: Close
Leaf sheath type: Round
Ligule: Membranous, round off
Auricle: Short, rudiment
Collar: Continuous, narrow

Tetrapogon

78. *Tetrapogon tenellus*
79. *Tetrapogon villosus*

78. *Tetrapogon tenellus*(Fig.144 (78))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present with many parallel veins; long tuberculated based hairs are present on the dorsal surface
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Absent
Collar: Continuous, broad

79. *Tetrapogon villosus* (Fig.145 (79))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous, angled
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous
Auricle: Absent
Collar: Continuous

Differentiating feature:

Bearded node……*T. tenellus*
Angled node……..….*T.villosus*

80. *Acrachne racemosa* (Fig.145 (80))

Growth Habit: Annual
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present, toothed margin
Termination point: Acuminate, keelded
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous, ciliolate
Auricle: Absent
Collar: Divided

Dactyloctenium

81. *Dactyloctenium aegyptium*
82. *Dactyloctenium scindicus*

81. *Dactyloctenium aegyptium*(Fig.146 (81))

Growth Habit: Perennial
Vernation: Rolled
Node: Pubescent
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, acute
Auricle: Absent
Collar: Continuous, narrow

82. *Dactyloctenium sindicus* (Fig.146 (82))

Growth Habit: Perennial
Vernation: Rolled
Node: Pubescent
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present, hairs present on both the surfaces
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Short, rudiment
Collar: Continuous, narrow

Differentiating feature:

Acute termination point, membranous ligule, auricle absent……..…..*D. aegyptium*
Pointed needle like termination point, hairy ligule, short rudiment auricle..*D. sindicus*

83. *Desmostachya bipinnata* (Fig.147 (83))

Growth Habit: Perennial
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins are present
Termination point: Pointed needle like, flat
Leaf sheath margin: Close
Leaf sheath type: Round
Ligule: Membranous, round off
Auricle: Absent
Collar: Continuous, broad

84. *Dinebra retroflexa* (Fig.147 (84))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, bearded
Internode: Pubescent
Leaf Blade: Pubescent surface, single prominent midvein is present; few hairs are present on the surface
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, ciliate
Auricle: Absent
Collar: Continuous, broad

85. *Eleusine indica* (Fig.148 (85))

Growth Habit: Annual
Vernation: Folded
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present
Termination point: Acute, slightly keelded
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous
Auricle: Absent
Collar: Divided

Eragrostiella

86. *Eragrostiella bachyphylla*
87. *Eragrostiella bifaria*

86. *Eragrostiella bachyphylla* (Fig.148 (86))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous, angled
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Membranous, ciliolate
Auricle: Absent
Collar: Continuous, broad

87. *Eragrostiella bifaria* (Fig.149 (87))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, single prominent midvein is present, curved margin, rigid
Termination point: Acute, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Flattened
Ligule: Membranous, ciliolate
Auricle: Absent
Collar: Continuous, narrow

Differentiating feature:

Pointed termination point, round leaf sheath type, continuous broad collar……. *E. bachyphylla*

Acute termination point, flattened leaf sheath type, continuous narrow collar…… *E. bifaria*

Eragrostis

88. *Eragrostis cilianensis*
89. *Eragrostis ciliaris*
90. *Eragrostis japonica*
91. *Eragrostis nutans*
92. *Eragrostis pilosa*
93. *Eragrostis tenella*
94. *Eragrostis tremula*
95. *Eragrostis unioloides*
96. *Eragrostis viscosa*

88. *Eragrostis cilianensis* (Fig.149 (88))

Growth Habit: Annual

Vernation: Rolled

Node: Glabrous, angled

Internode: Smooth

Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins

Termination point: Acuminate, keeled

Leaf sheath margin: Close

Leaf sheath type: Round

Ligule: Fringe of short hairs

Auricle: Absent

Collar: Continuous, narrow

89. *Eragrostis ciliaris* (Fig.150 (89))

Growth Habit: Annual

Vernation: Rolled

Node: Glabrous, angled

Internode: Smooth

Leaf Blade: Glabrous surface, single prominent midvein is present with other parallel veins

Termination point: Pointed needle like, flat

Leaf sheath margin: Close

Leaf sheath type: Round

Ligule: Fringe of hairs

Auricle: Absent

Collar: Continuous, narrow, hairy

90. *Eragrostis japonica* (Fig.150 (90))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, no single midvein is present, all are similar parallel veins parallel veins
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Divided

91. *Eragrostis nutans* (Fig.151 (91))

Growth Habit: Perennial
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, no single midvein, all are similar parallel veins
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Divided

92. *Eragrostis pilosa* (Fig.151 (92))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Glabrous surface, no single prominent midvein is present, all are similar parallel veins
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Continuous, narrow

93. *Eragrostis tenella* (Fig.152 (93))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, no single prominent midvein is present
Termination point: Pointed needle like, flat
Leaf sheath margin: Close
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Continuous, narrow, long cilia are present at mouth of collar

94. *Eragrostis tremula* (Fig.152 (94))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, no single prominent midvein is present
Termination point: Pointed needle like, flat
Leaf sheath margin: Close
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Continuous, narrow

95. *Eragrostis unioloides* (Fig.153 (95))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein present, long hairs present on the dorsal surface
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of short hairs
Auricle: Absent
Collar: Continuous, narrow

96. *Eragrostis viscosa* (Fig.153 (96))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous, bearded
Internode: Smooth
Leaf Blade: Glabrous surface, no single prominent midvein is present
Termination point: Pointed needle like, flat
Leaf sheath margin: Split with overlapping margins
Leaf sheath type: Round
Ligule: Fringe of hairs
Auricle: Absent
Collar: Continuous, narrow, long cilia are present at mouth of collar

Differentating characters:

Divided collar region
- Annual growth habit ……*E. japonica*
- Perennial growth habit……*E. nutans*

Continuous collar region
- Leaf sheath margin is close
  - Acuminate termination point……*E. cilianensis*
  - Pointed termination point
    - Angled node region……*E. ciliaris*
    - Bearded node region
      - Long cilia present at mouth of collar…….*E. tenella*
      - Hairs absent at mouth of collar……*Etremula*
- Leaf sheath margin is split with overlapping margin
  - Long cilia present at mouth of collar…….*E. viscosa*
  - Hairs absent at mouth of collar
    - Bearded node region……*E. unioloides*
    - Simple node region……*E. pilosa*

Sporobolus

97. *Sporobolus coromandelianus*
98. *Sporobolus diander*
99. *Sporobolus indicus*

97. *Sporobolus coromardelianus* (Fig.154 (97))

Growth Habit: Annual
Vernation: Rolled
Node: Glabrous
Internode: Smooth
Leaf Blade: Pubescent surface, single prominent midvein is present, few tuberculated hairs are present on the ventral surface
Termination point: Acuminate, flat
Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Round

Ligule: Fringe of hairs

Auricle: Absent

Collar: Continuous

98. *Sporobolus diander* (Fig.154 (98))

Growth Habit: Annual

Vernation: Rolled

Node: Glabrous

Internode: Smooth

Leaf Blade: Pubescent surface, single prominent midvein is present, few hairs are present on the dorsal surface specially towards the base

Termination point: Pointed needle like, flat

Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Round

Ligule: Fringe of hairs

Auricle: Absent

Collar: Continuous

99.*Sporobolus indicus* (Fig.155 (99))

Growth Habit: Perennial

Vernation: Folded

Node: Glabrous

Internode: Smooth

Leaf Blade: Pubescent surface, single prominent midvein is present

Termination point: Pointed needle like, flat

Leaf sheath margin: Split with overlapping margins

Leaf sheath type: Round

Ligule: Fringe of hairs

Auricle: Absent

Collar: Continuous

Differentiating feature:

Folded vernation……..……*S. indicus*

Rolled vernation

Acuminate termination point……*S. coromardelianus*

Pointed termination point……..……..*S. diander*

100.*Tragus biflorus*(Fig.155 (100))

Growth Habit: Annual

Vernation: Rolled

Node: Pubescent

Internode: Smooth

Leaf Blade: Pubescent surface, no single prominent misvein is present, all veins are parallel, serrate margin

Termination point: Acute, flat

Leaf sheath margin: Close

Leaf sheath type: Round

Ligule: Fringe of hairs

Auricle: Long, clapsing

Collar: Continuous

Table 19: Distribution of seedling into clusters on the basis of their qualitative features

Cluster number	Number of observation (grass species) per cluster	Maximum value from centroid	Avarage distance from centroid
1	36	1.48	2.24
2	15	1.65	2.12
3	11	1.53	2.13
4	11	1.31	2.16
5	11	1.45	2.09
6	6	1.36	2.03
7	6	1.29	1.62
8	1	0.00	0.00
9	1	0.00	0.00
10	2	0.71	0.71

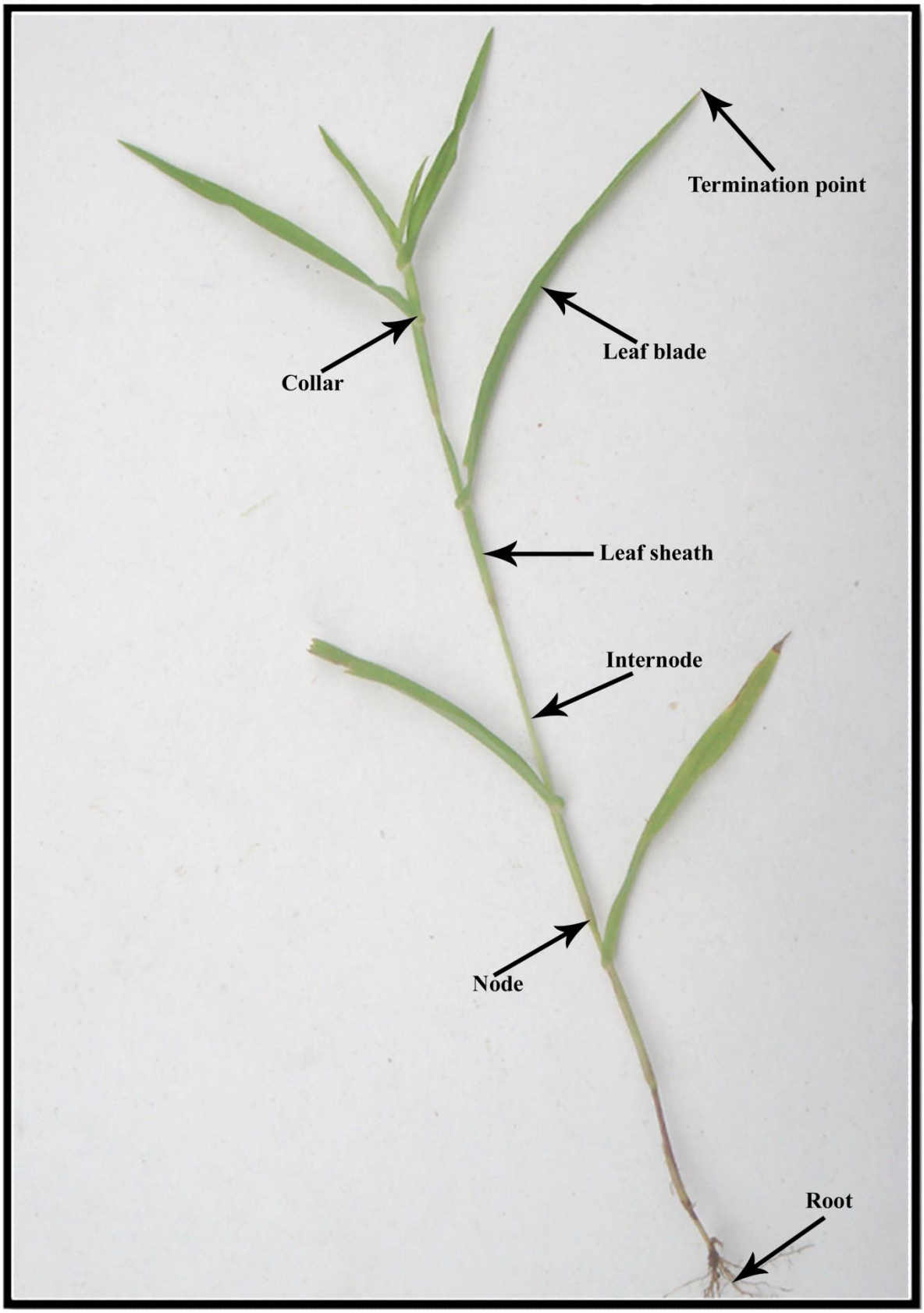


Fig. 103 : Different parts of Grass seedling

Fig. 104 Characteristic clum and leaf features of grass seedling

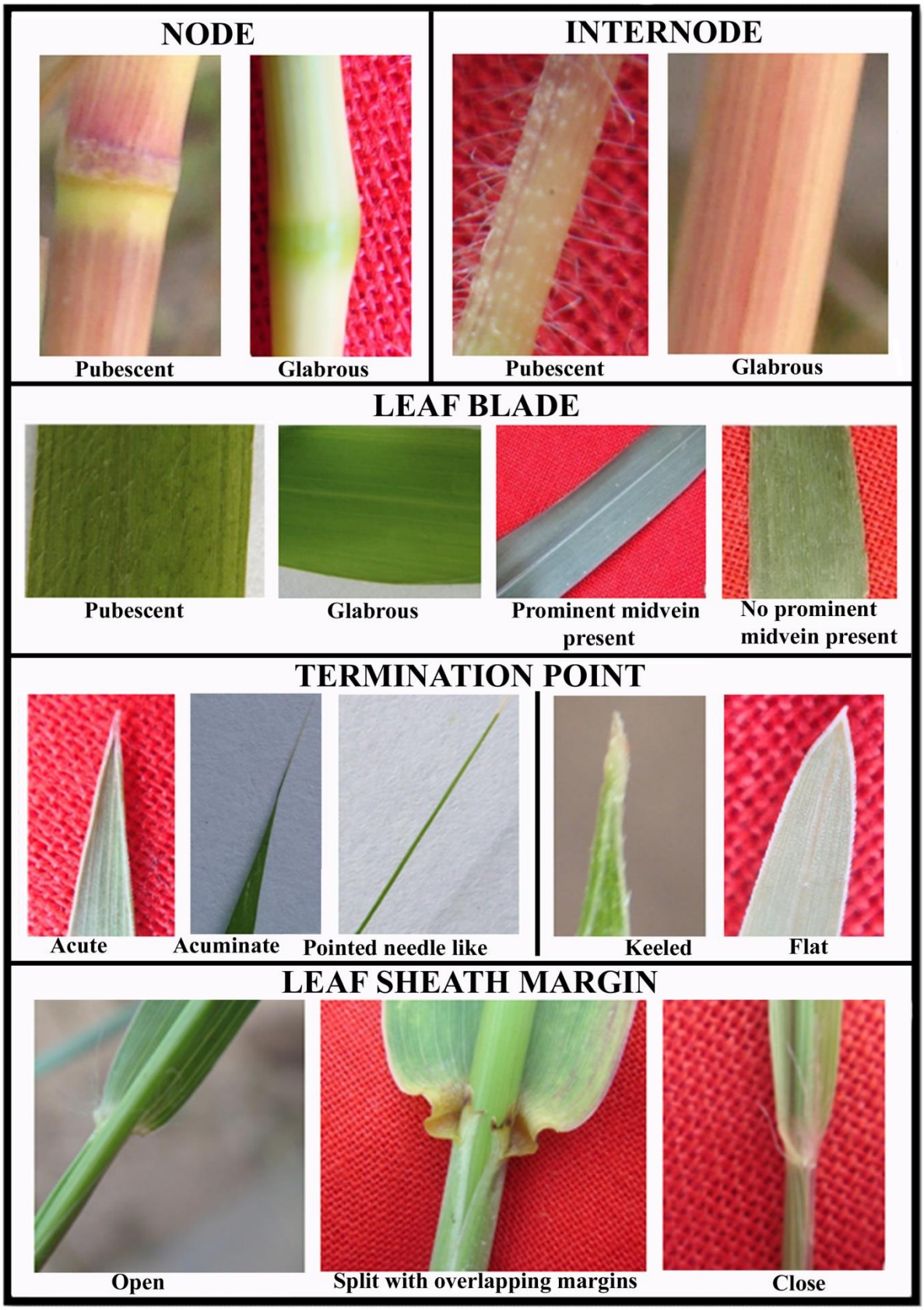

NODE
Pubescent
Glabrous
INTERNODE
Pubescent
Glabrous
LEAF BLADE
Pubescent
Glabrous
Prominent midvein present
No prominent midvein present
TERMINATION POINT
Acute
Acuminate
Pointed needle like
Keeled
Flat
LEAF SHEATH MARGIN
Open
Split with overlapping margins
Close

Fig. 104

Fig. 105 Characteristic auricle, ligule and collar features of grass seedling

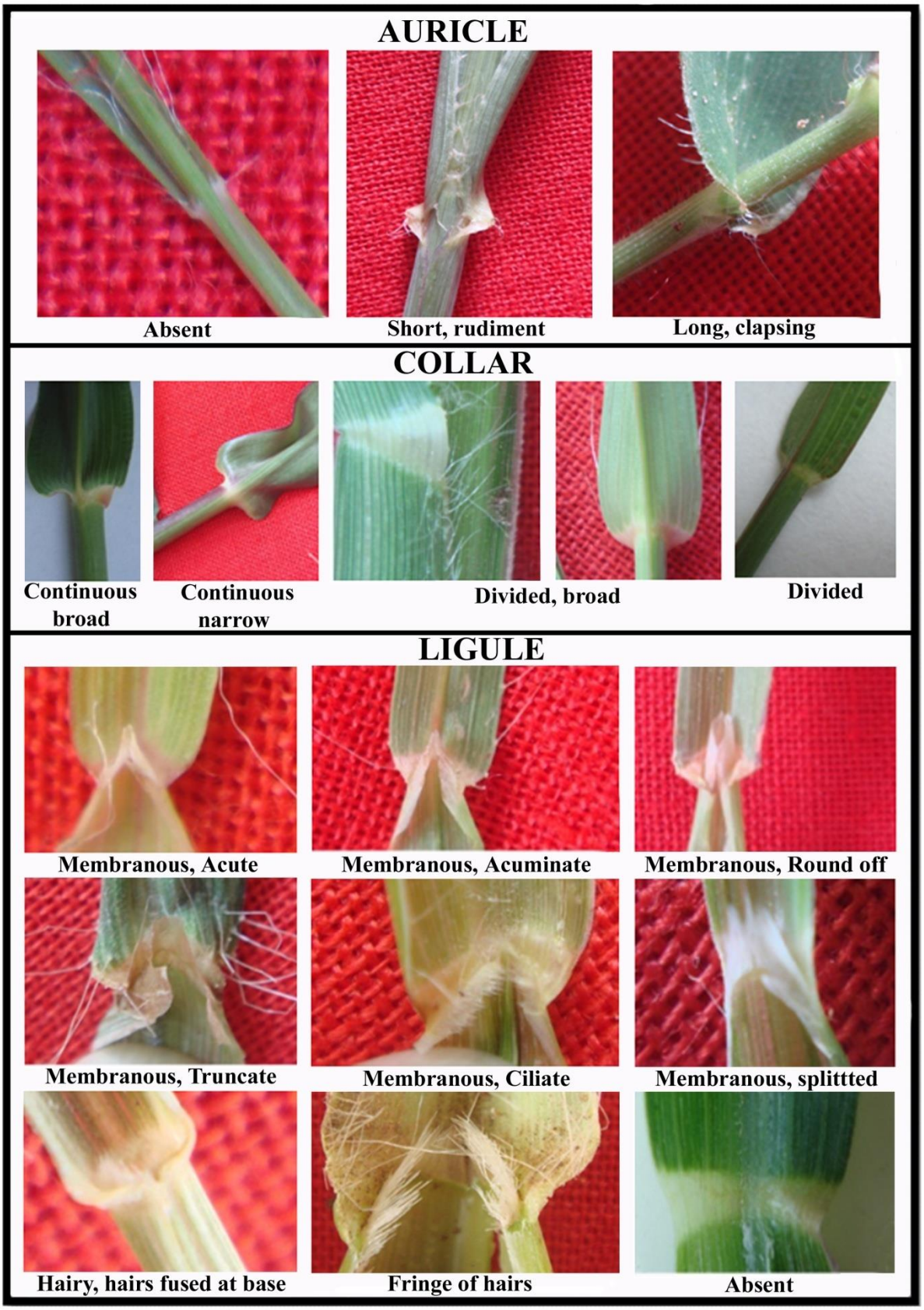

AURICLE
Absent
Short, rudiment
Long, clapsing
COLLAR
Continuous broad
Continuous narrow
Divided, broad
Divided
LIGULE
Membranous, Acute
Membranous, Acuminate
Membranous, Round off
Membranous, Truncate
Membranous, Ciliate
Membranous, splittted
Hairy, hairs fused at base
Fringe of hairs
Absent

Fig. 105

Figs. 106-155 Qualitative features of grass seedlings

A. Habit

B. Node

C. Internode;

D. Dorsal surface of lamina

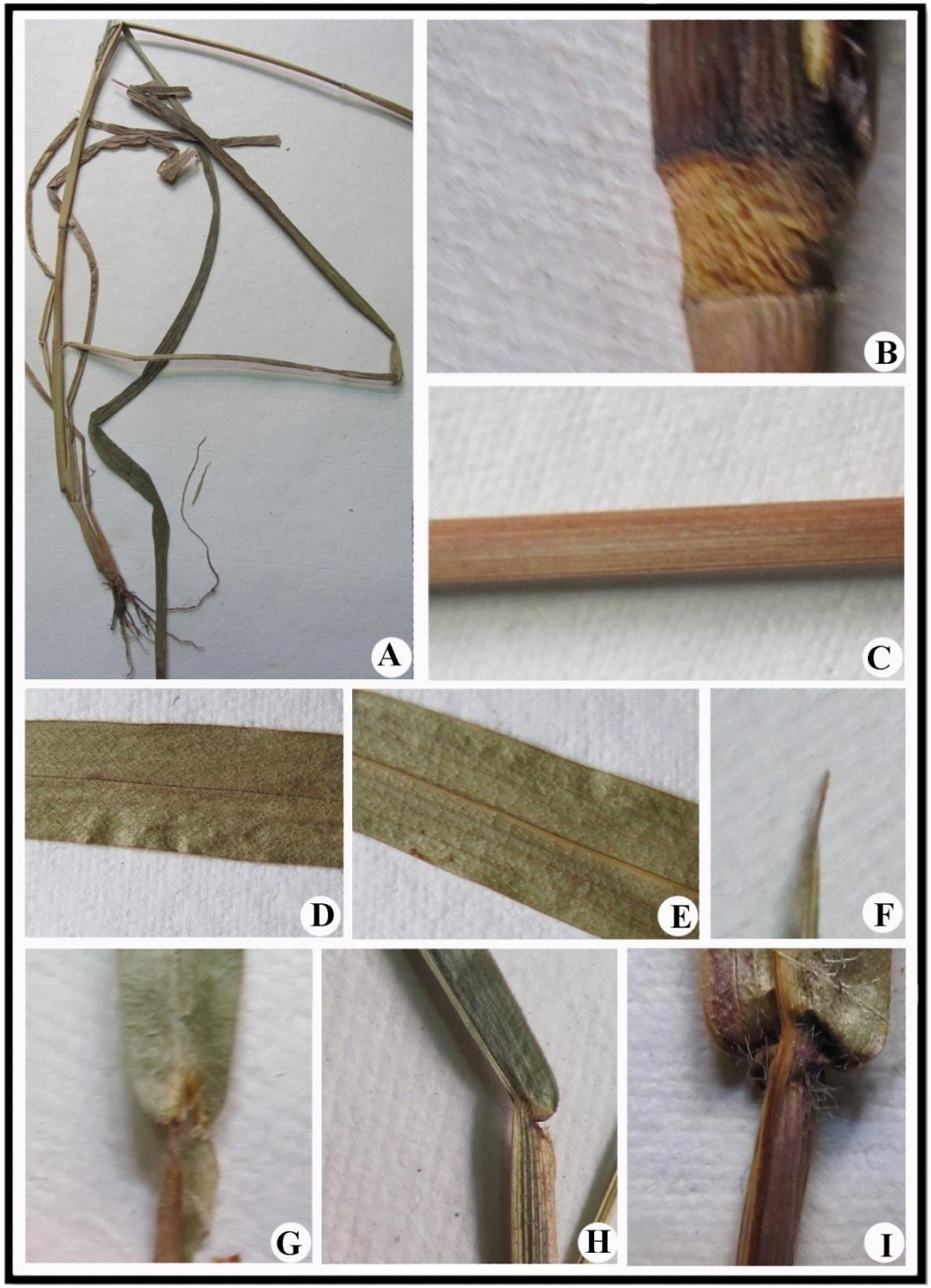
E. Ventral surface of lamina

F. Termination point (Leaf tip)

G. Ligule

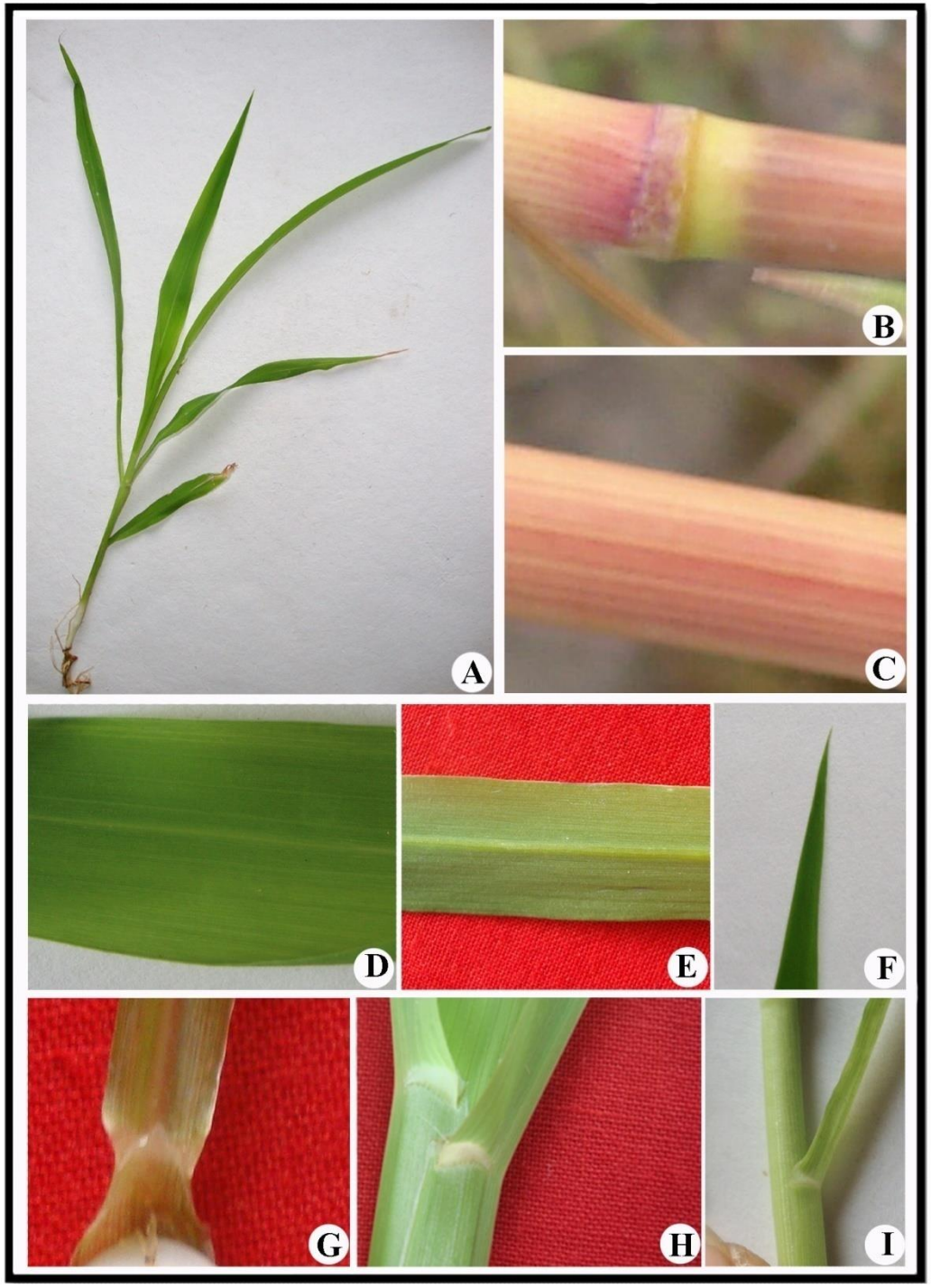
H. Auricle

I. Collar

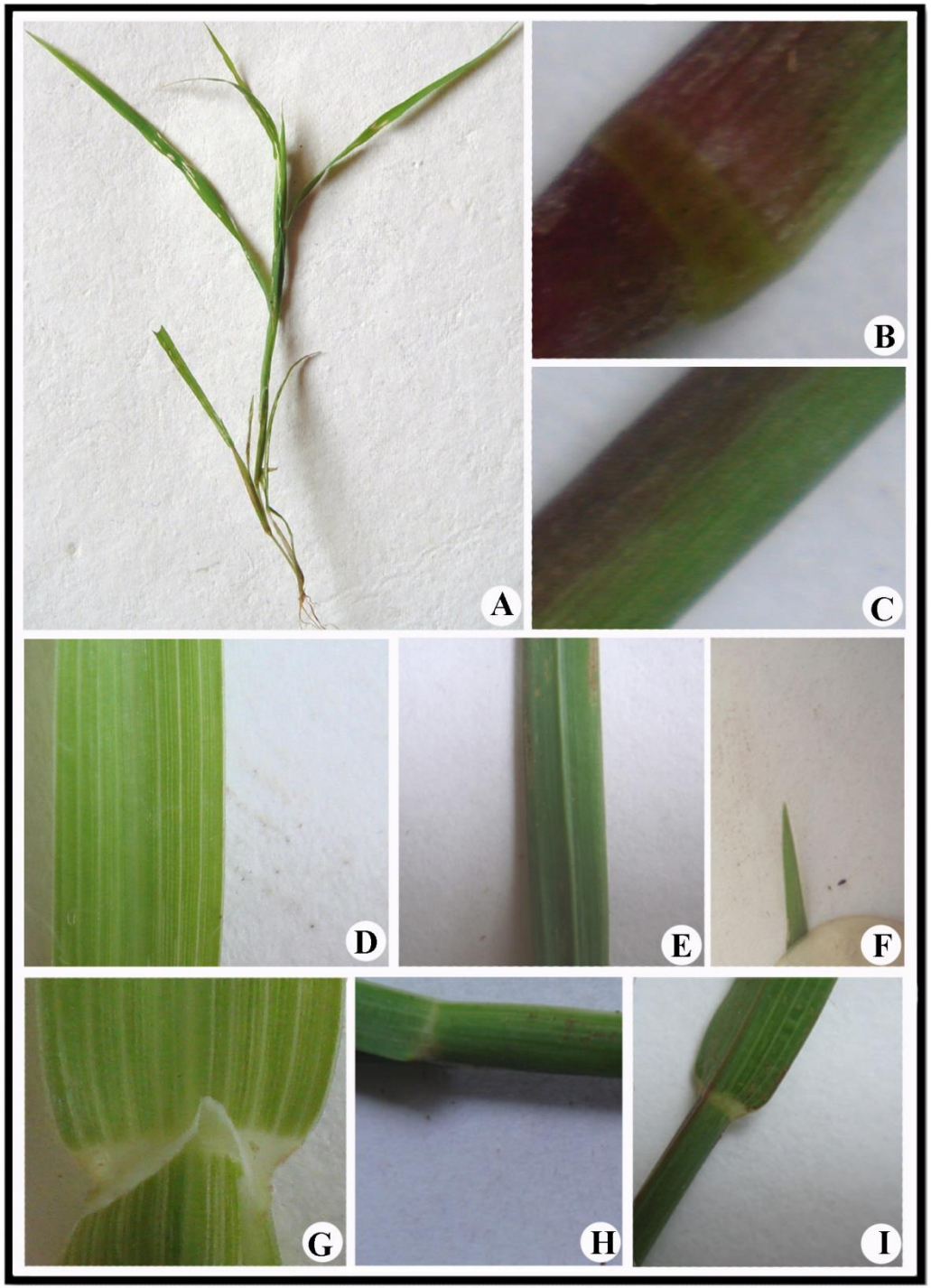


1. *Chionachne koenigii*

Fig. 106

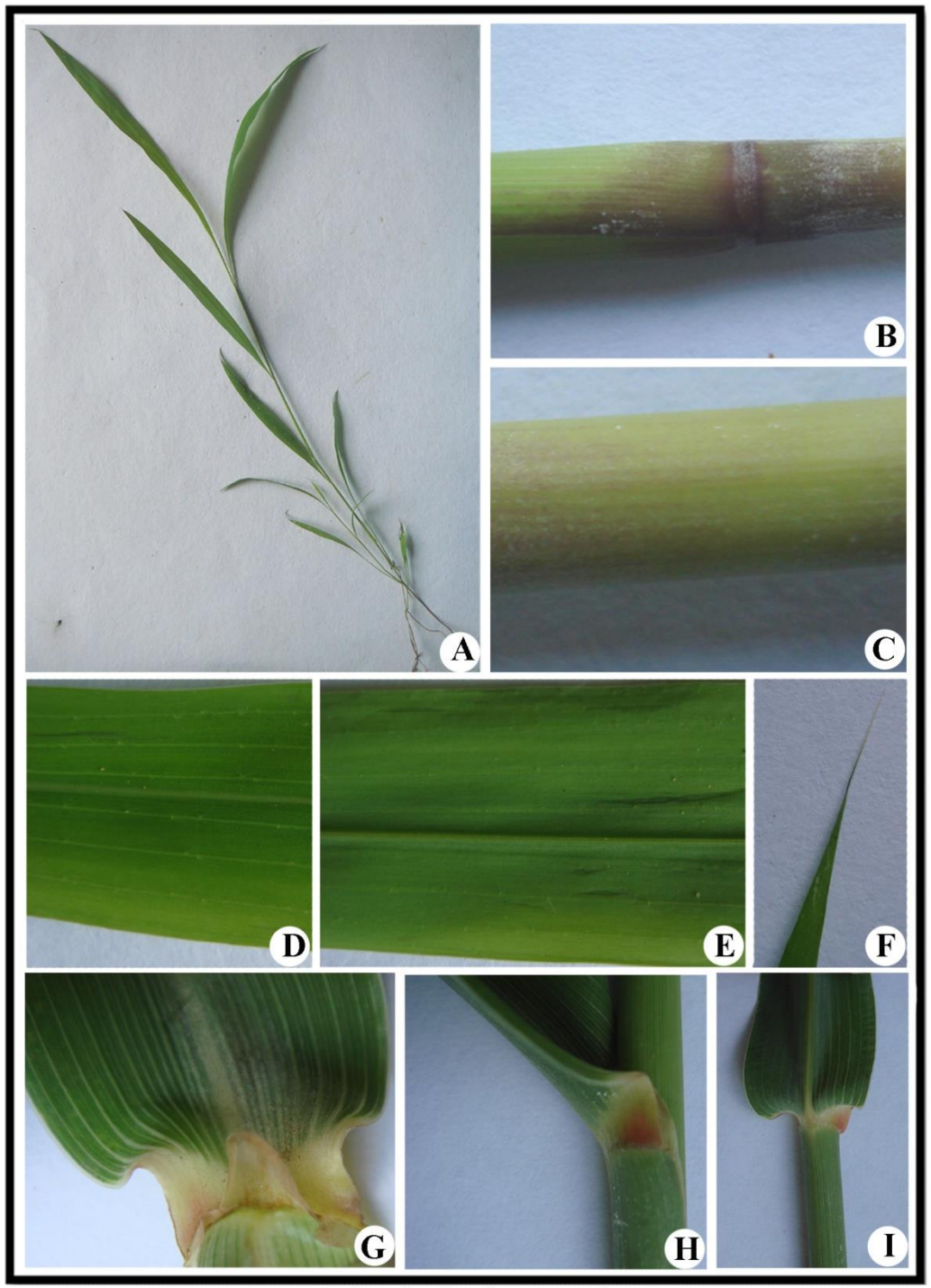


2. *Coix lachrymal-jobi*

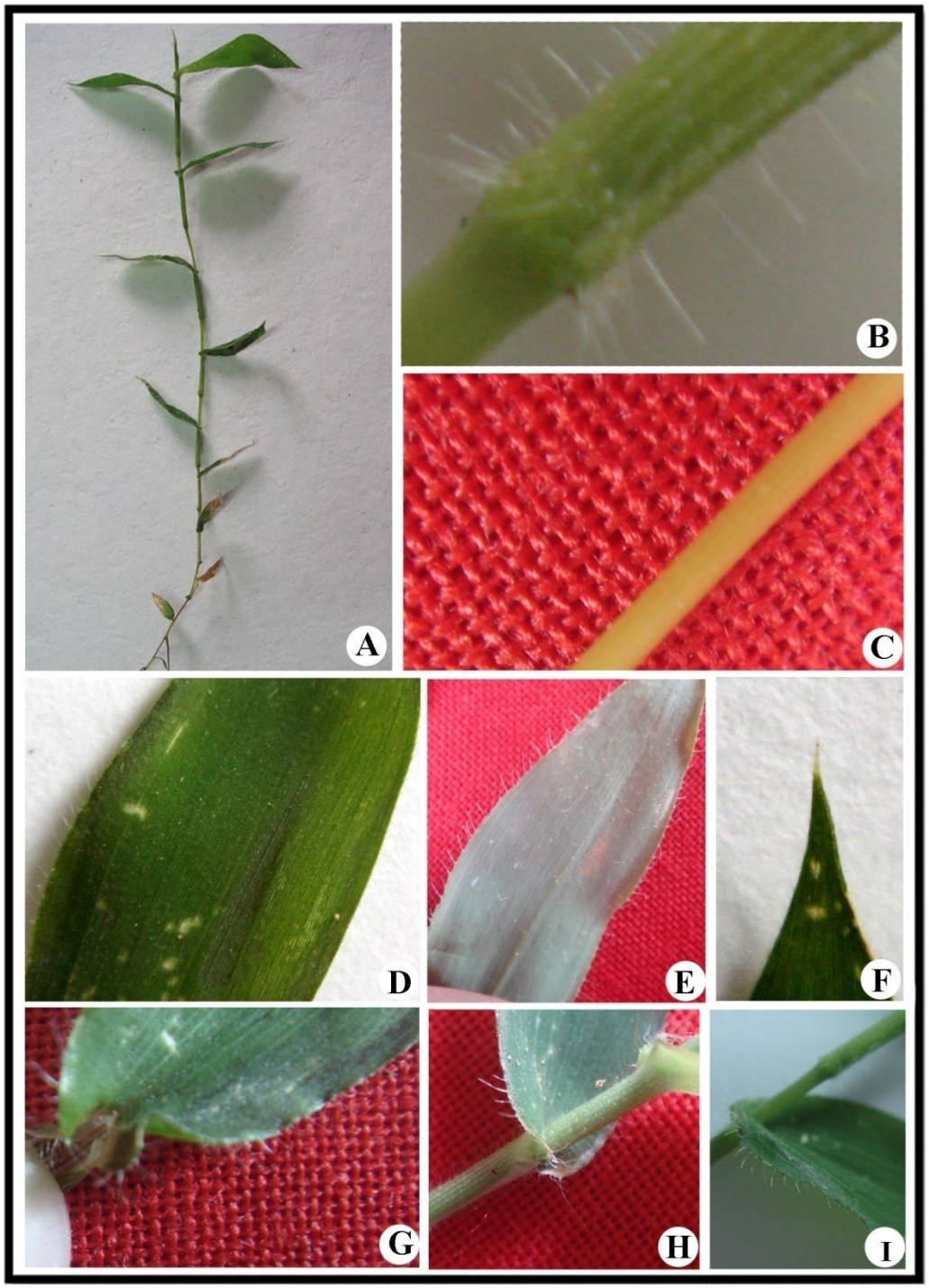


3. *Andropogon pumilus*

Fig. 107

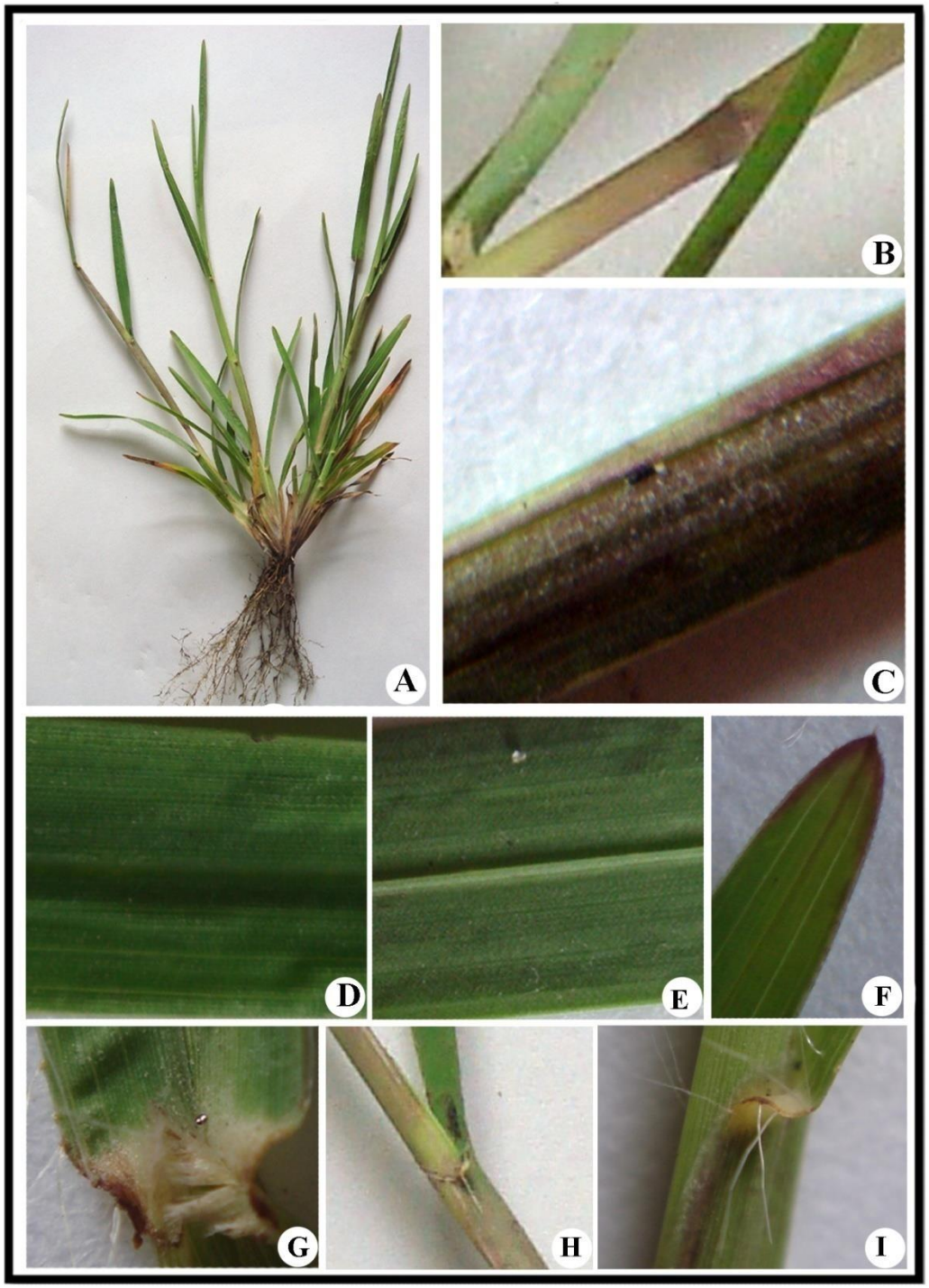


4. *Apluda mutica*

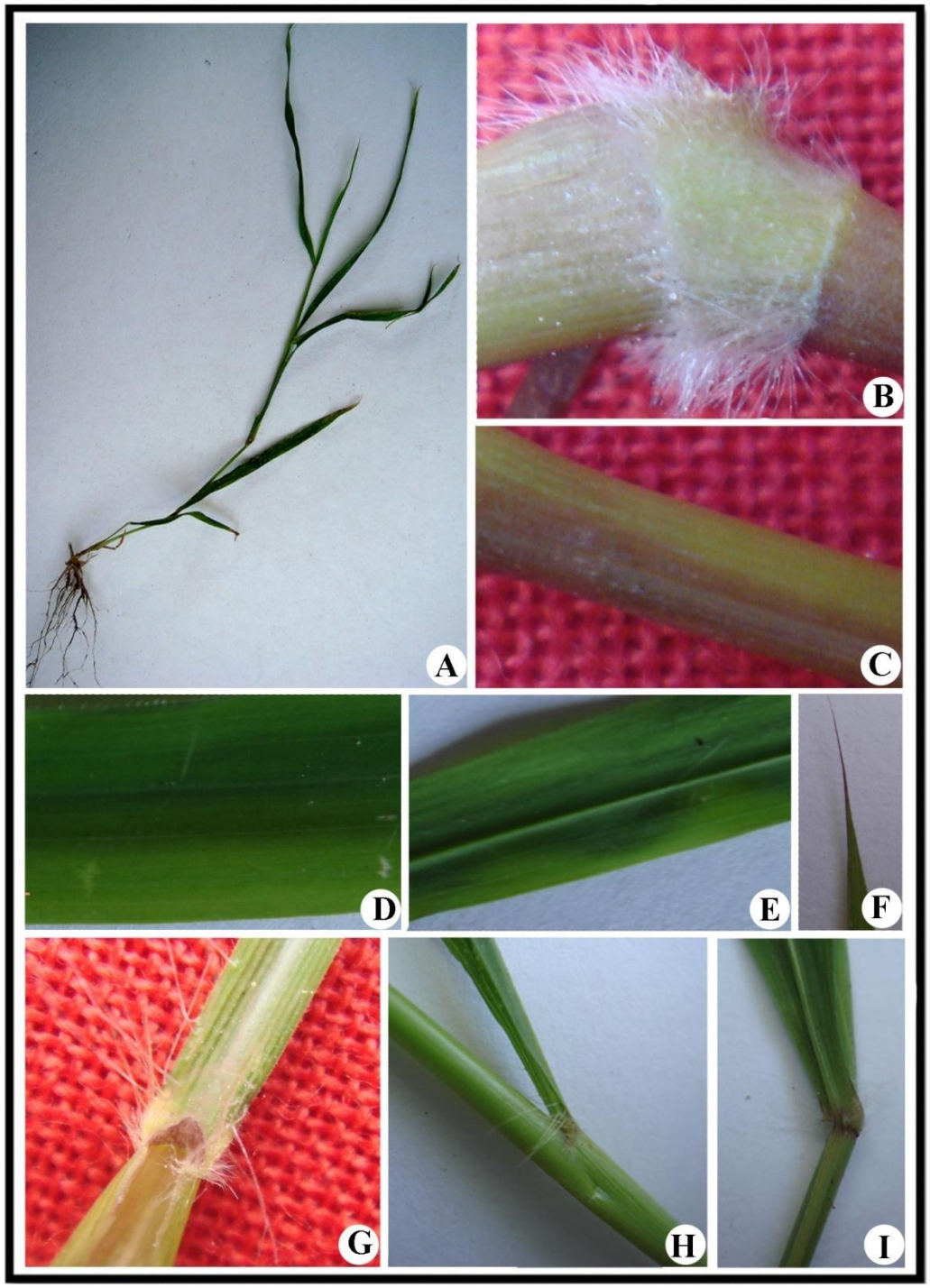


5. *Arthraxon lanceolatus*

Fig. 108

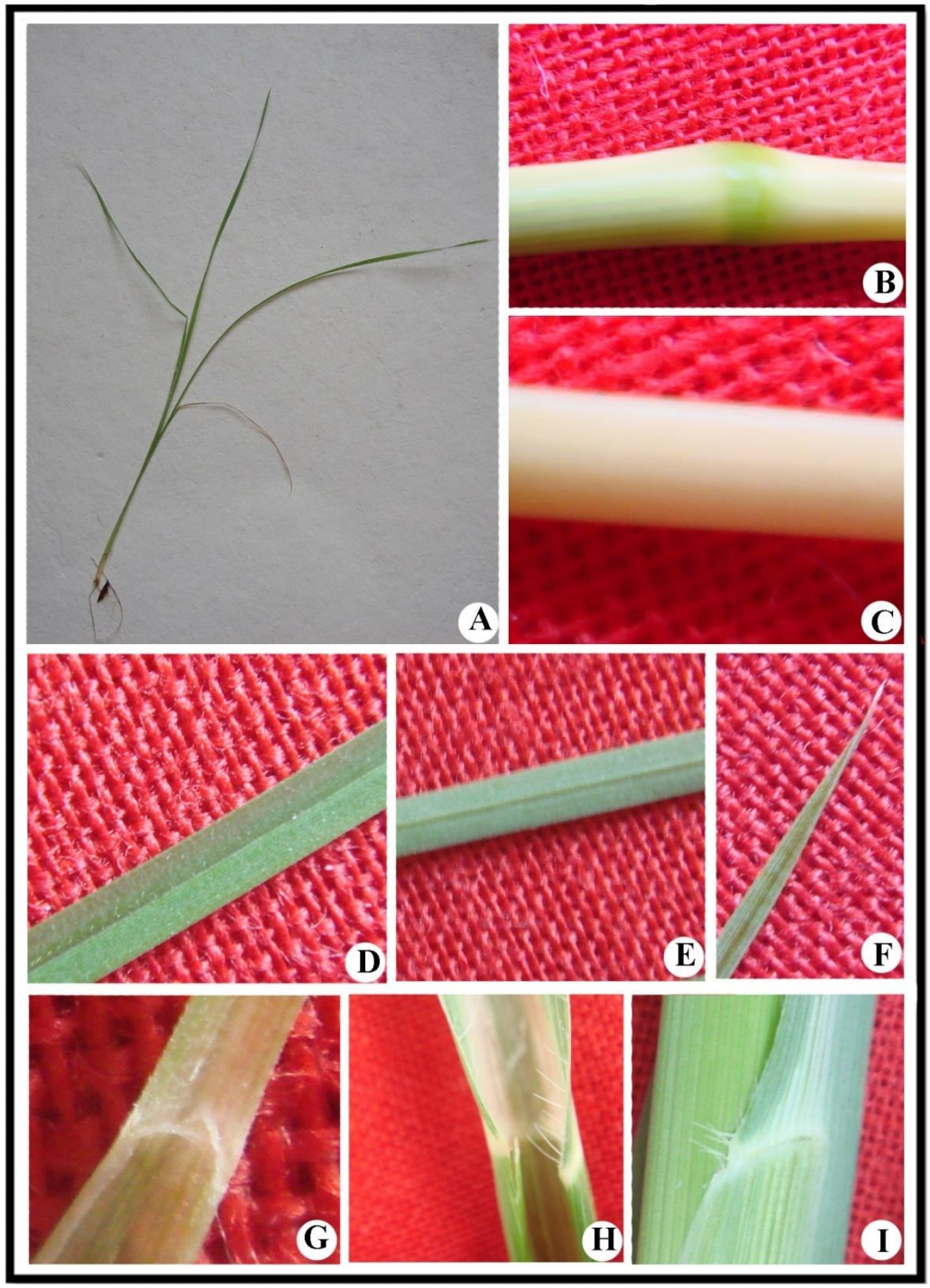


6. *Bothriochloa pertusa*

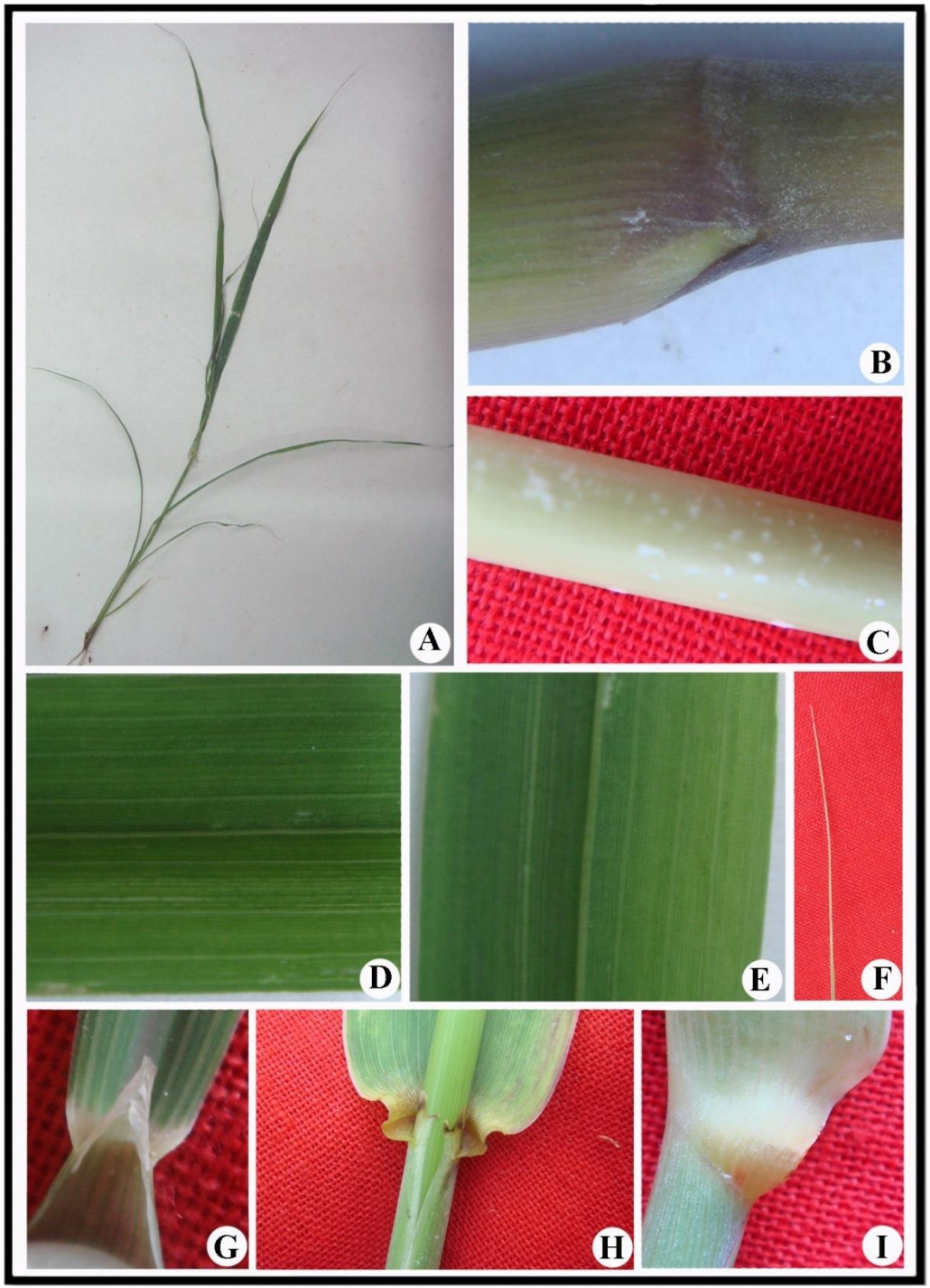


7. *Capillipedium huegelii*

Fig. 109

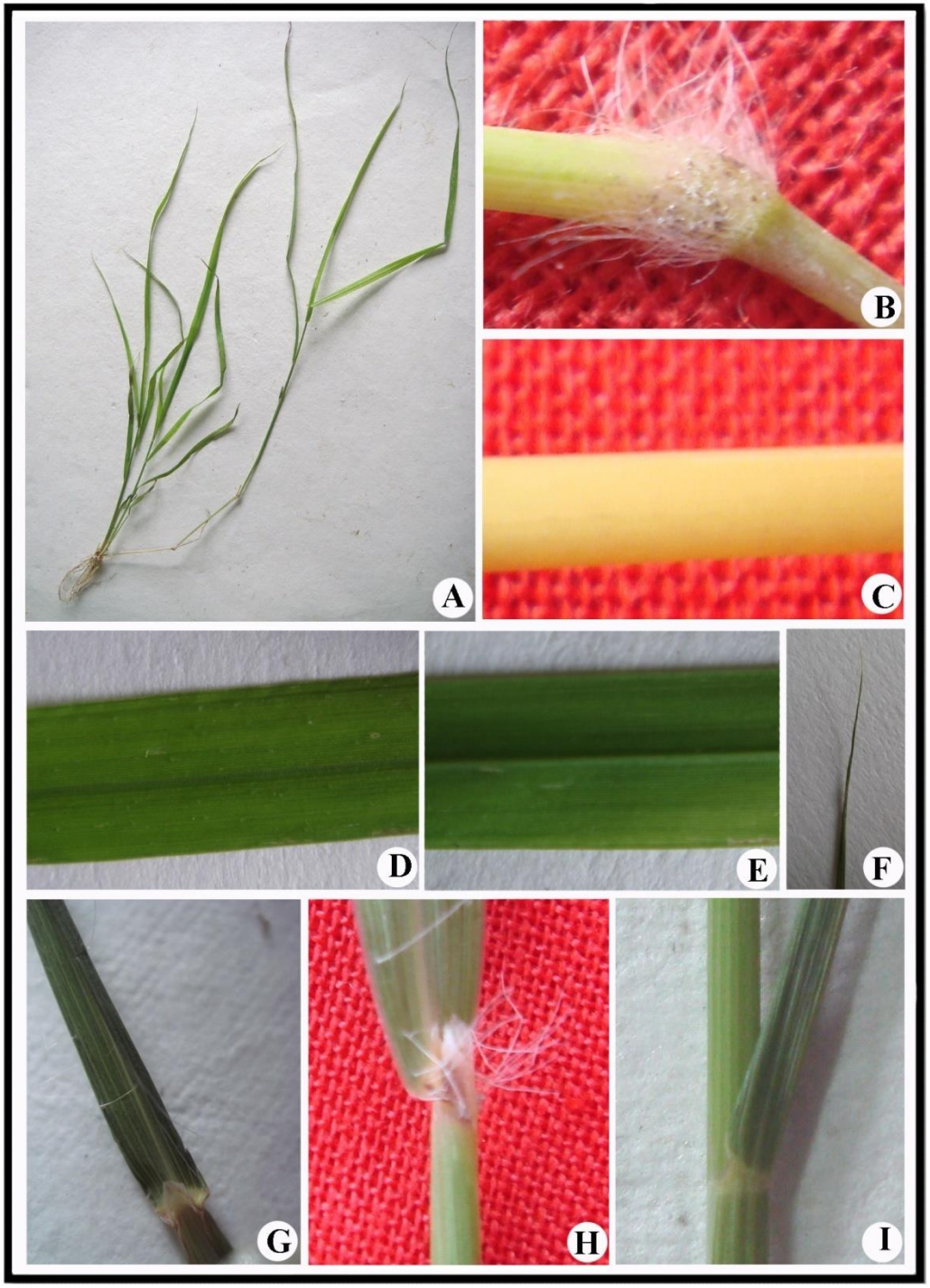


8. *Chrysopogon fulvus*

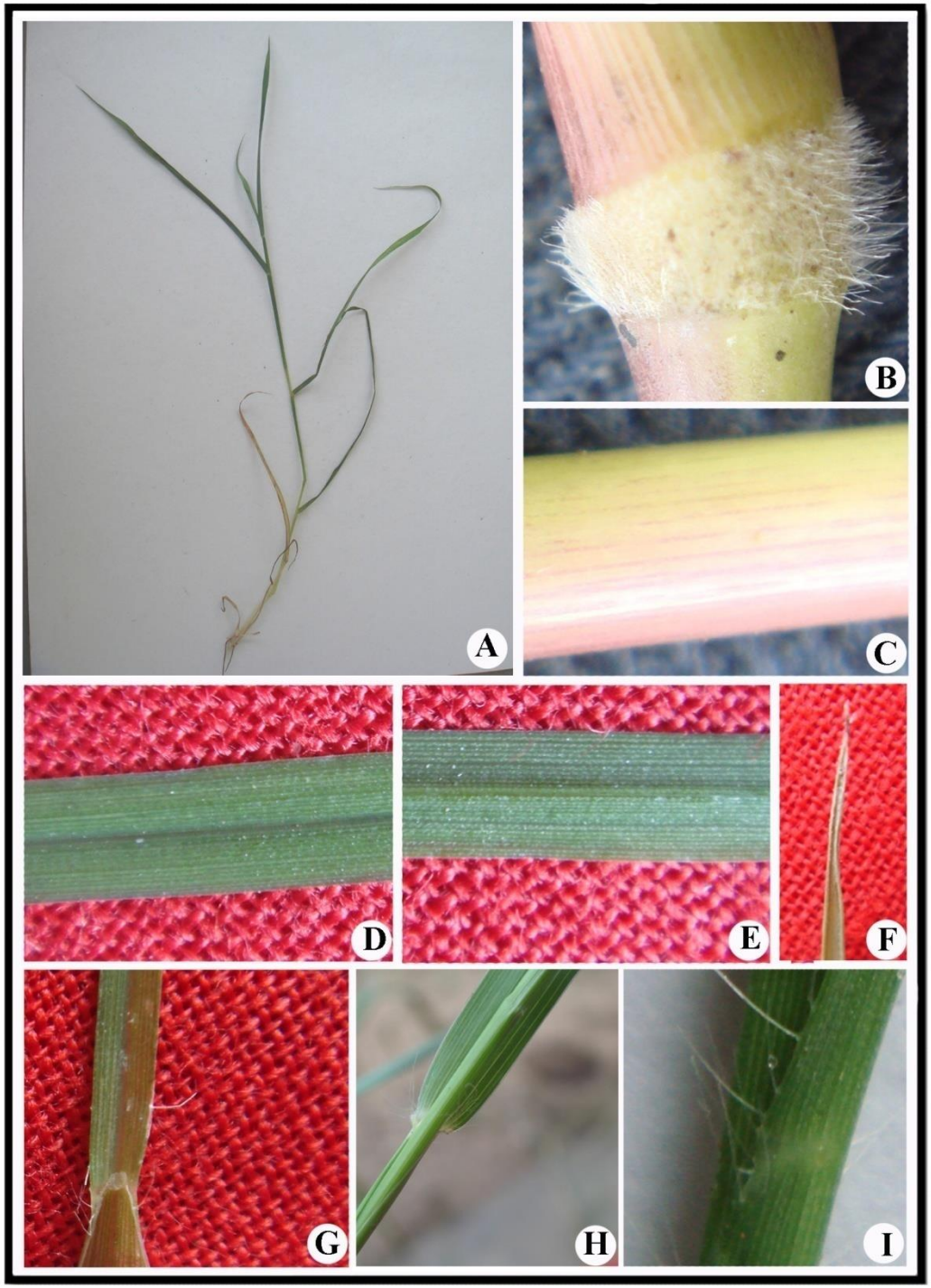


9. *Cymbopogon martinii*

Fig. 110

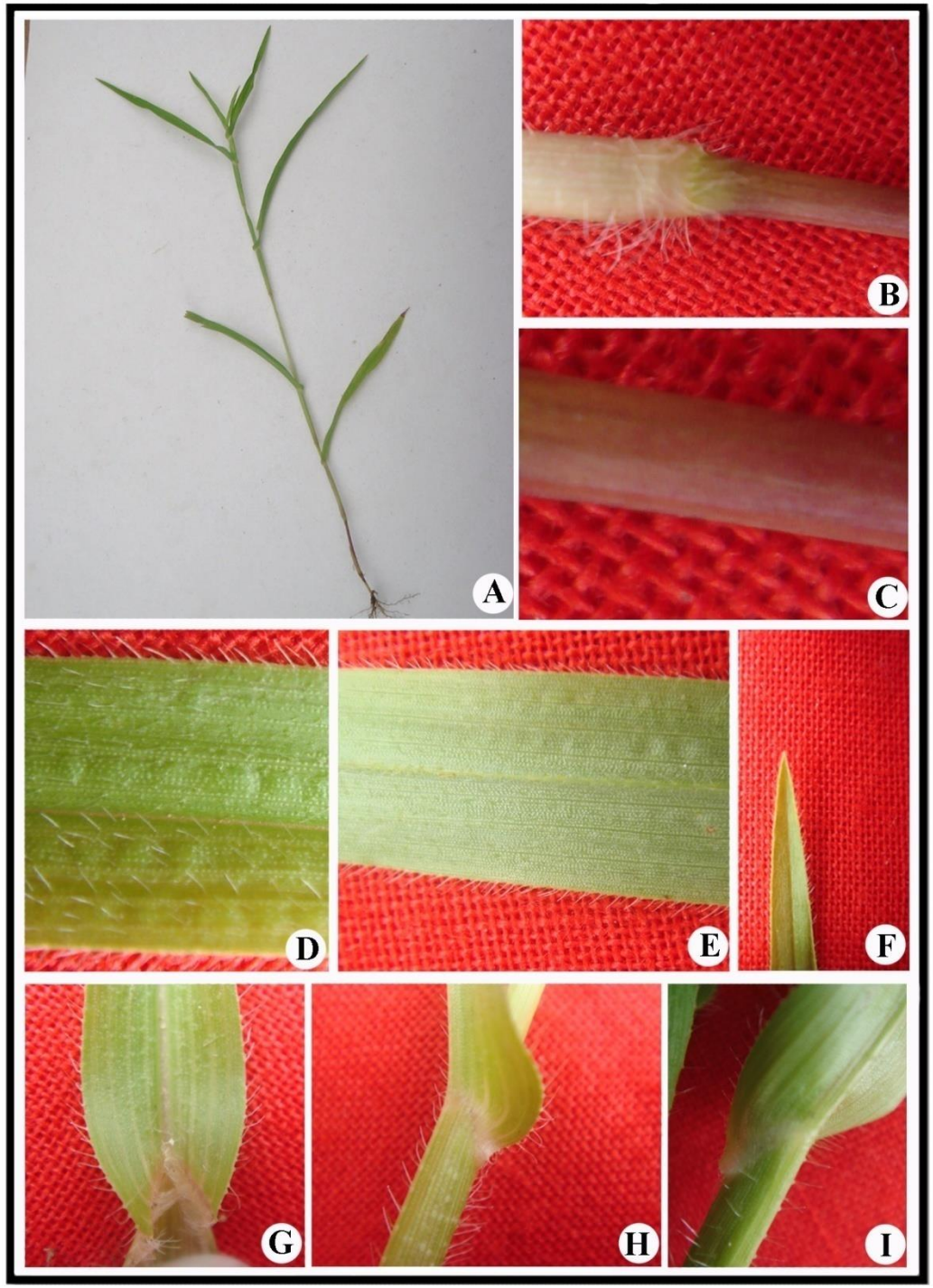


10. *Dichanthium annulatum*

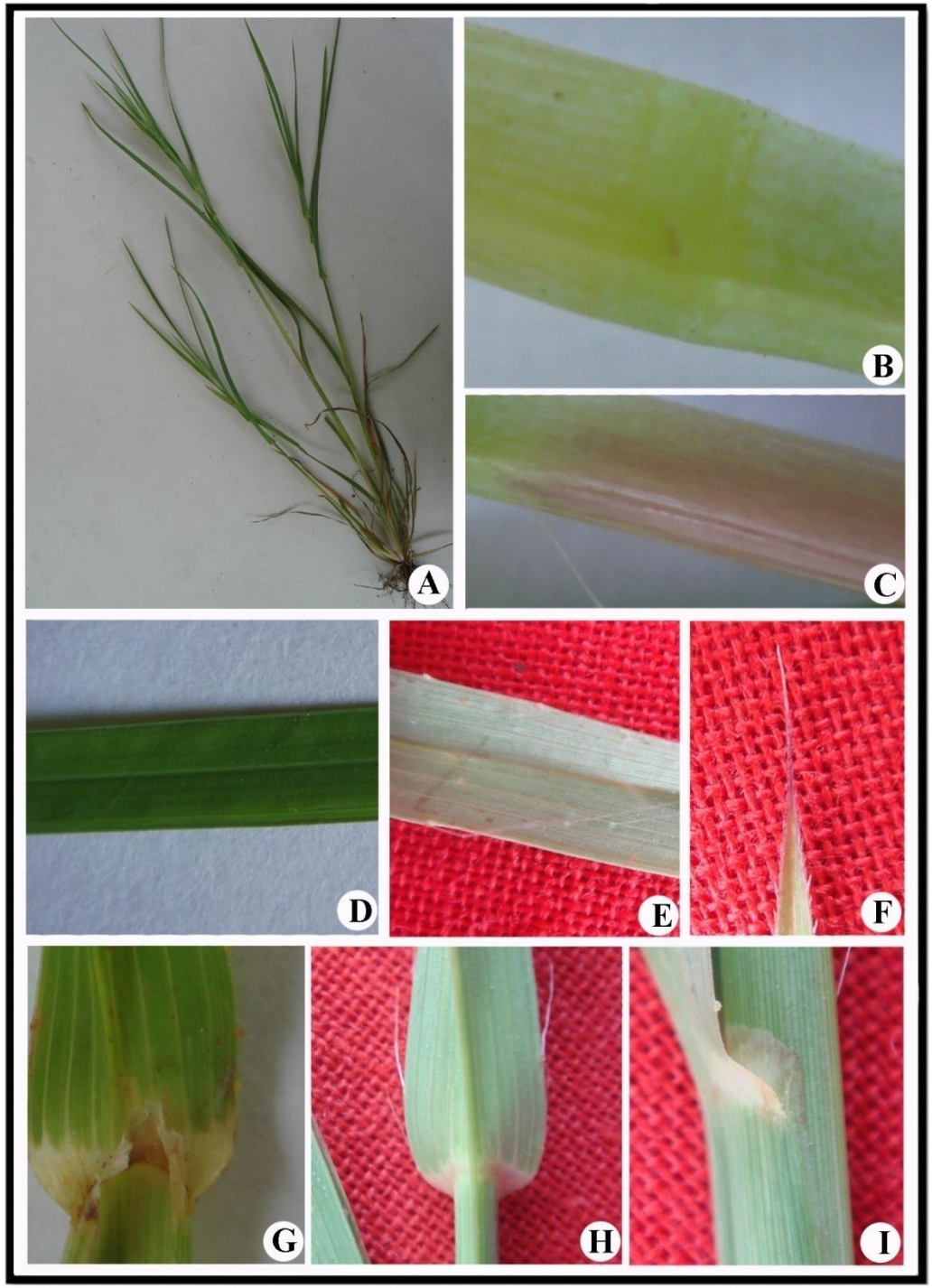


11. *Dichanthium caricosum*

Fig. 111

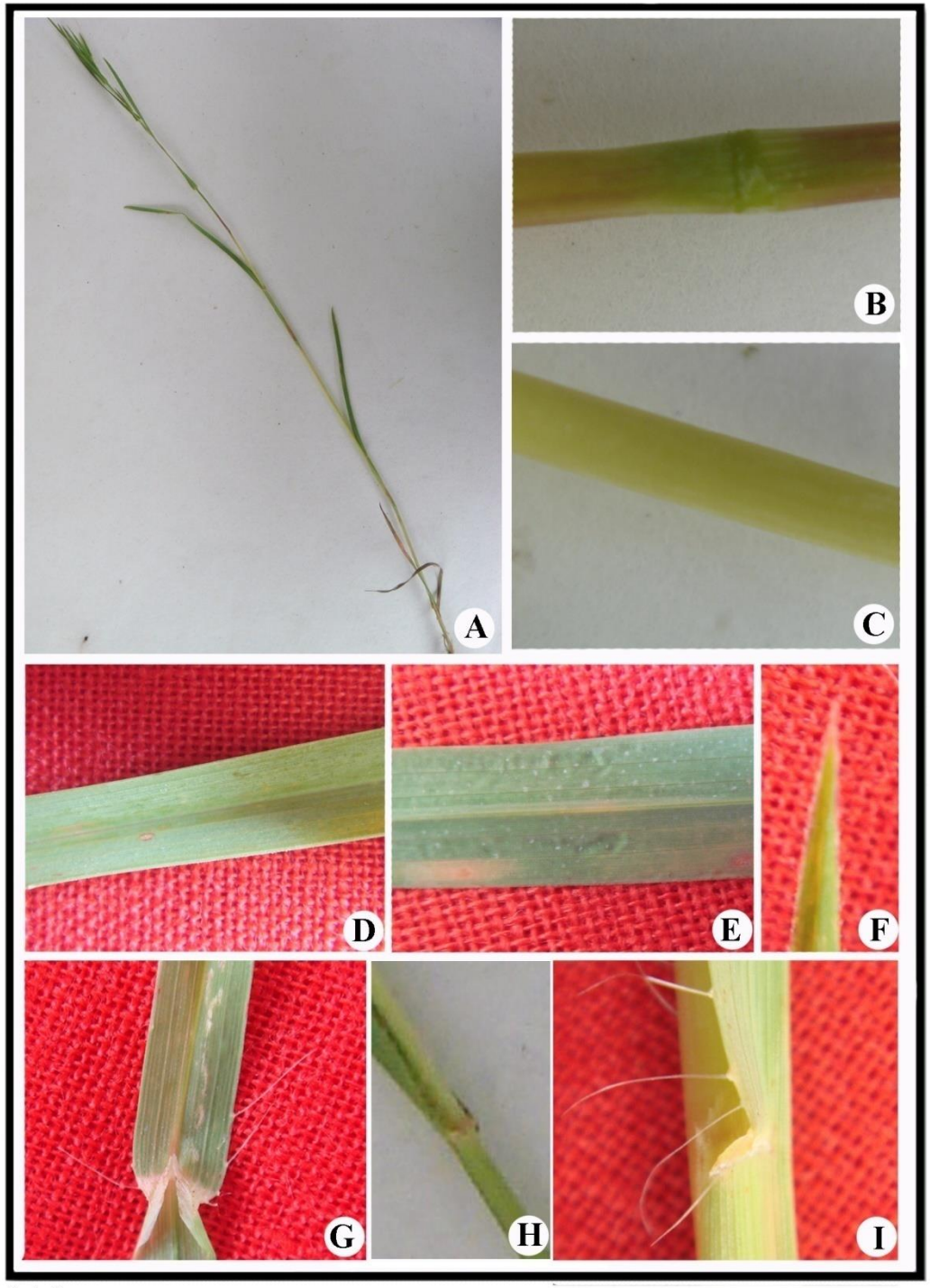


12. *Hackelochloa granularis*

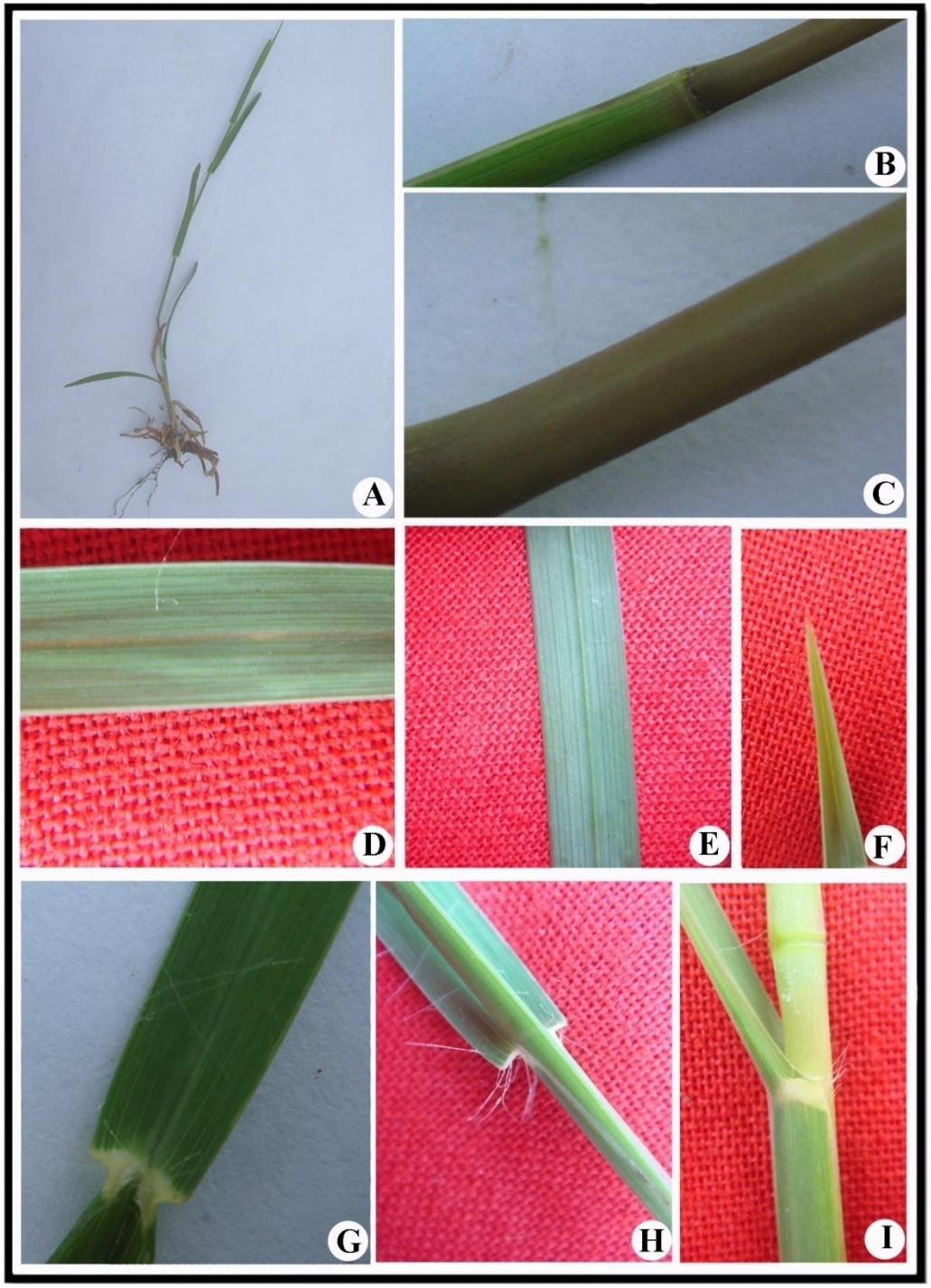


13.

Fig. 112

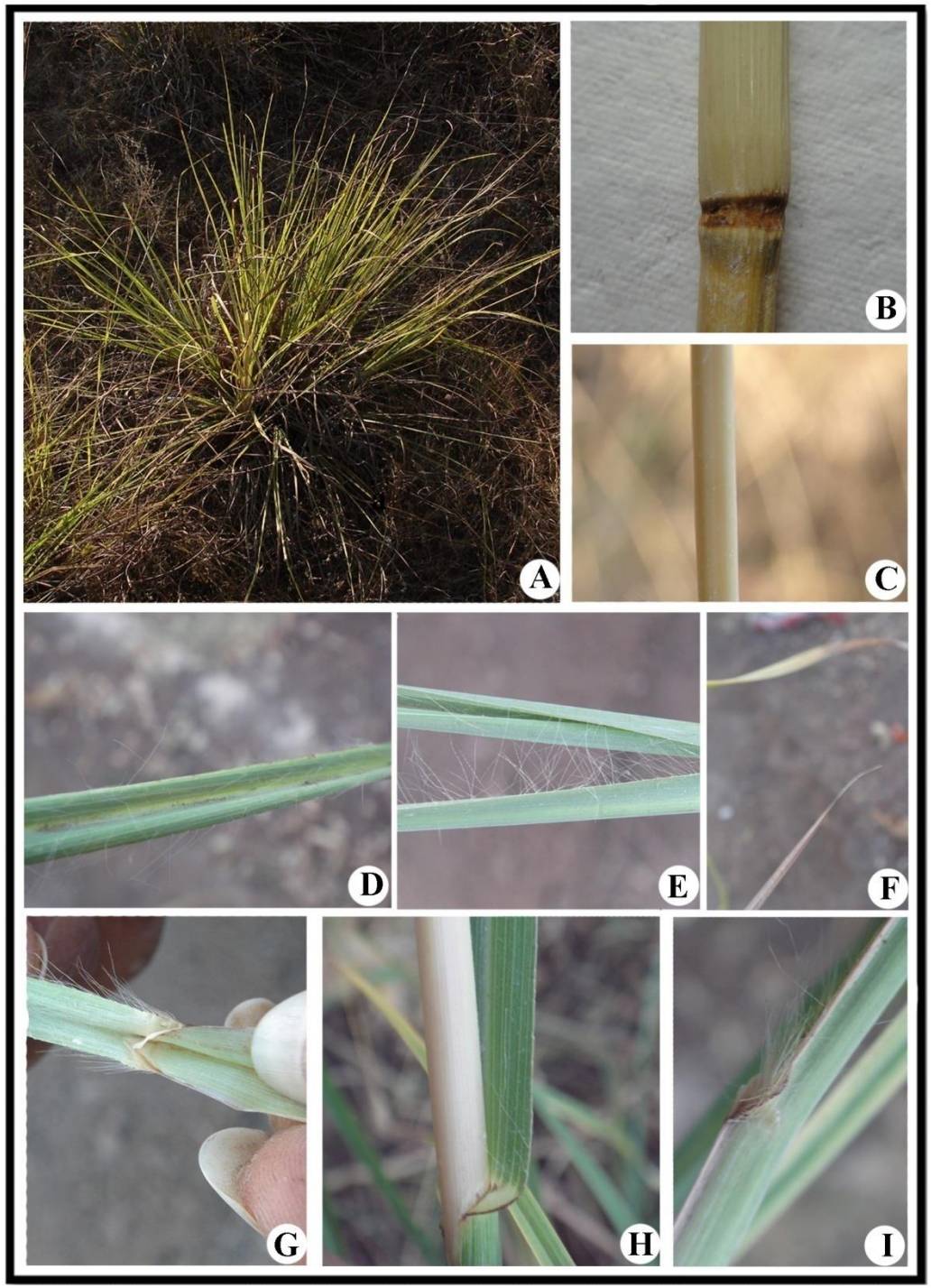


14.

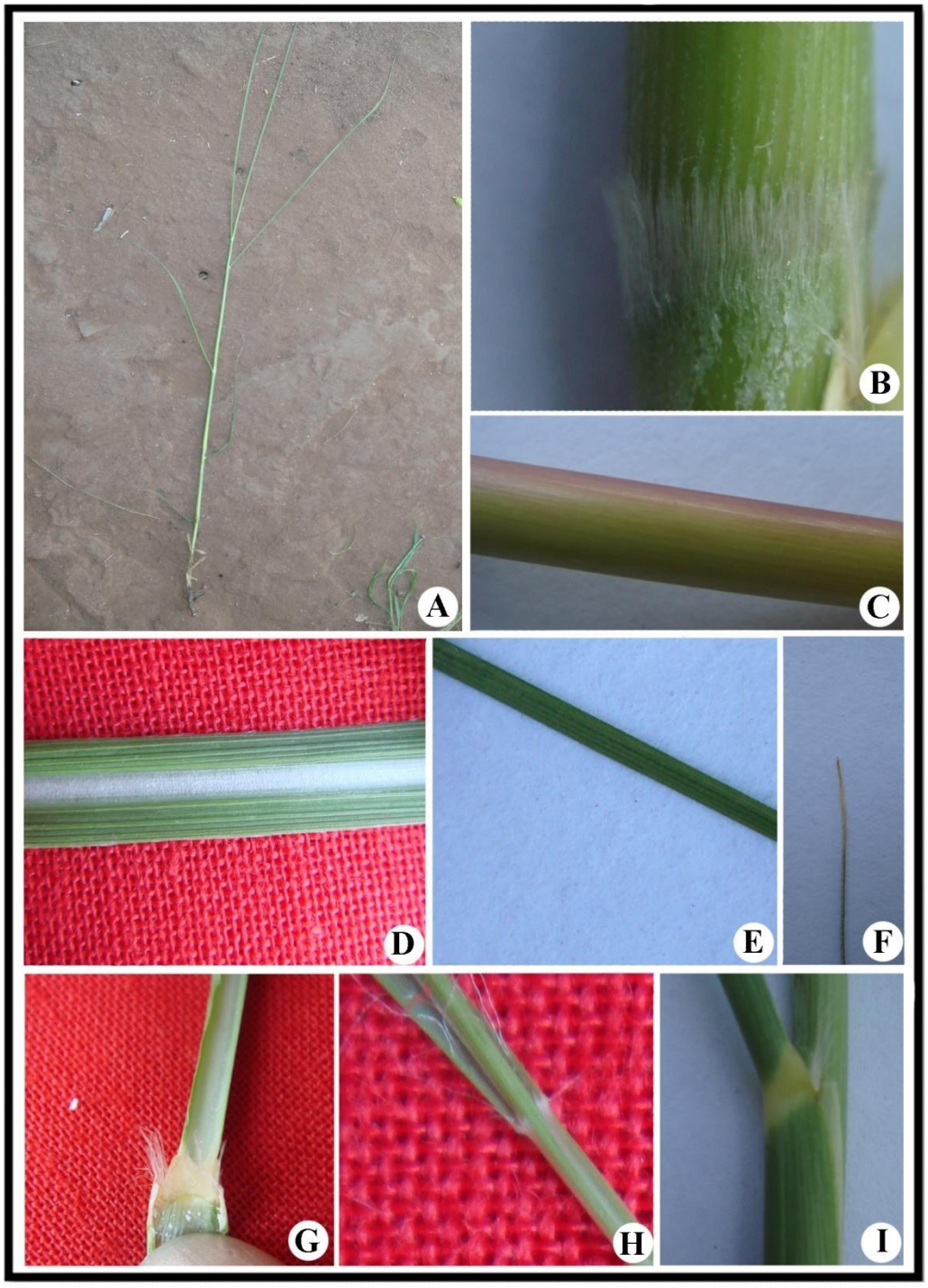


15. *Heteropogon ritchiei*

Fig. 113

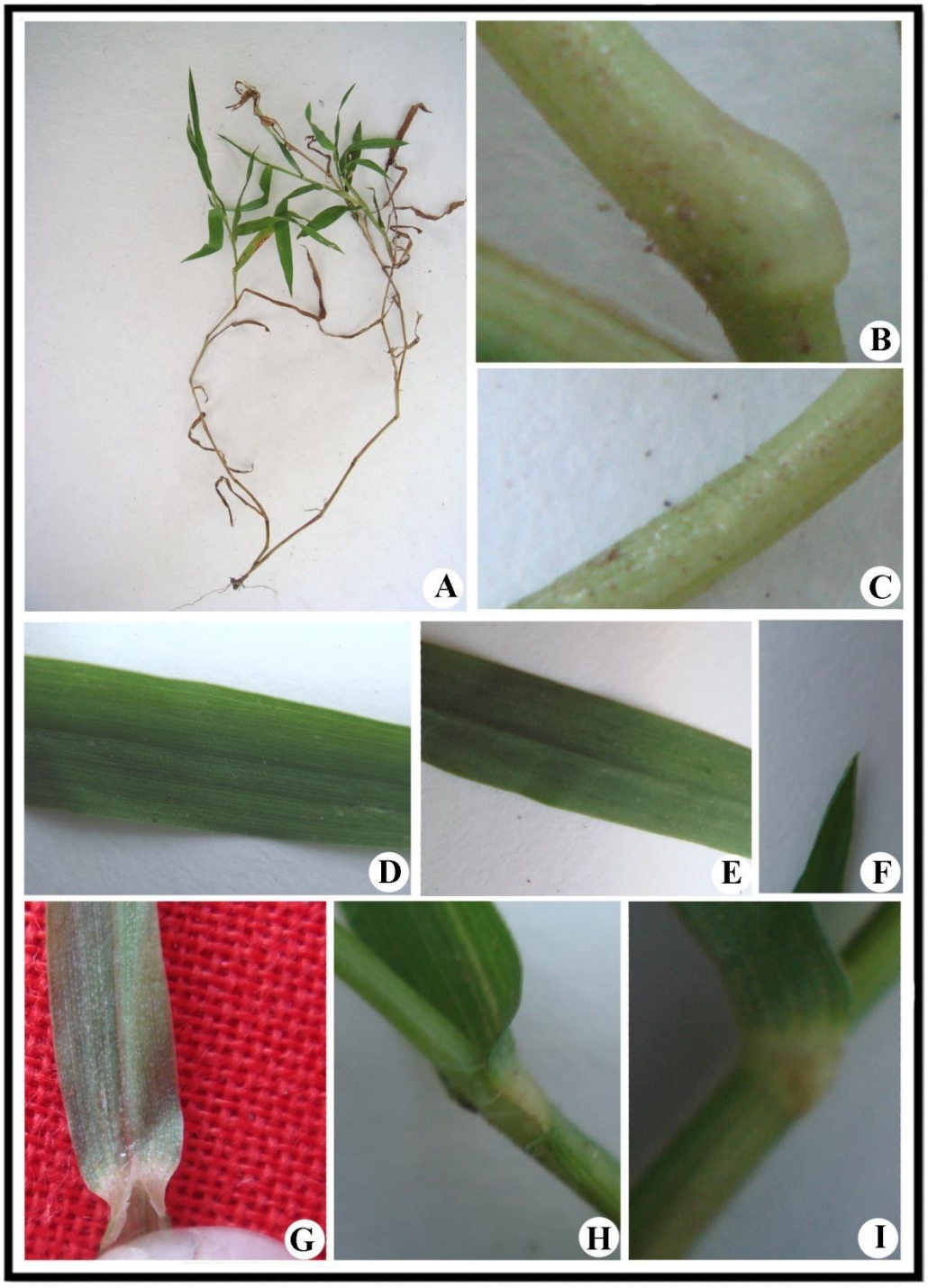


16. *Heteropogon triticeus*

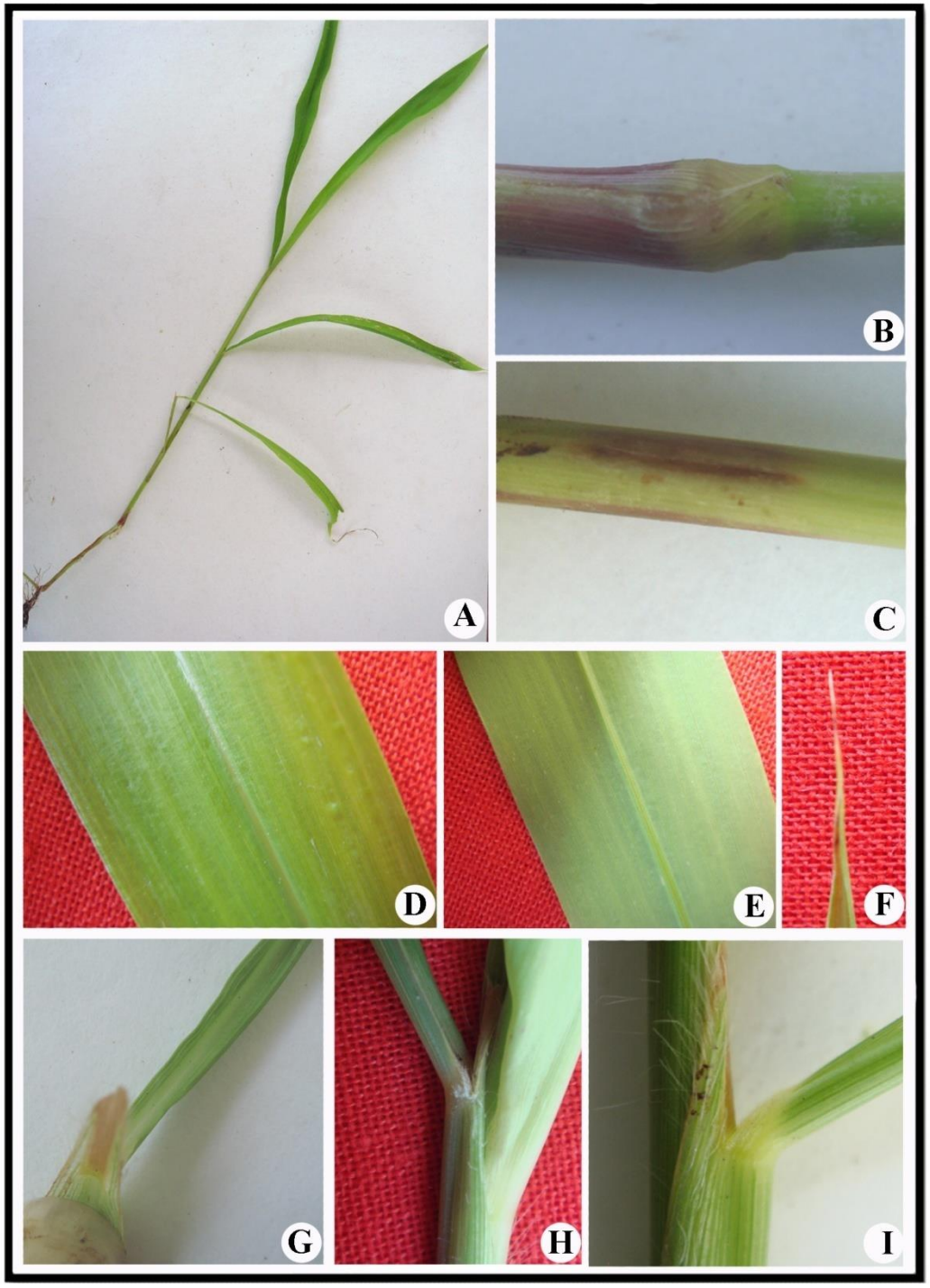


17. *Imperata cylindrica*

Fig. 114

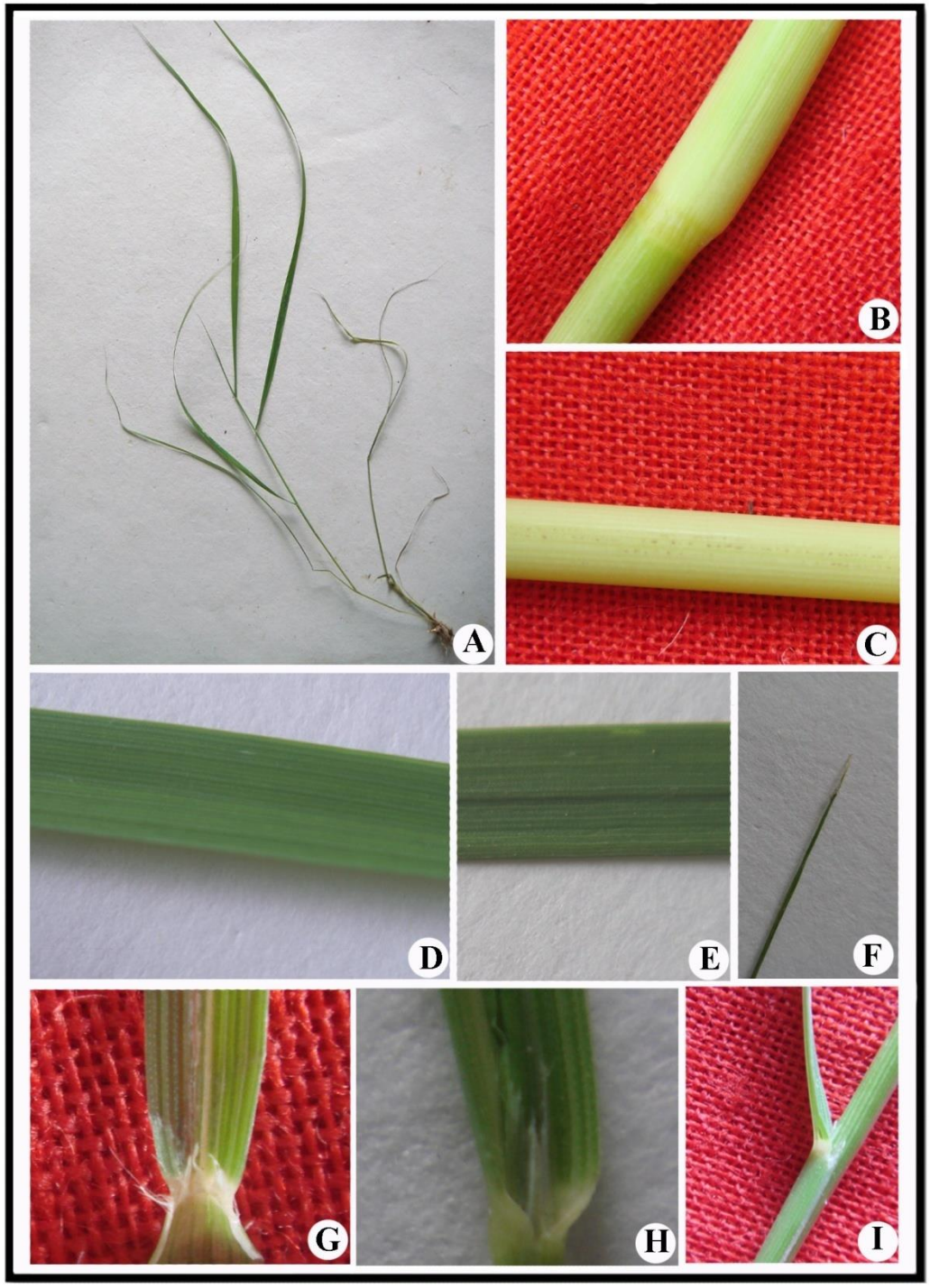


18. *Ischaemum indicum*

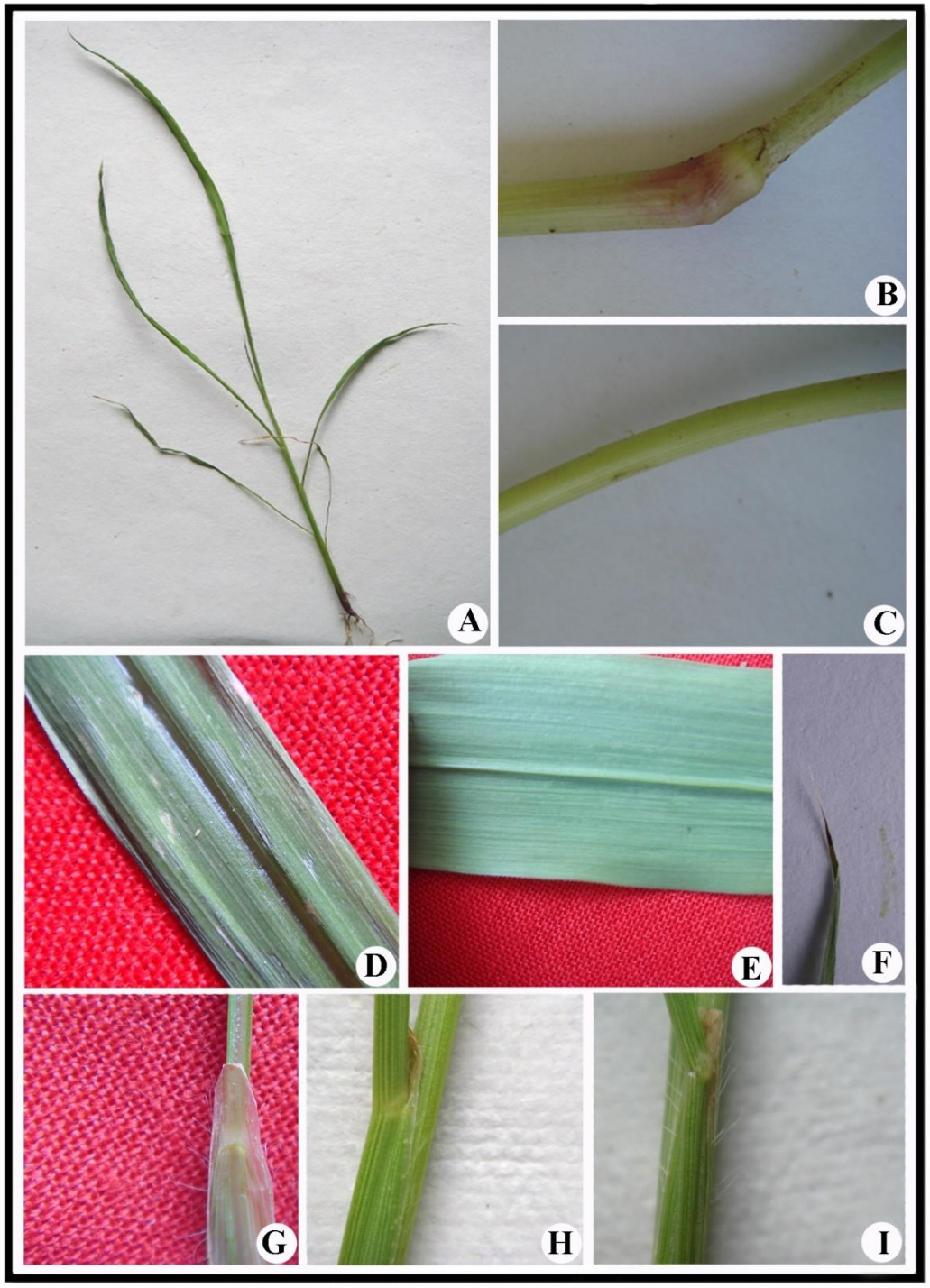


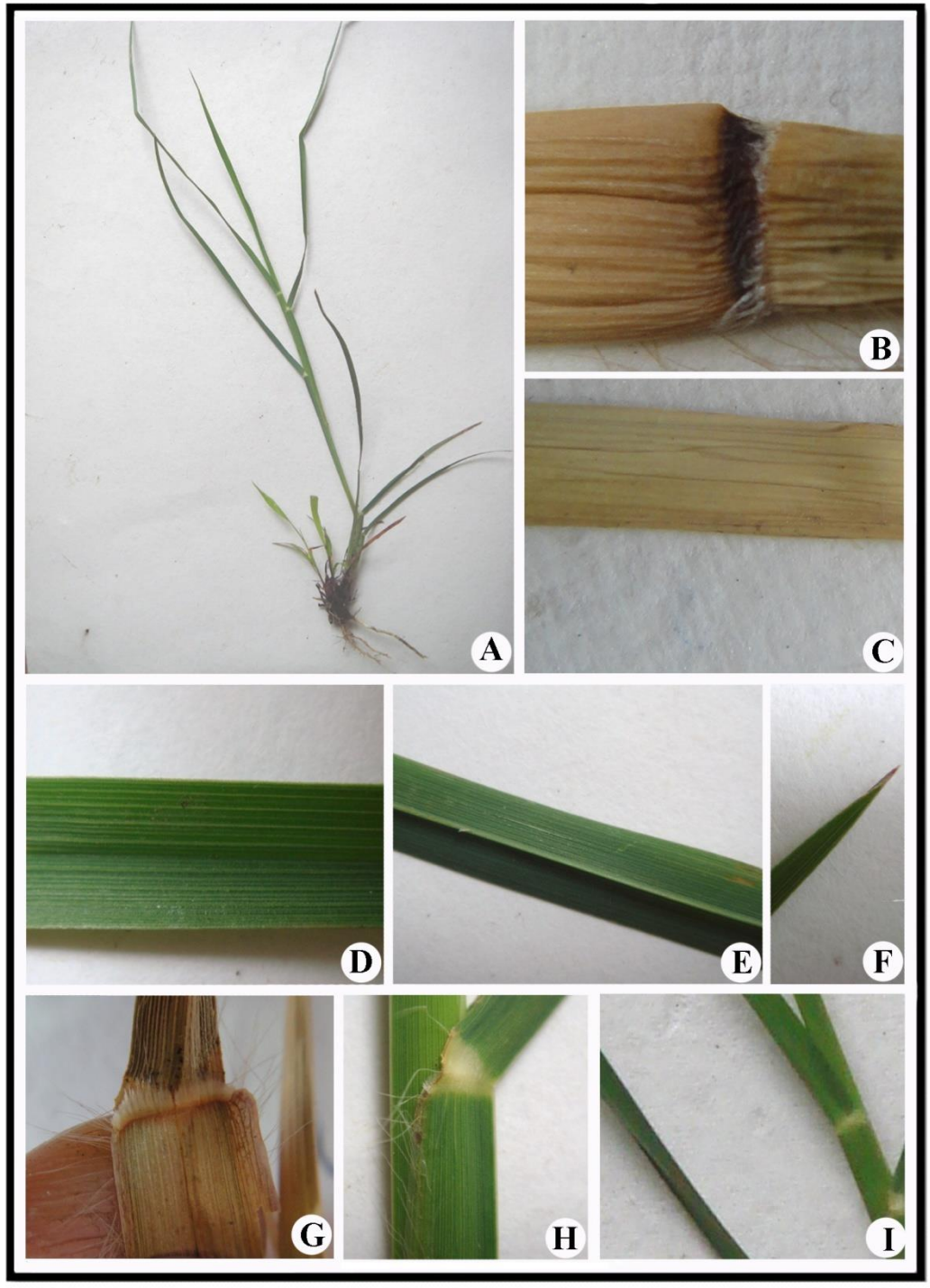
19. *Ischaemum molle*

Fig. 115

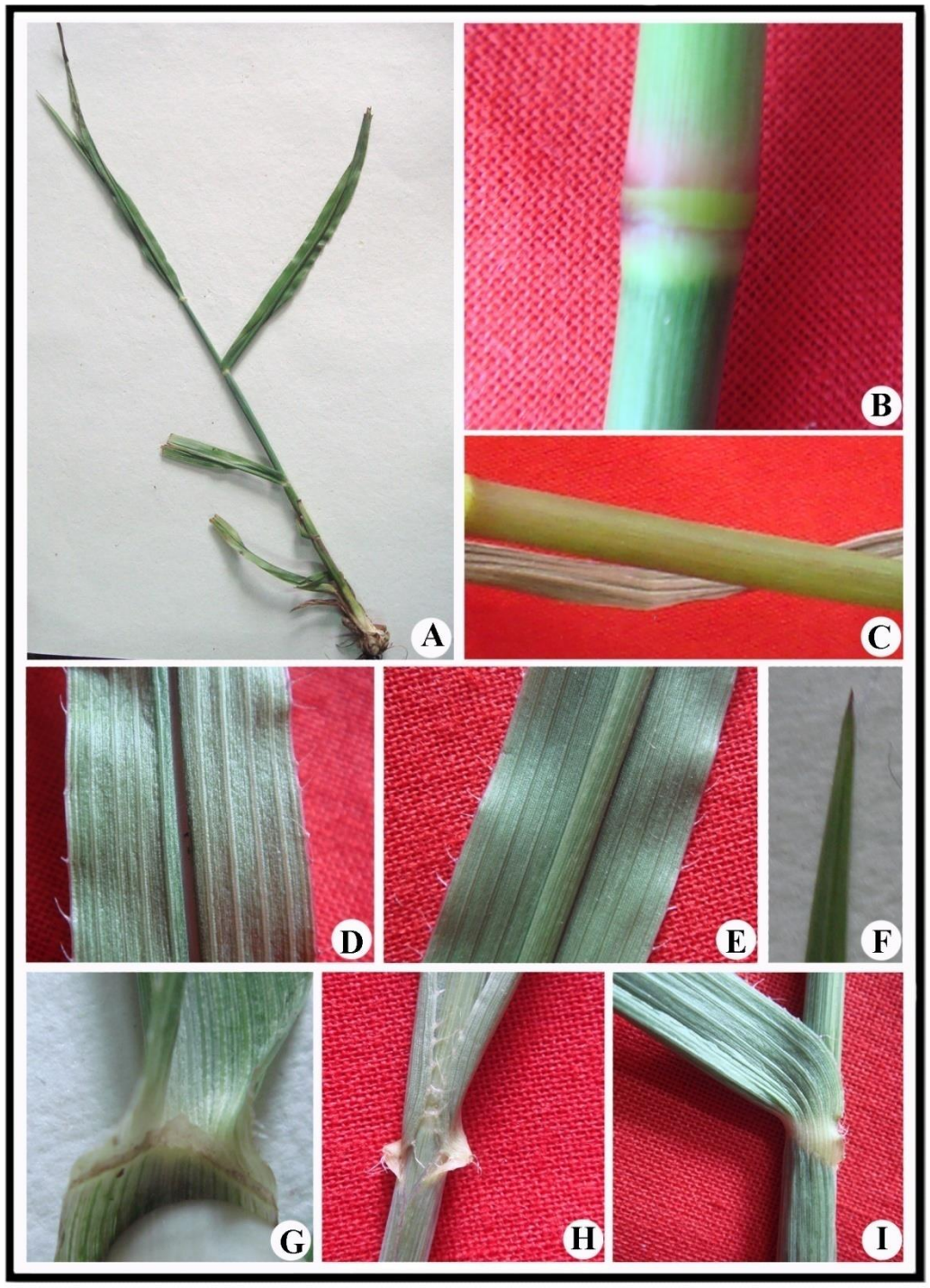


20. *Ischaemum pilosum*



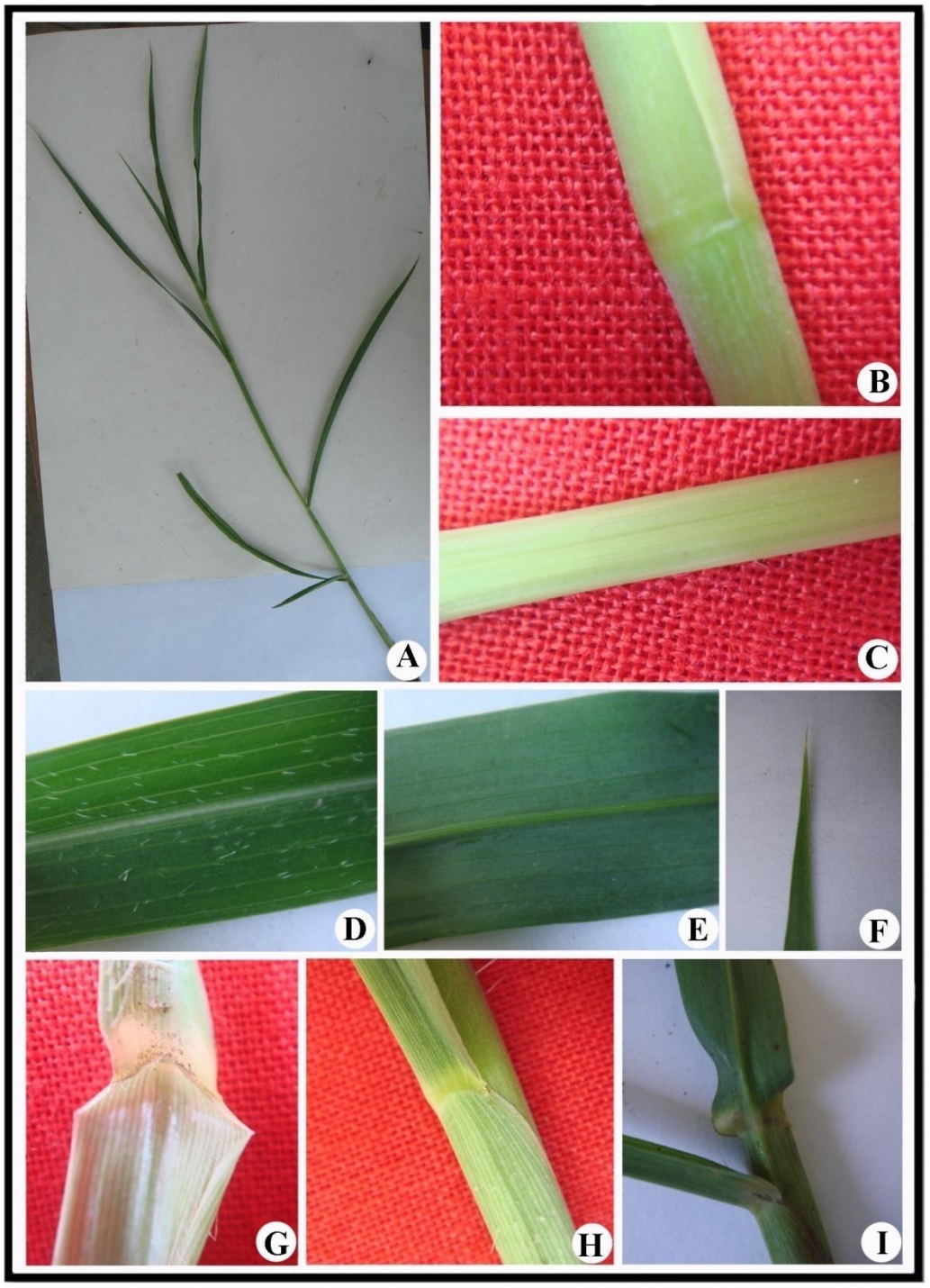


21. *Ischaemum rugosum* **Fig. 116** **22. *Iseilema laxum***

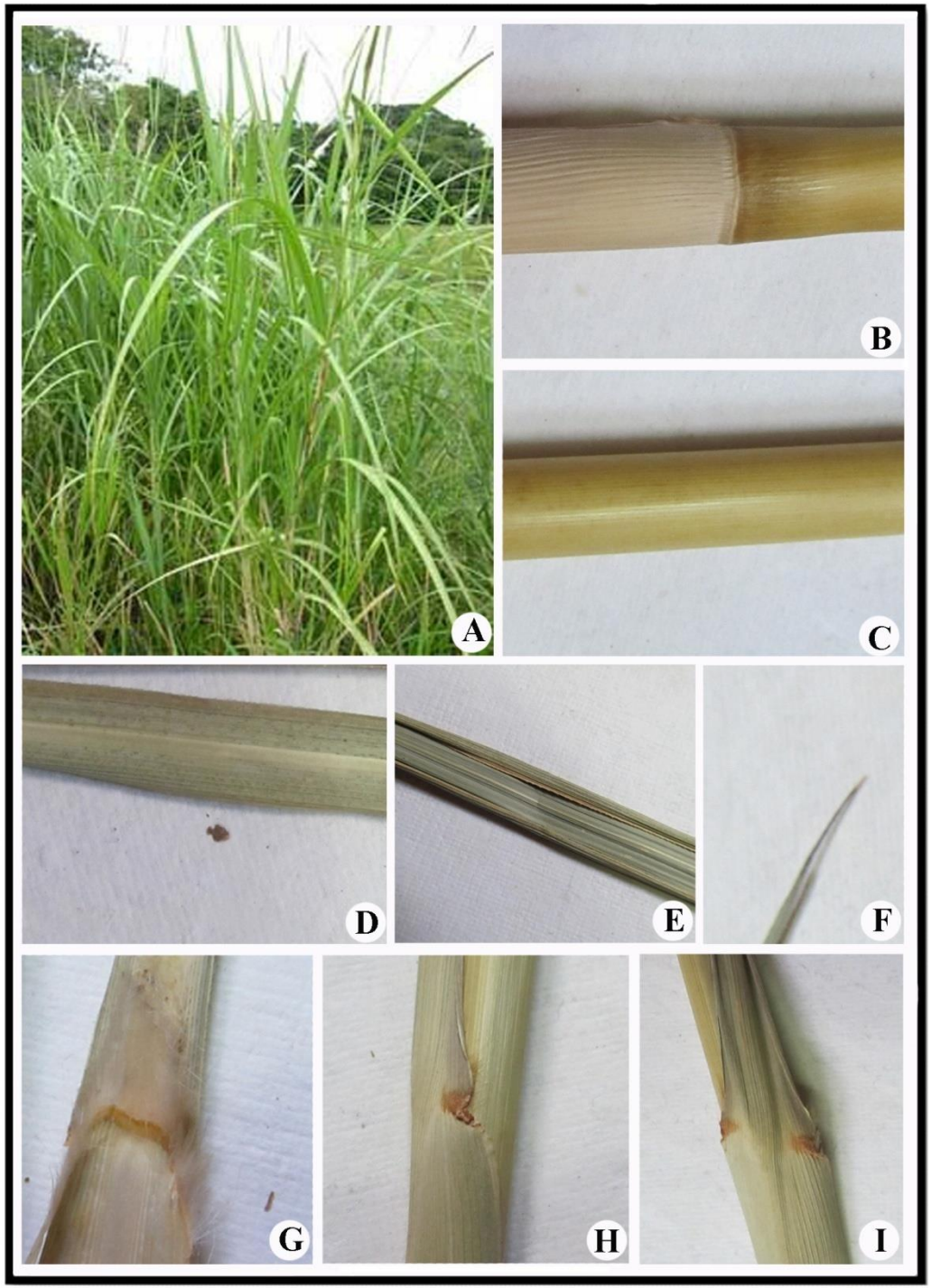


23. *Ophiorus exaltatus*

Fig. 117

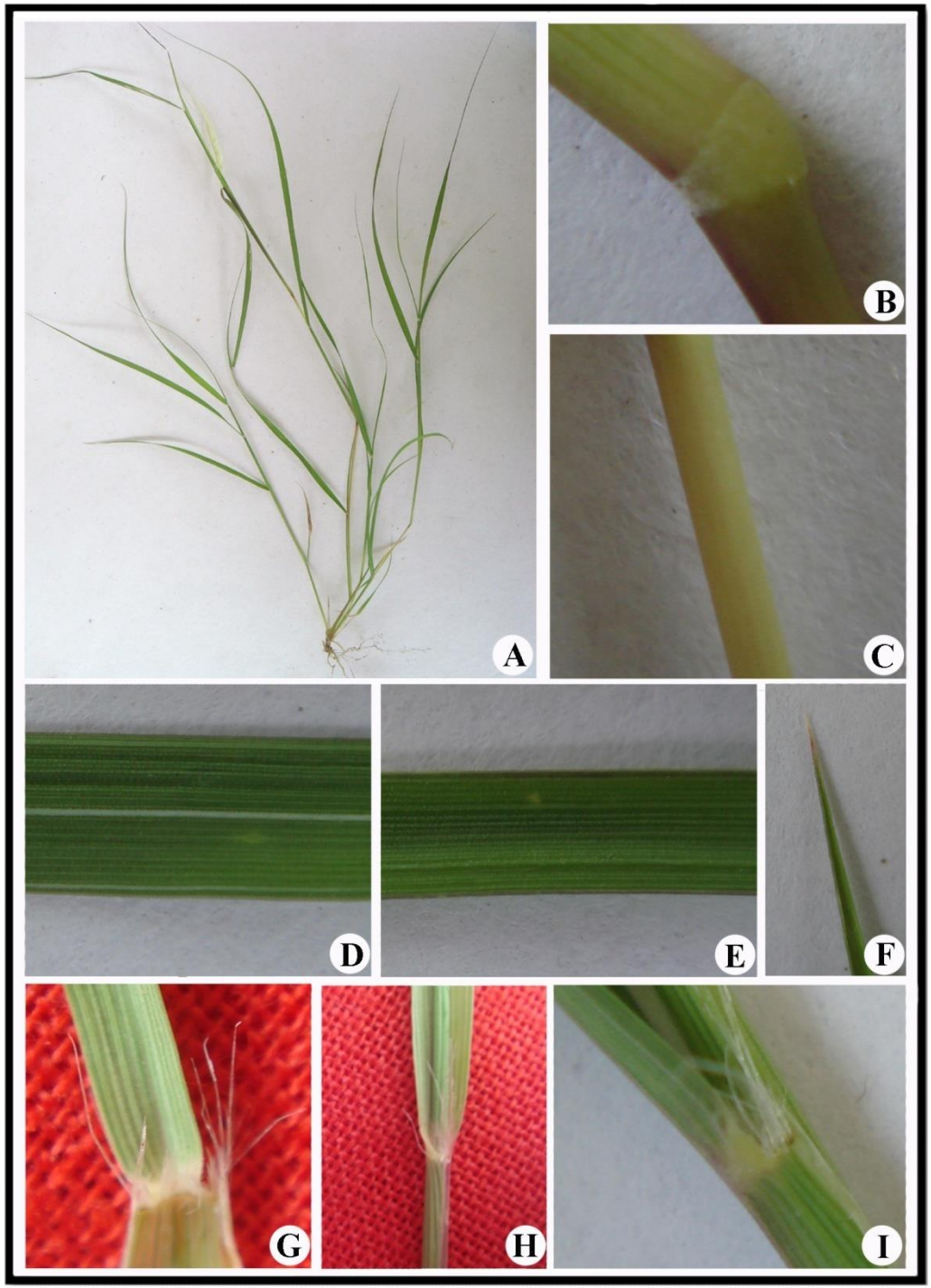


24. *Rottboellia exaltata*

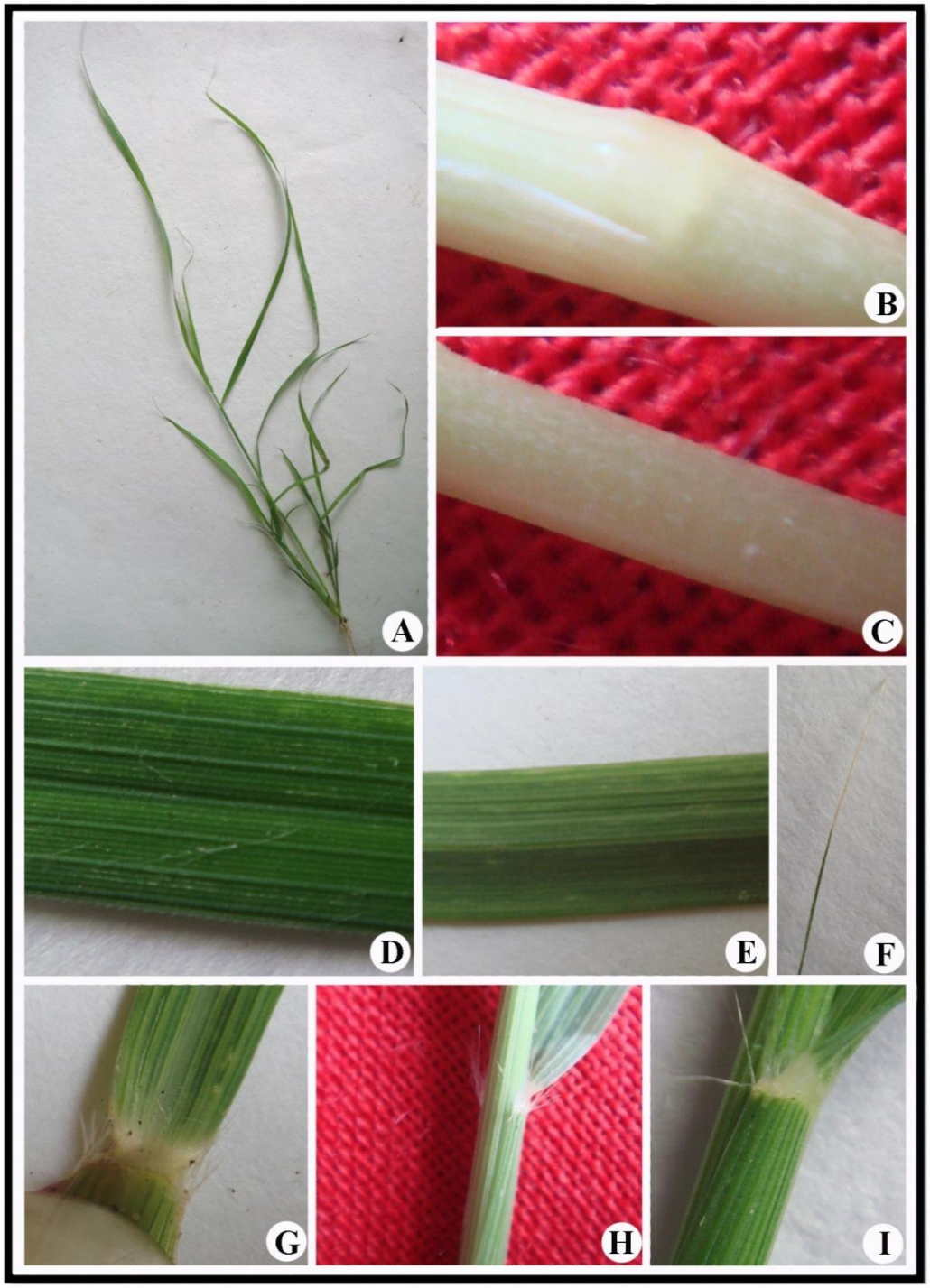


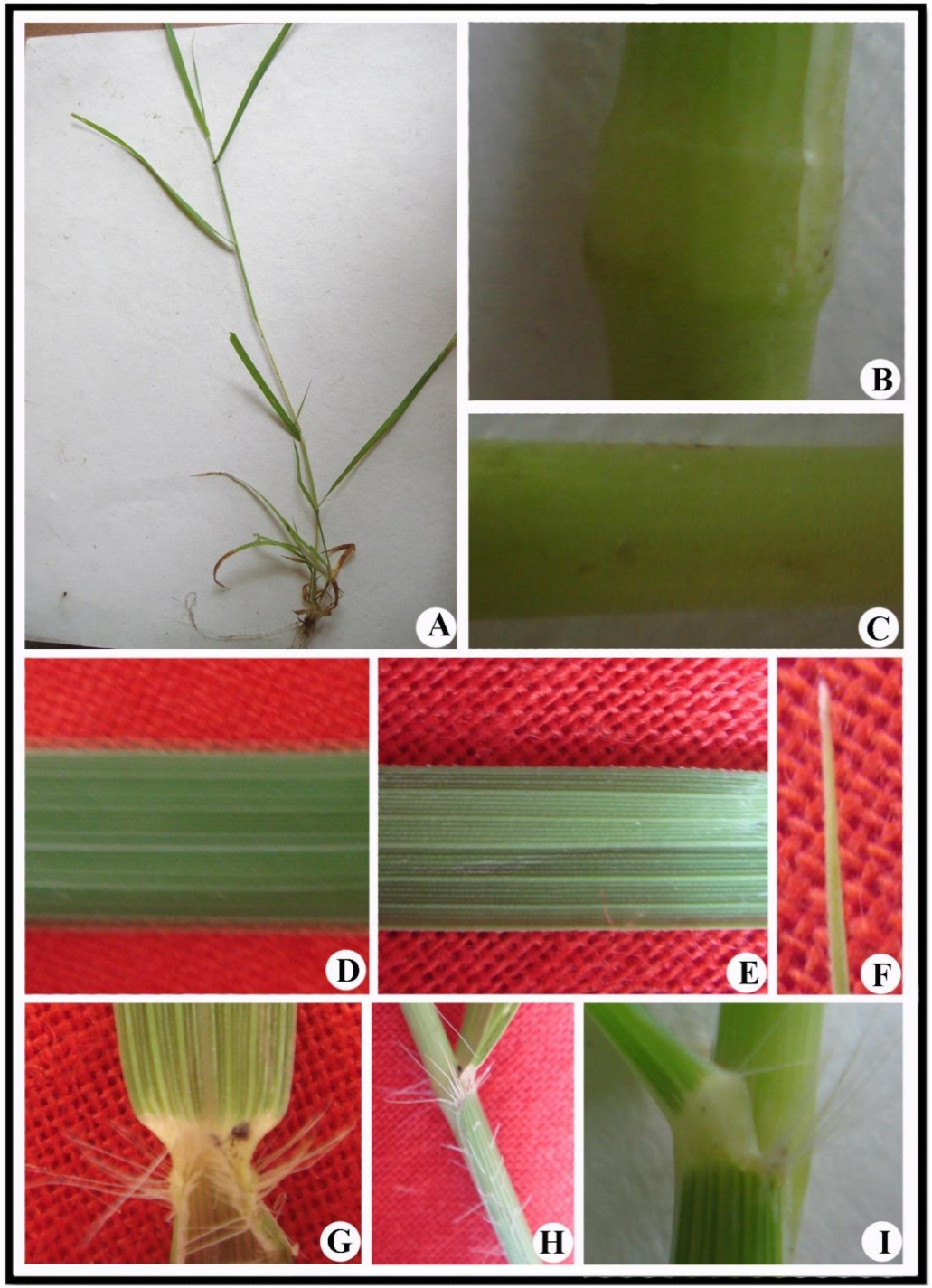
25. *Saccharum spontaneum*

Fig. 118



26. *Sehima ischaemoides*

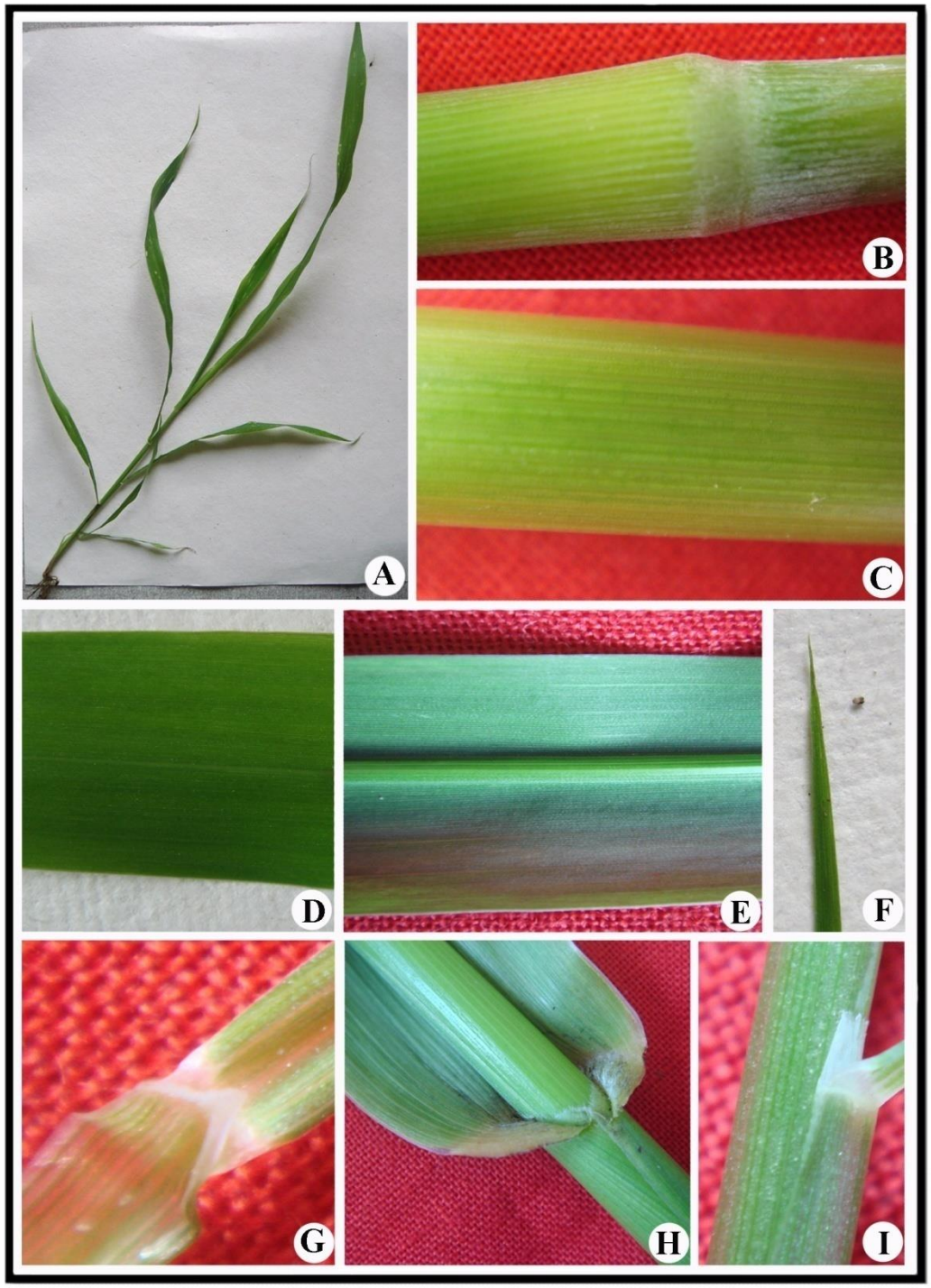




27. *Sehima nervosum*

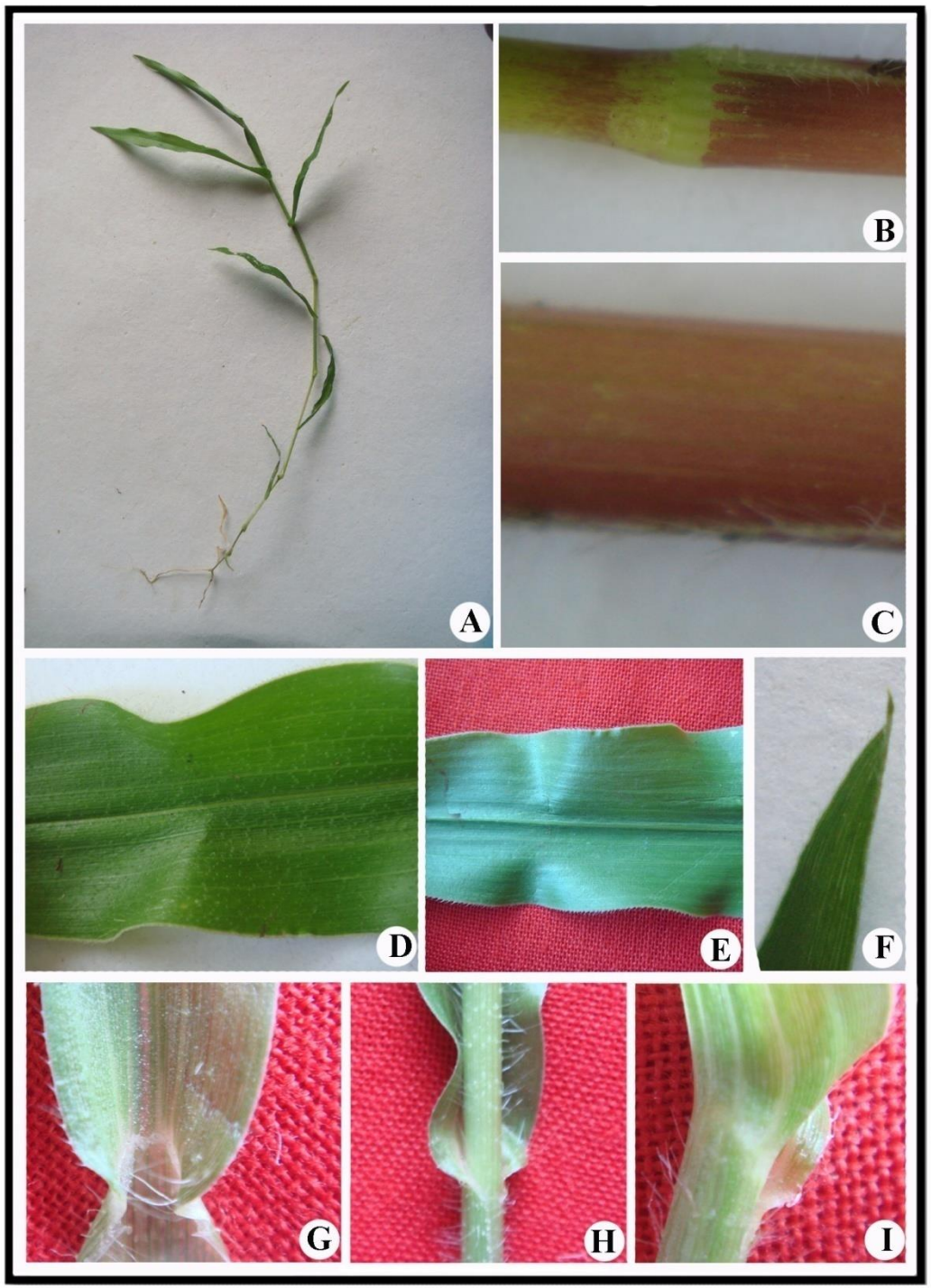
Fig. 119

28. *Sehima sulcatum*

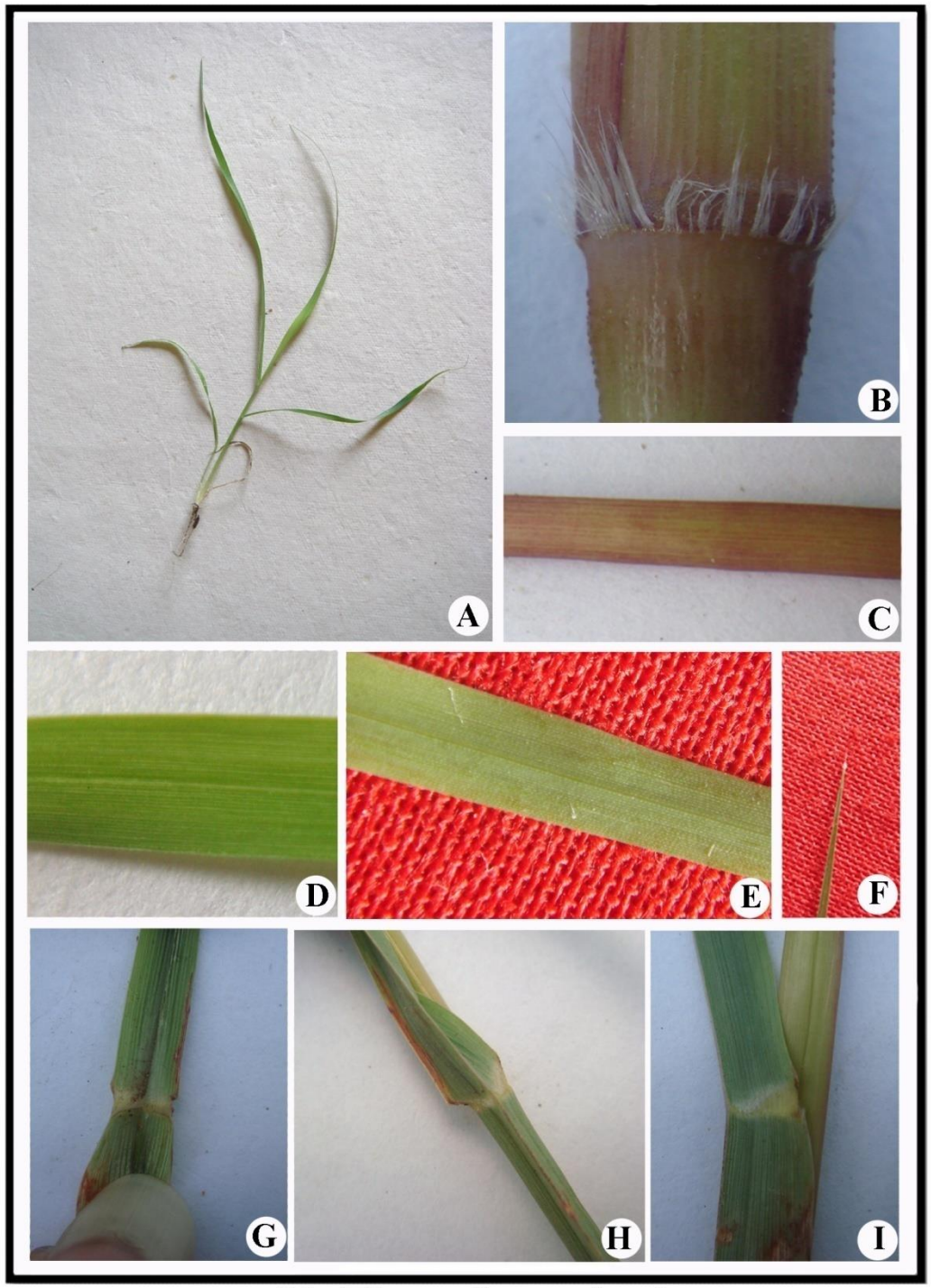


29. *Sorghum halepense*

Fig. 120

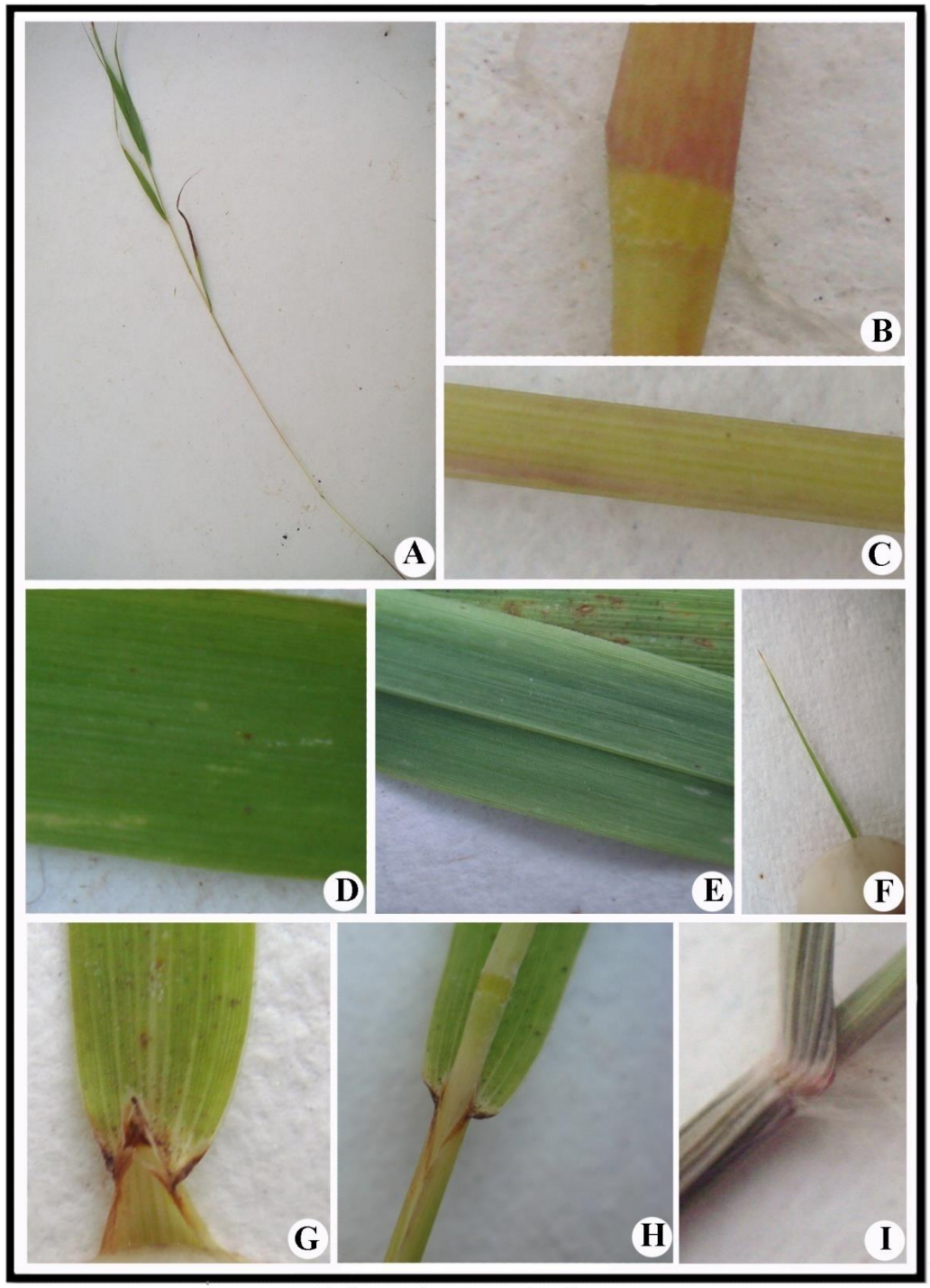


30. *Thelepogon elegans*

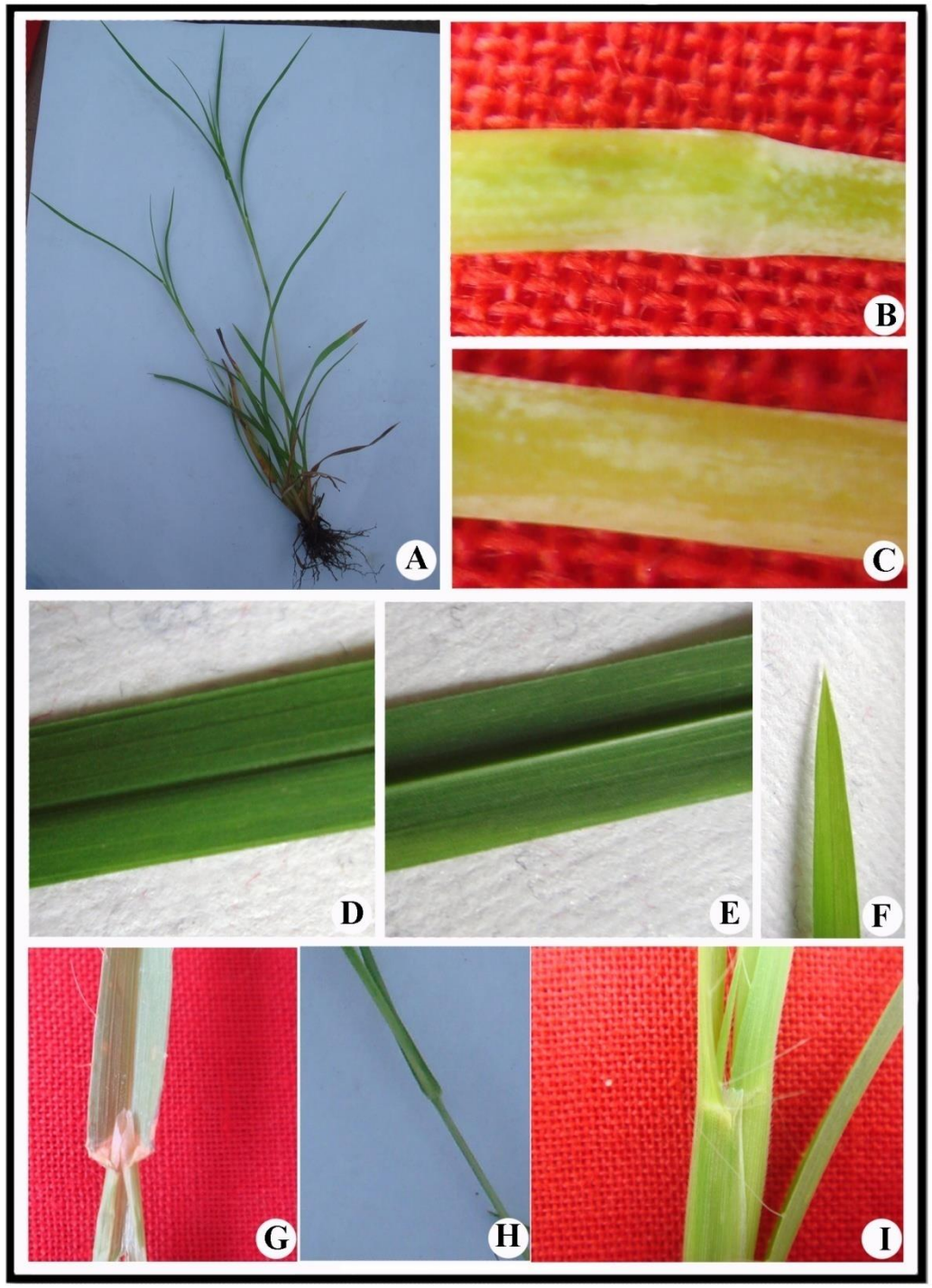


31. *Themeda cymbaria*

Fig. 121

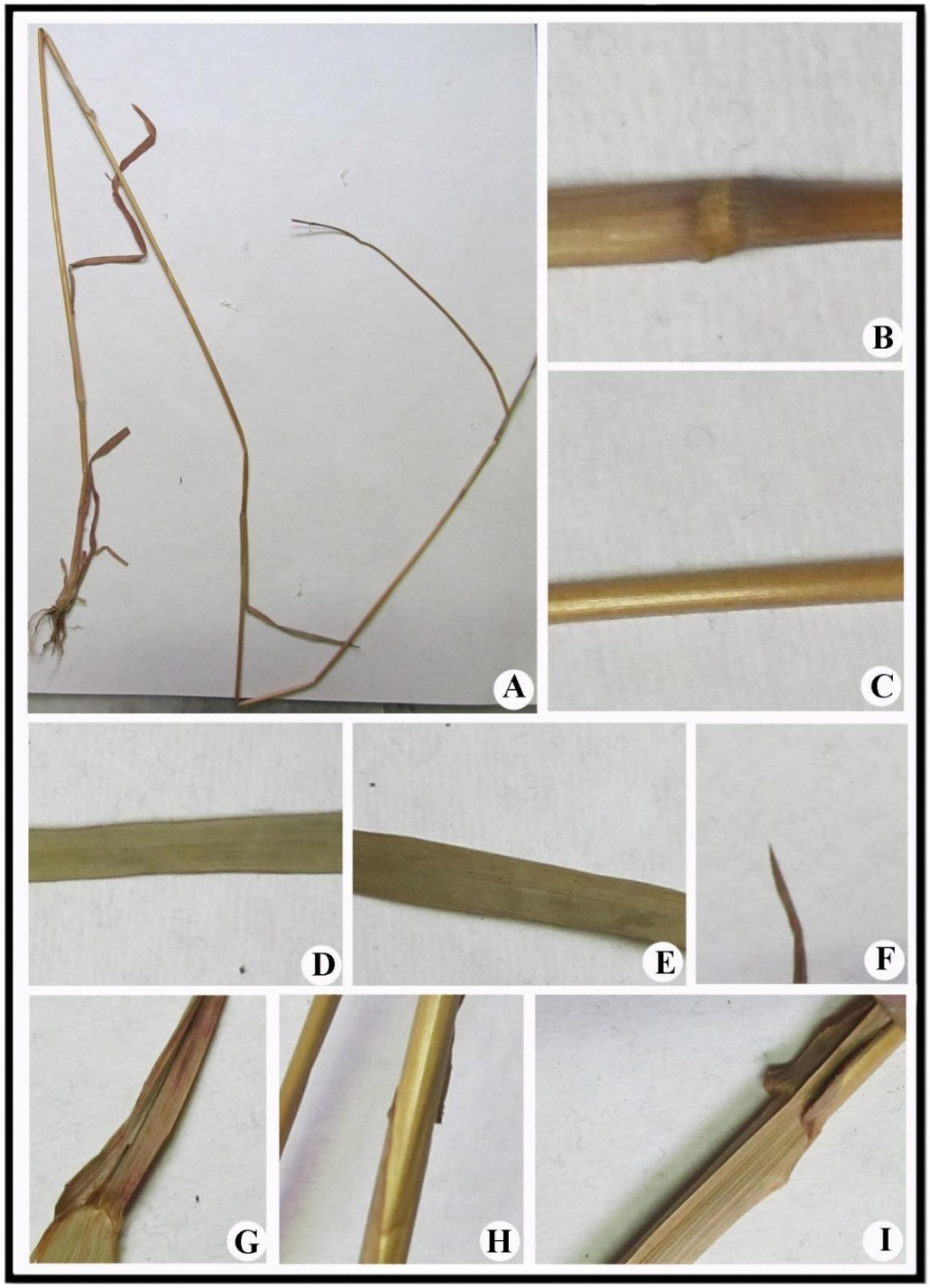


32. *Themeda laxa*

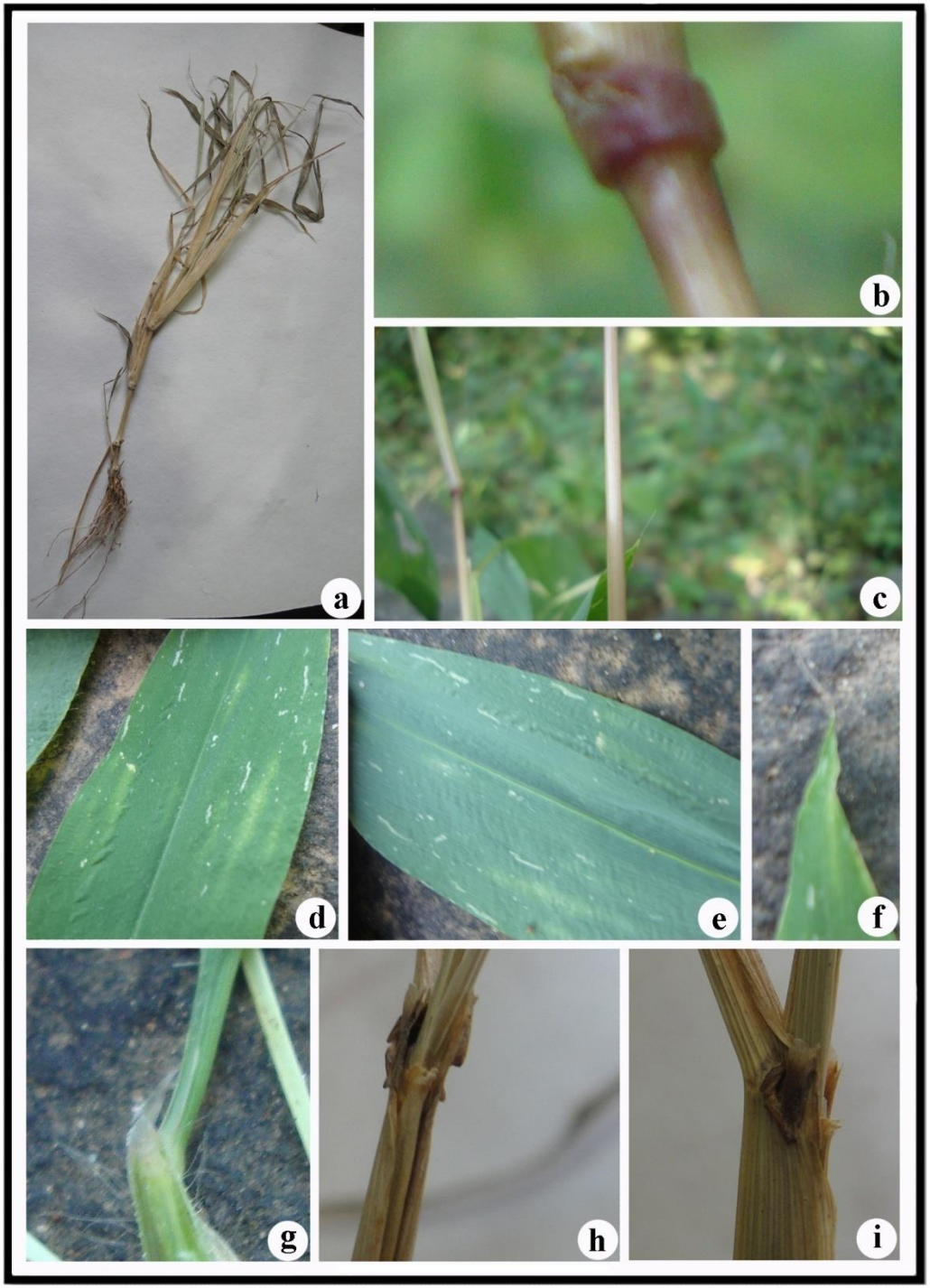


33. *Themeda triandra*

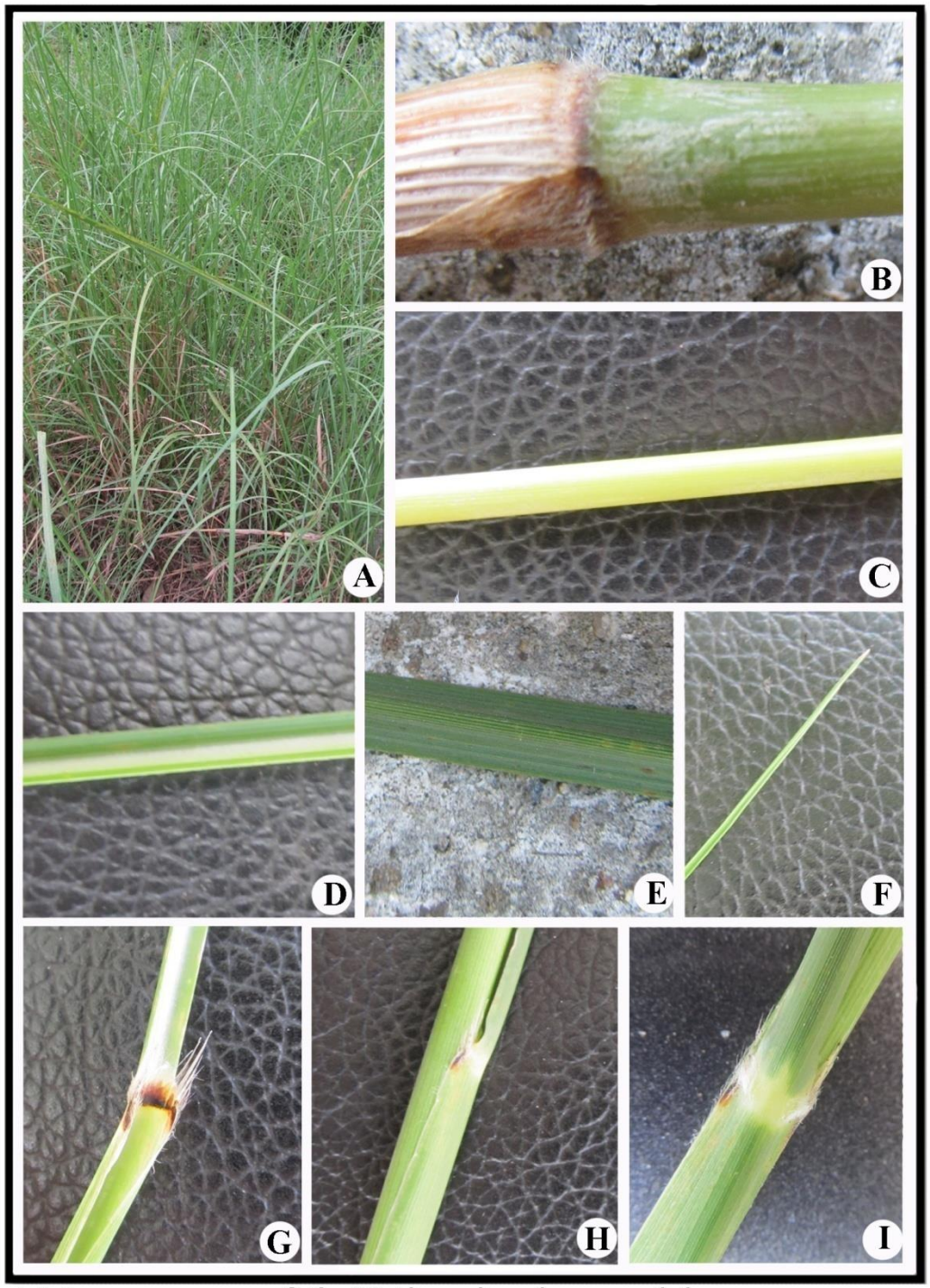
Fig. 122



34. *Themeda quadrivalvis*

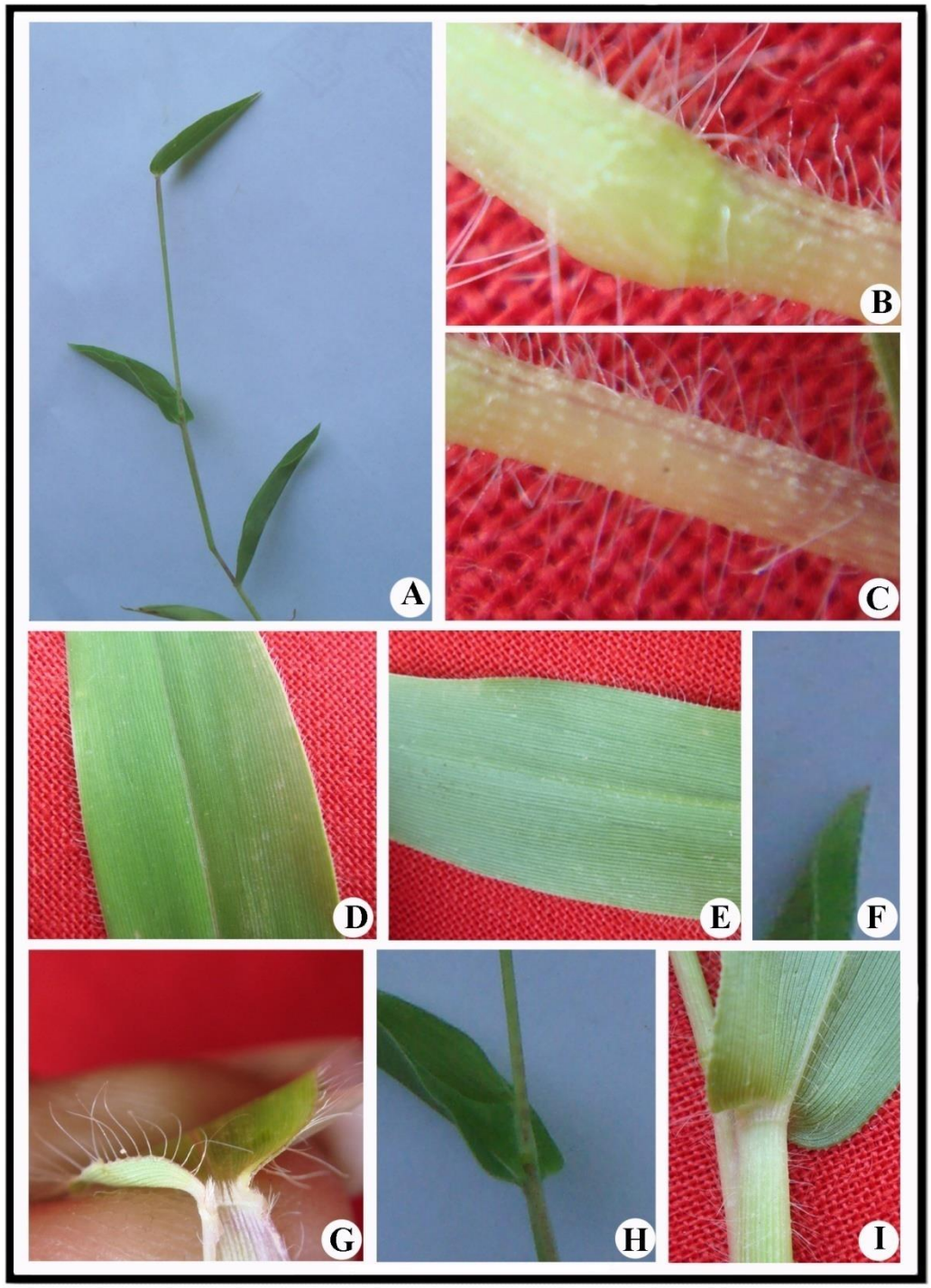


35. *Triplopogon ramosissimus*



36. *Vetivaria zinzanoides*

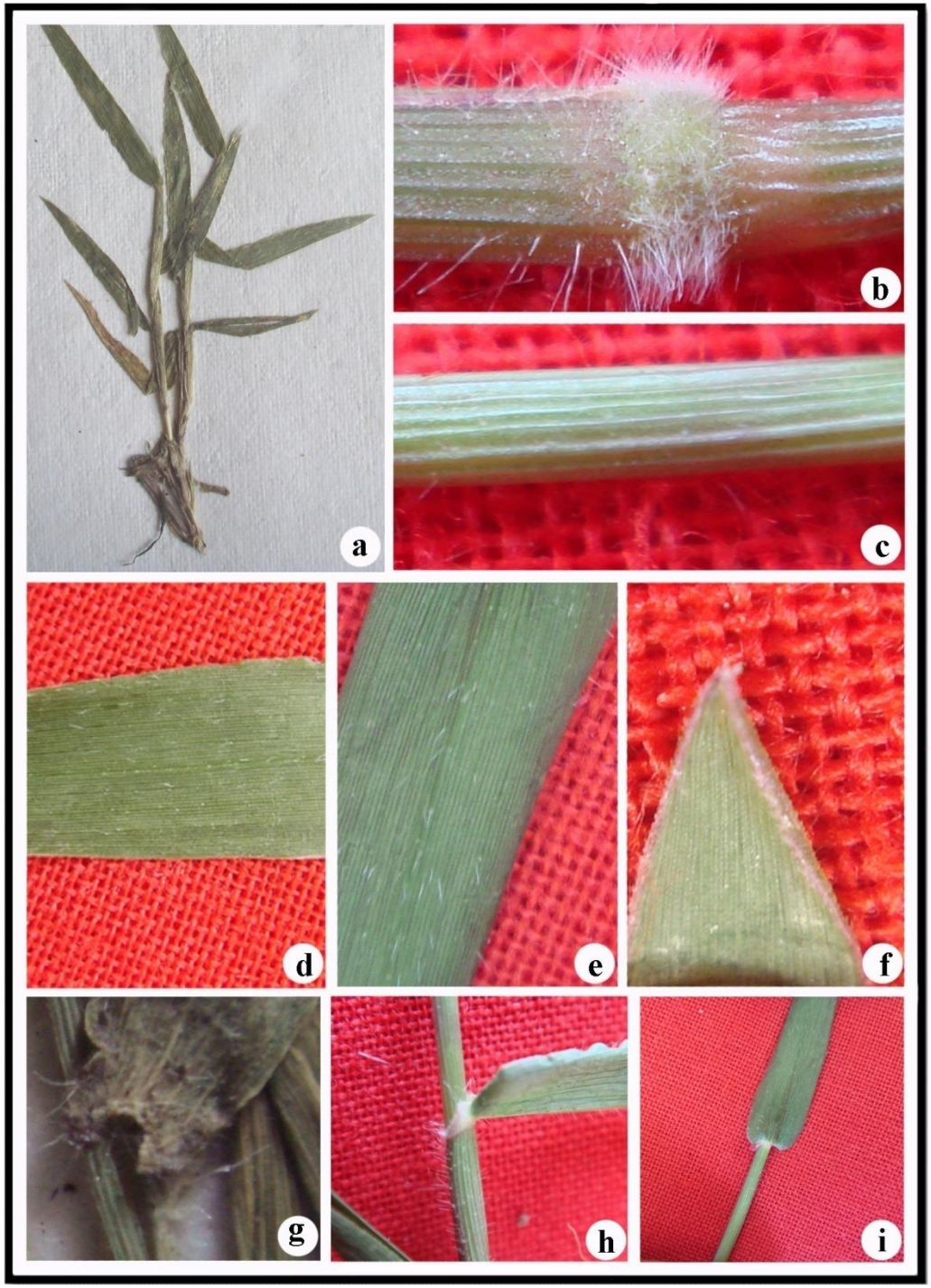
Fig. 123



37. *Alloteropsis cimicina*

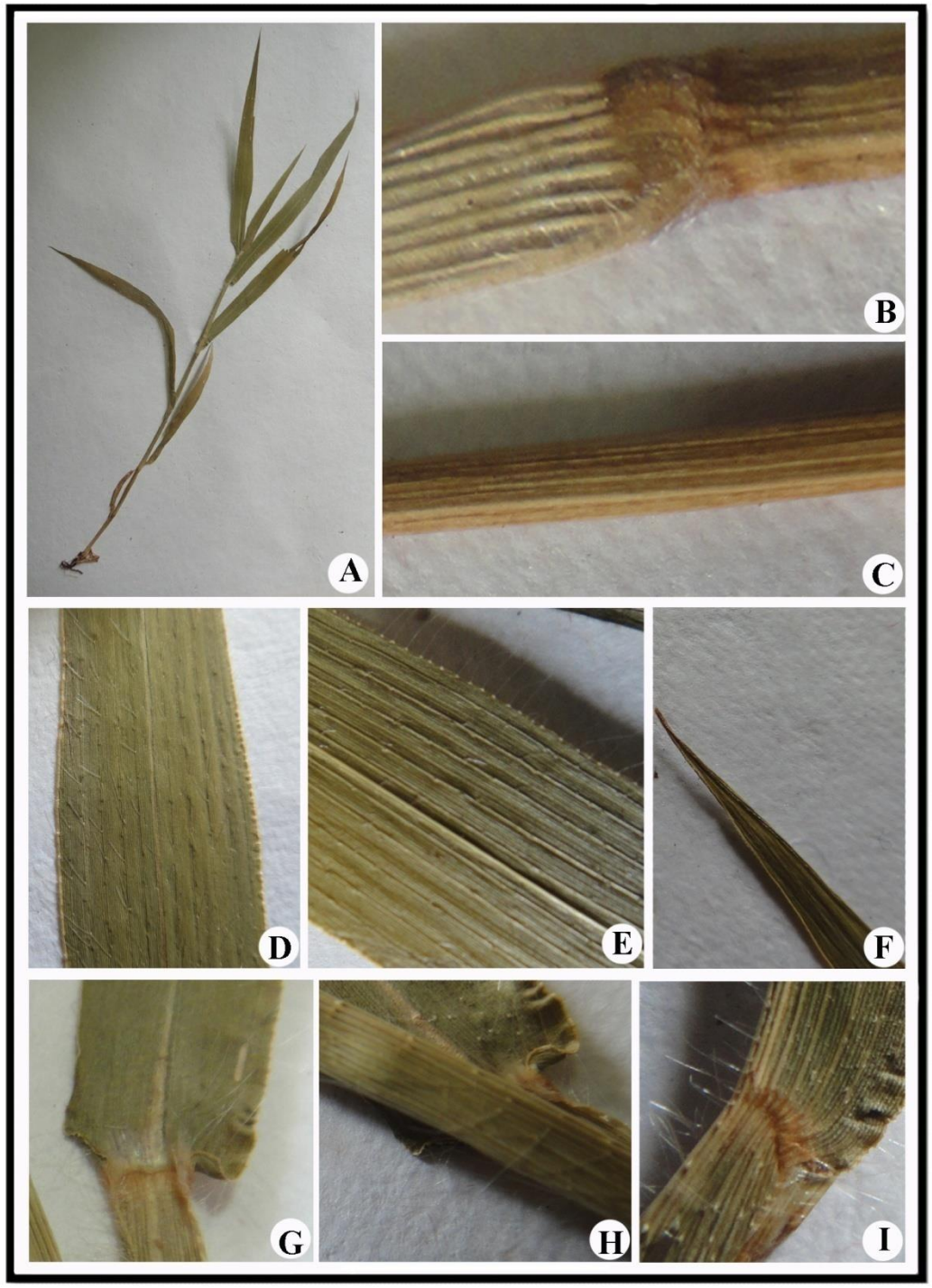
Fig. 124

38. *Brachiaria distachya*

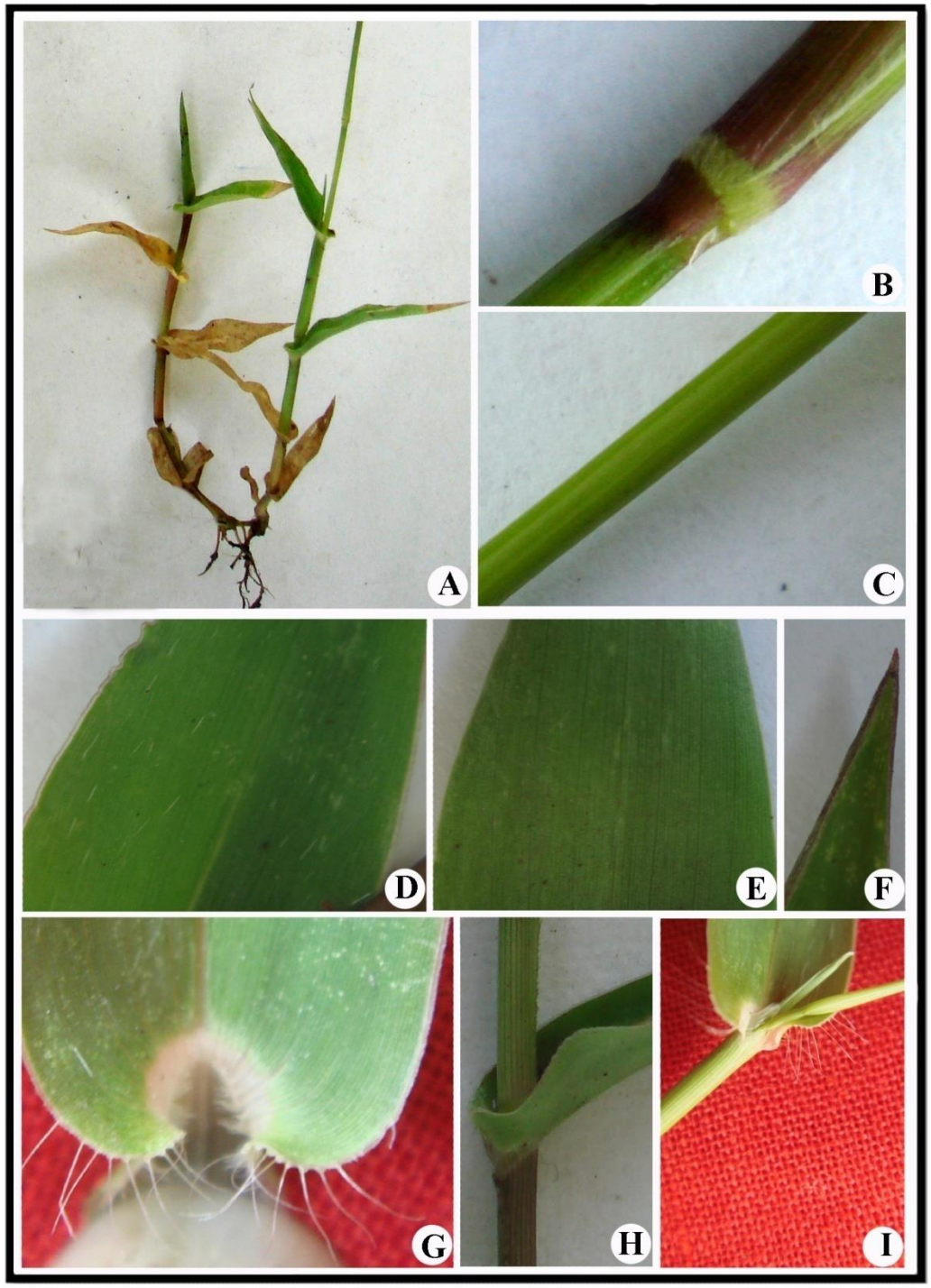


39. *Brachiaria eruciformis*

Fig. 125

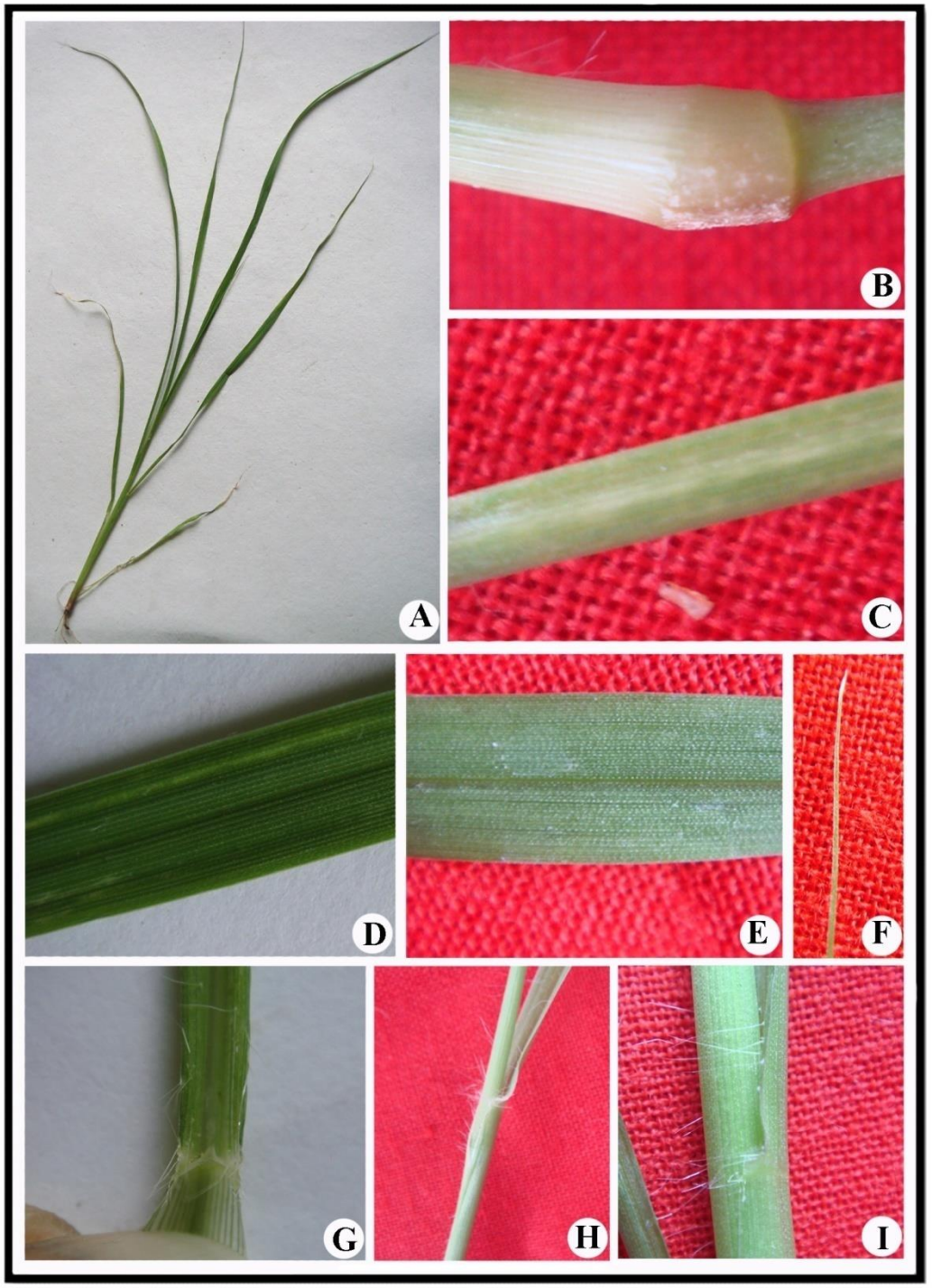


40. *Brachiaria ramosa*

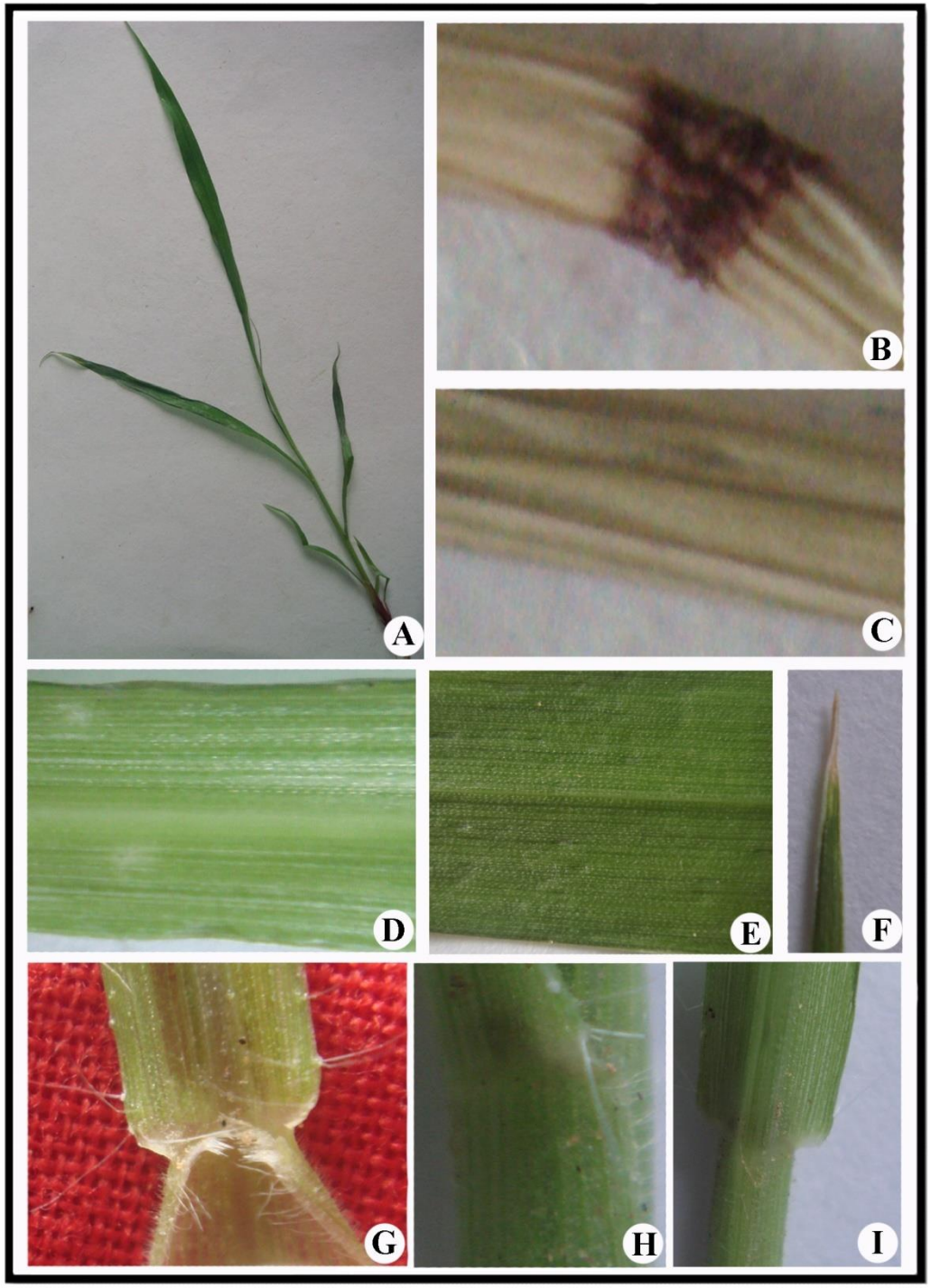


41. *Brachiaria reptans*

Fig. 126

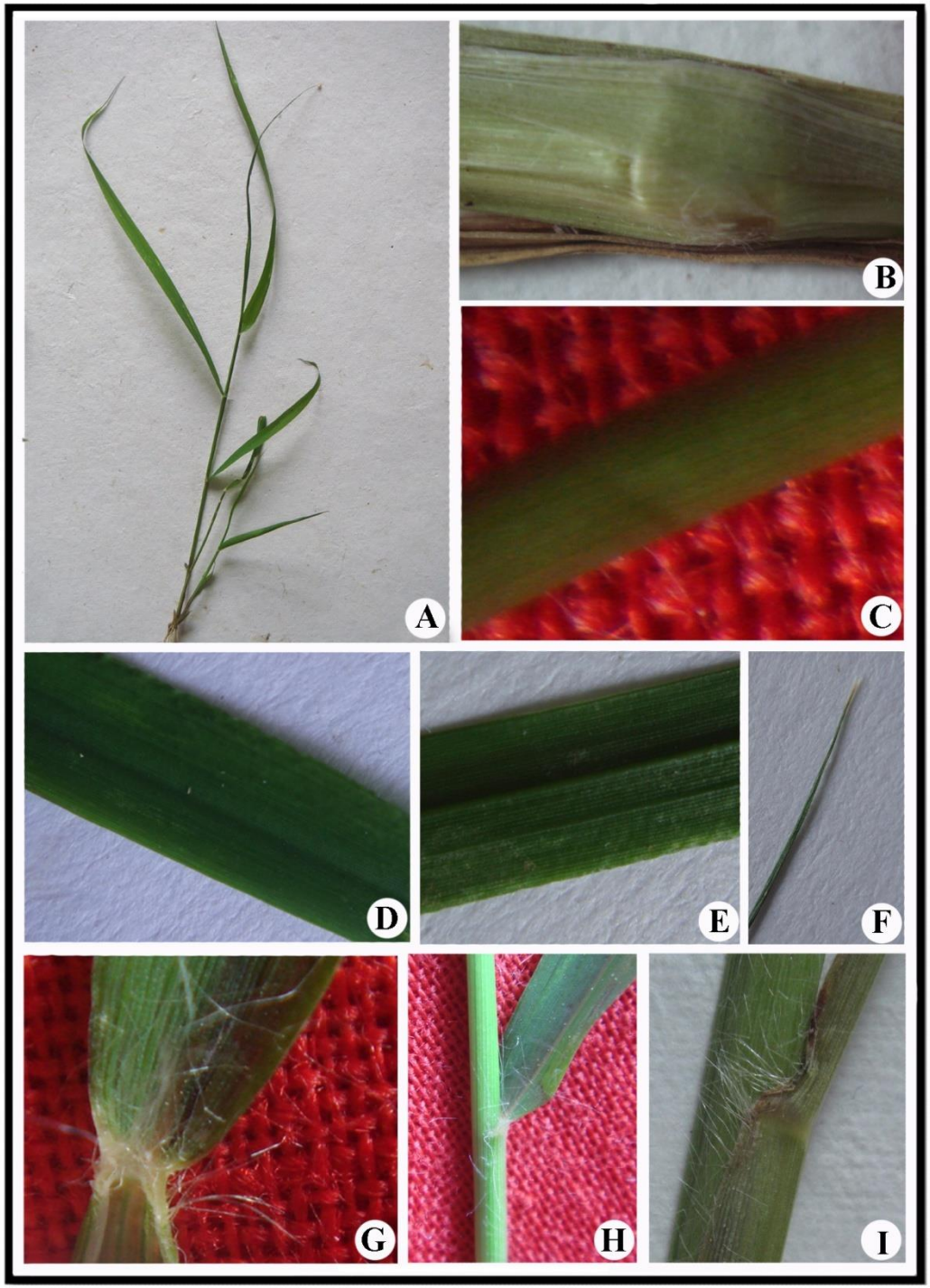


42. *Cenchrus biflorus*

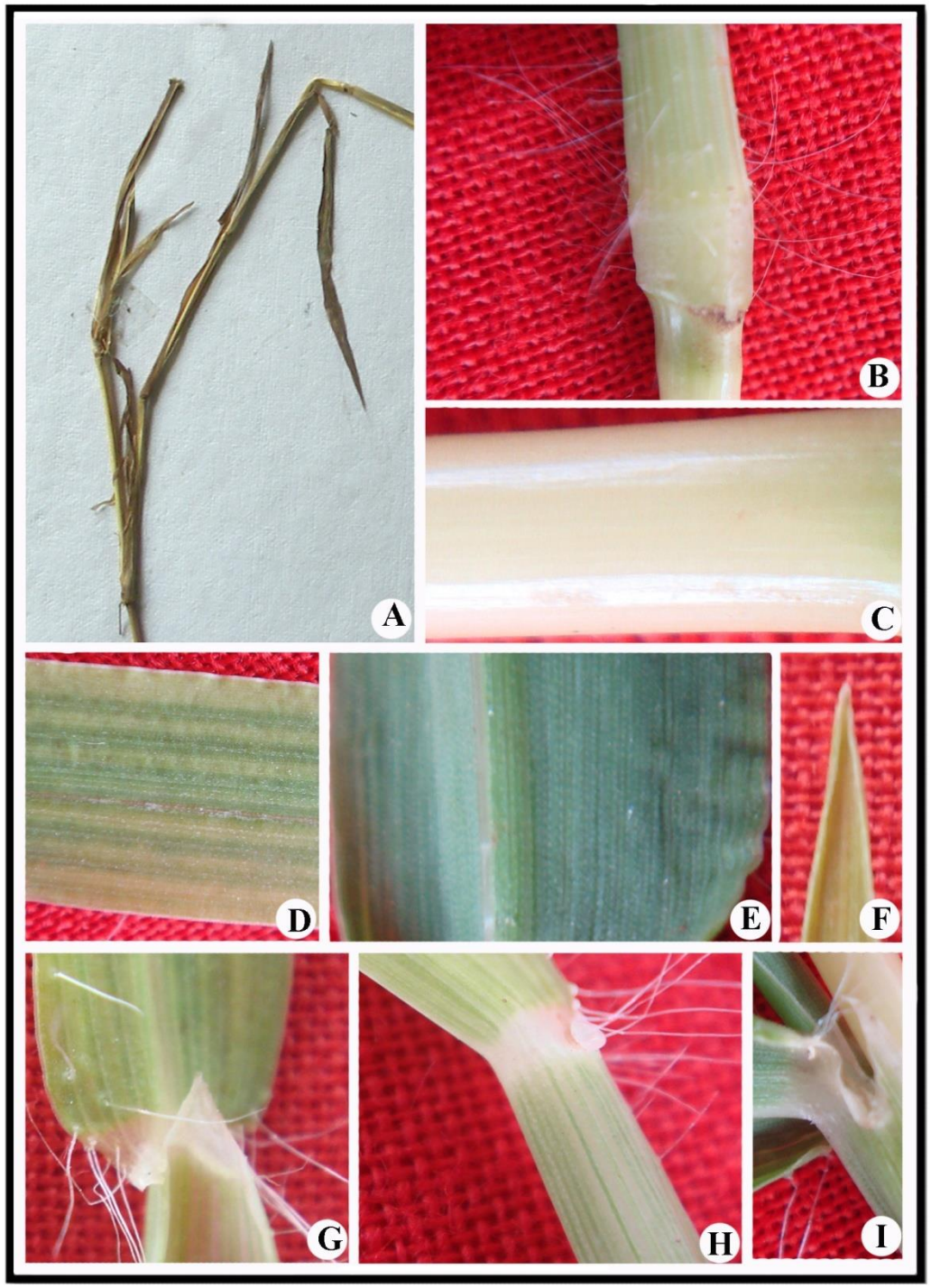


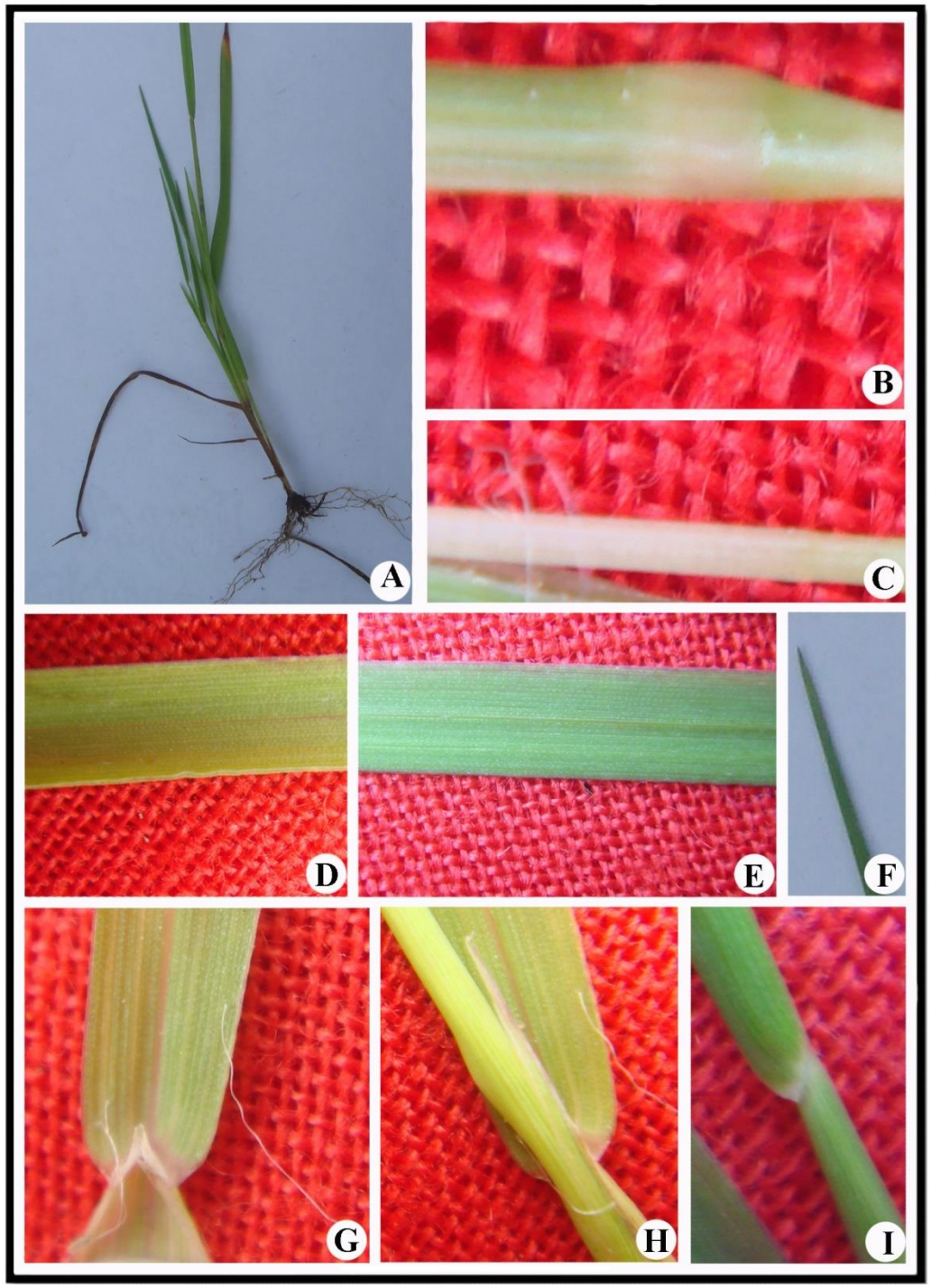
43. *Cenchrus ciliaris*

Fig. 127



44. *Cenchrus setigerus*

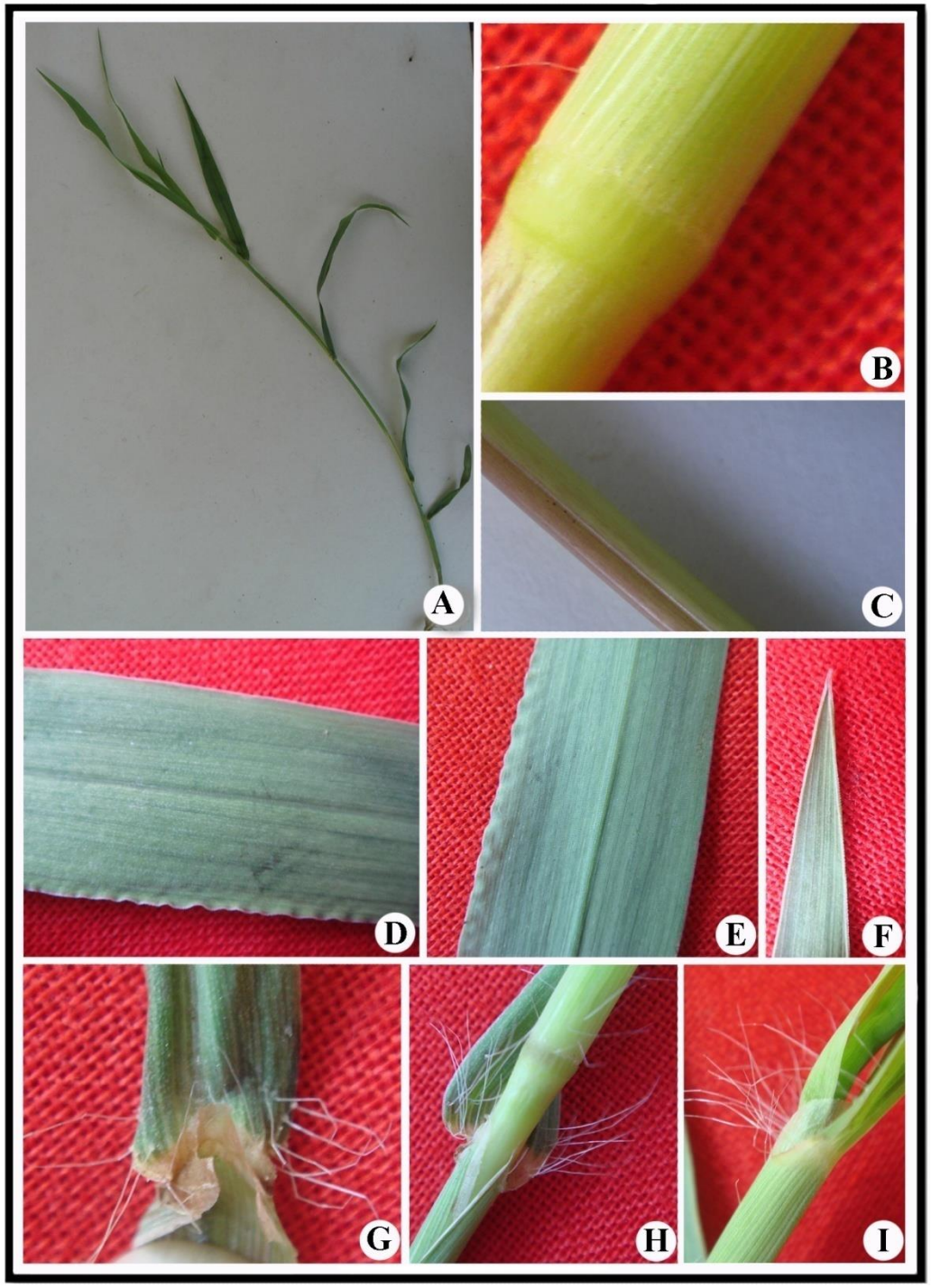




45. *Digitaria ciliaris*

Fig. 128

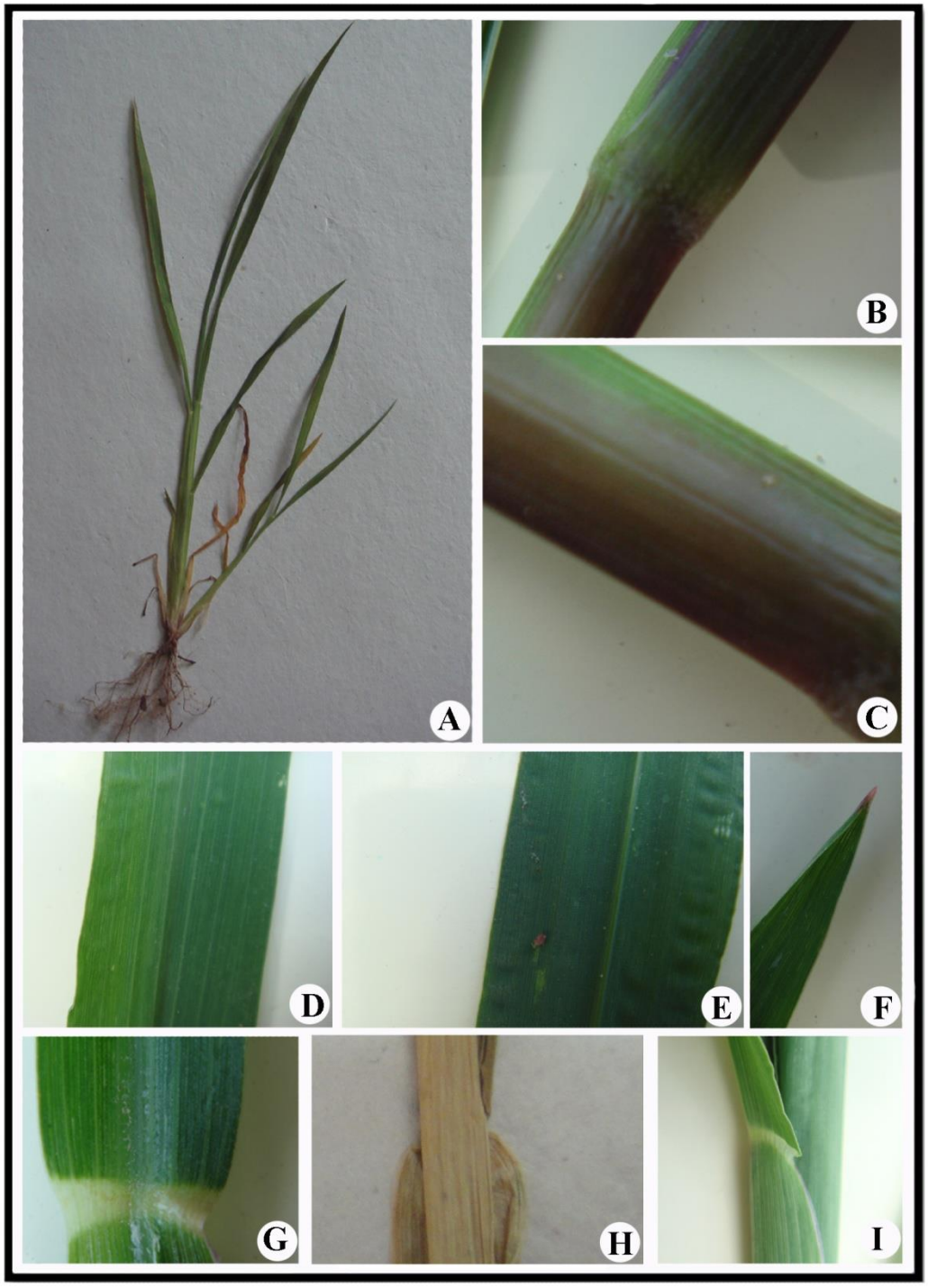
46. *Digitaria granularis*



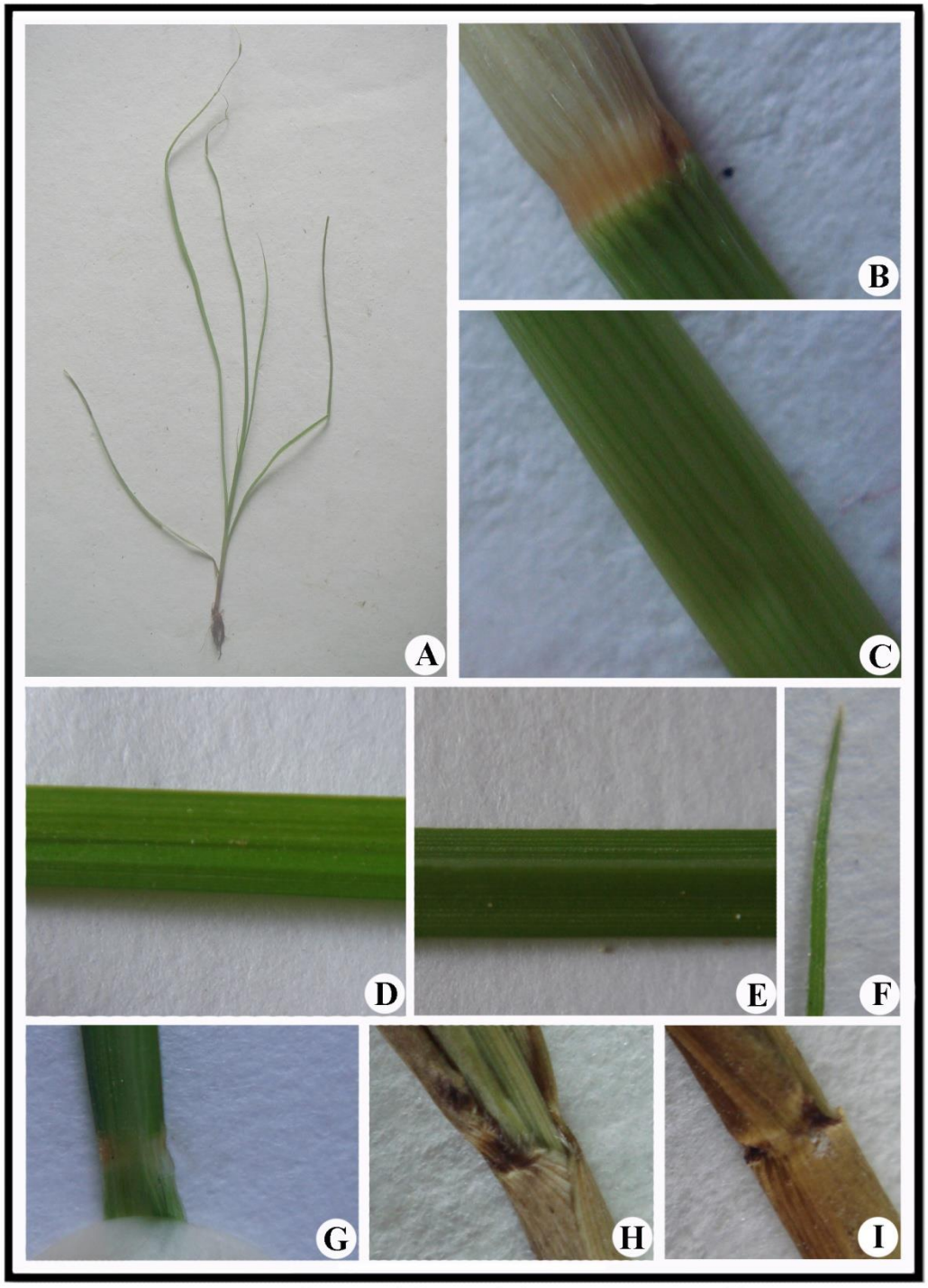
47. *Digitaria longiflora*

Fig. 129

48. *Digitaria stricta*

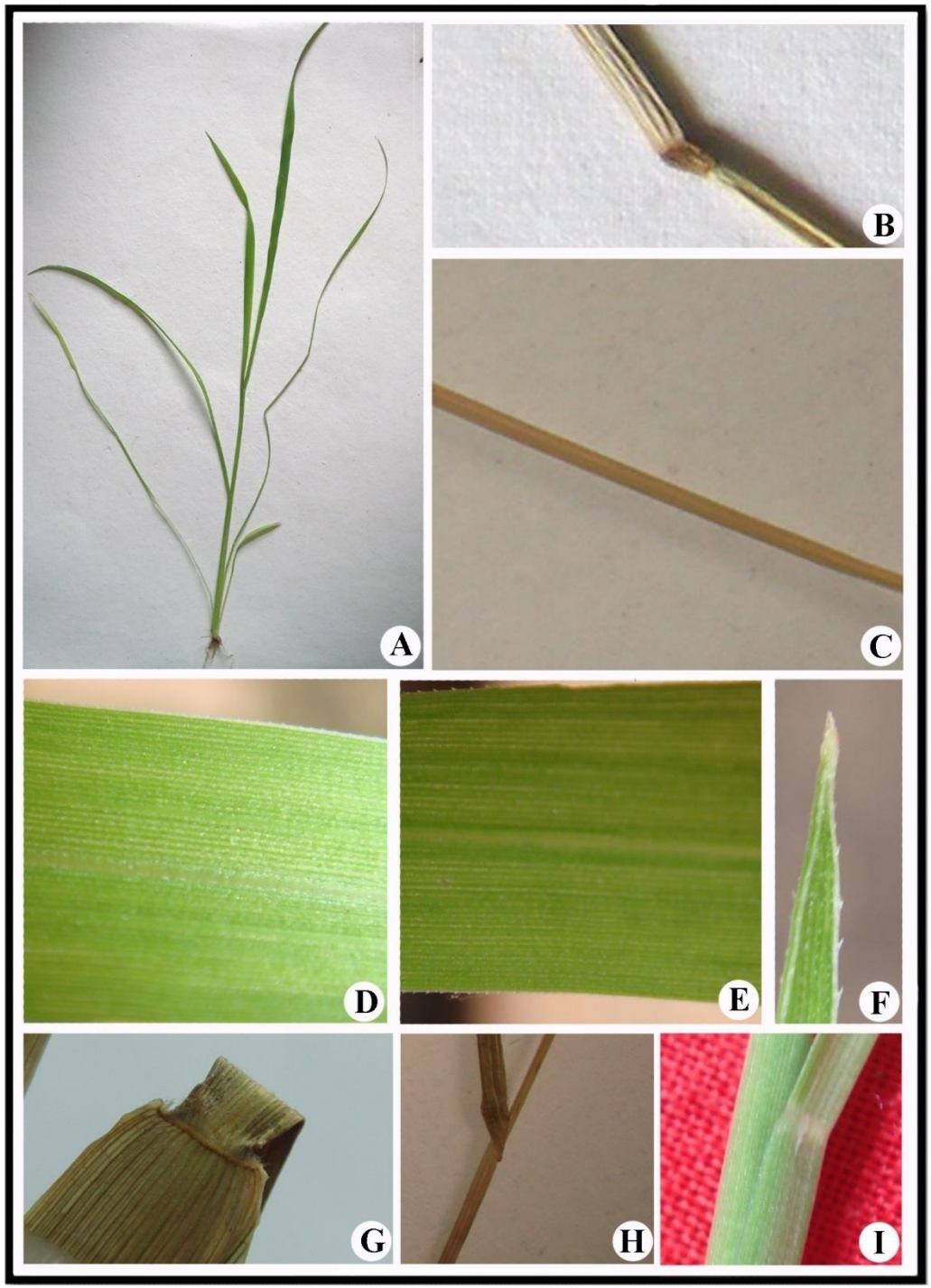


49. *Echinochloa colona*



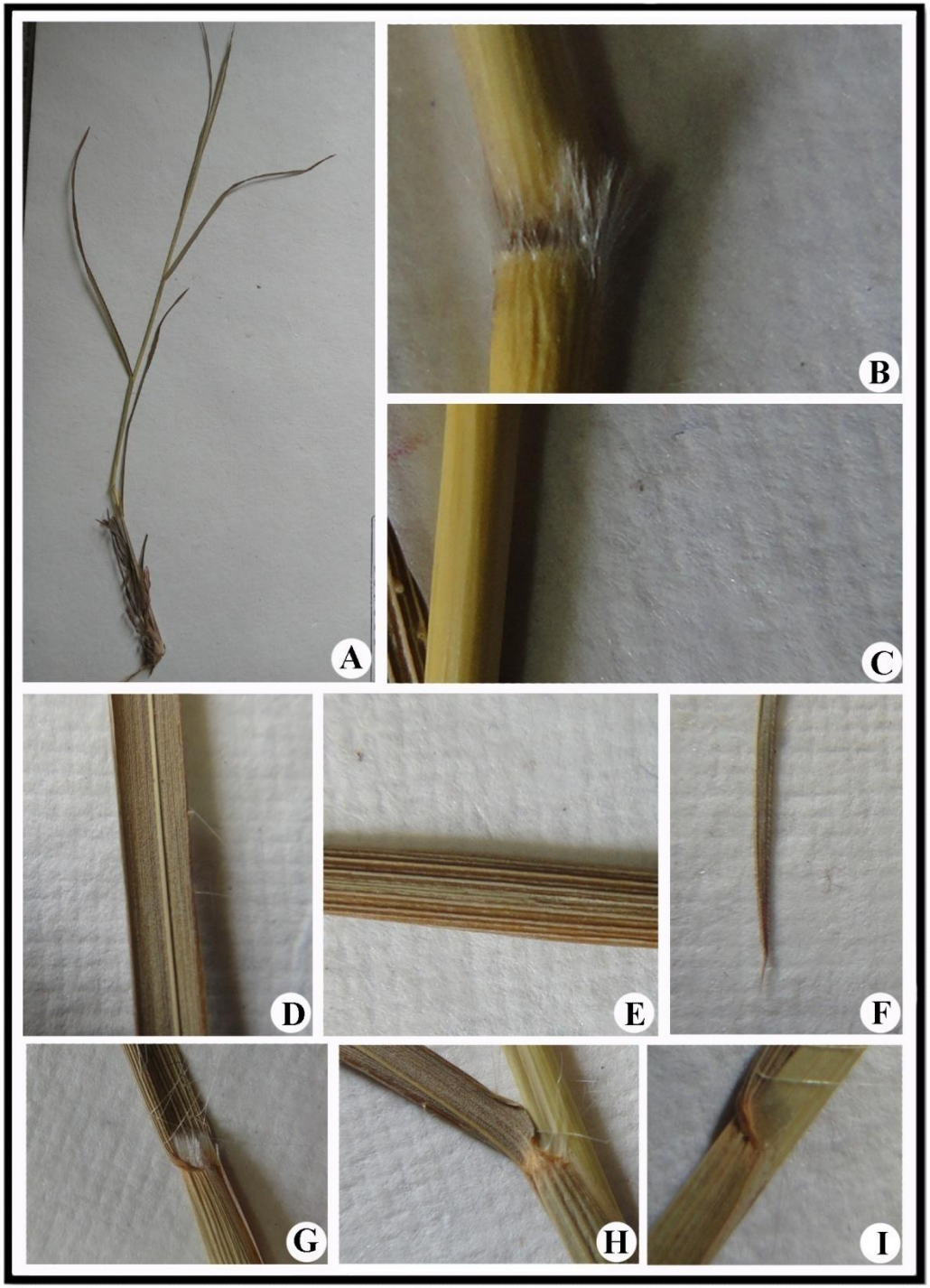
50. *Echinochloa crus-galli*

Fig. 130

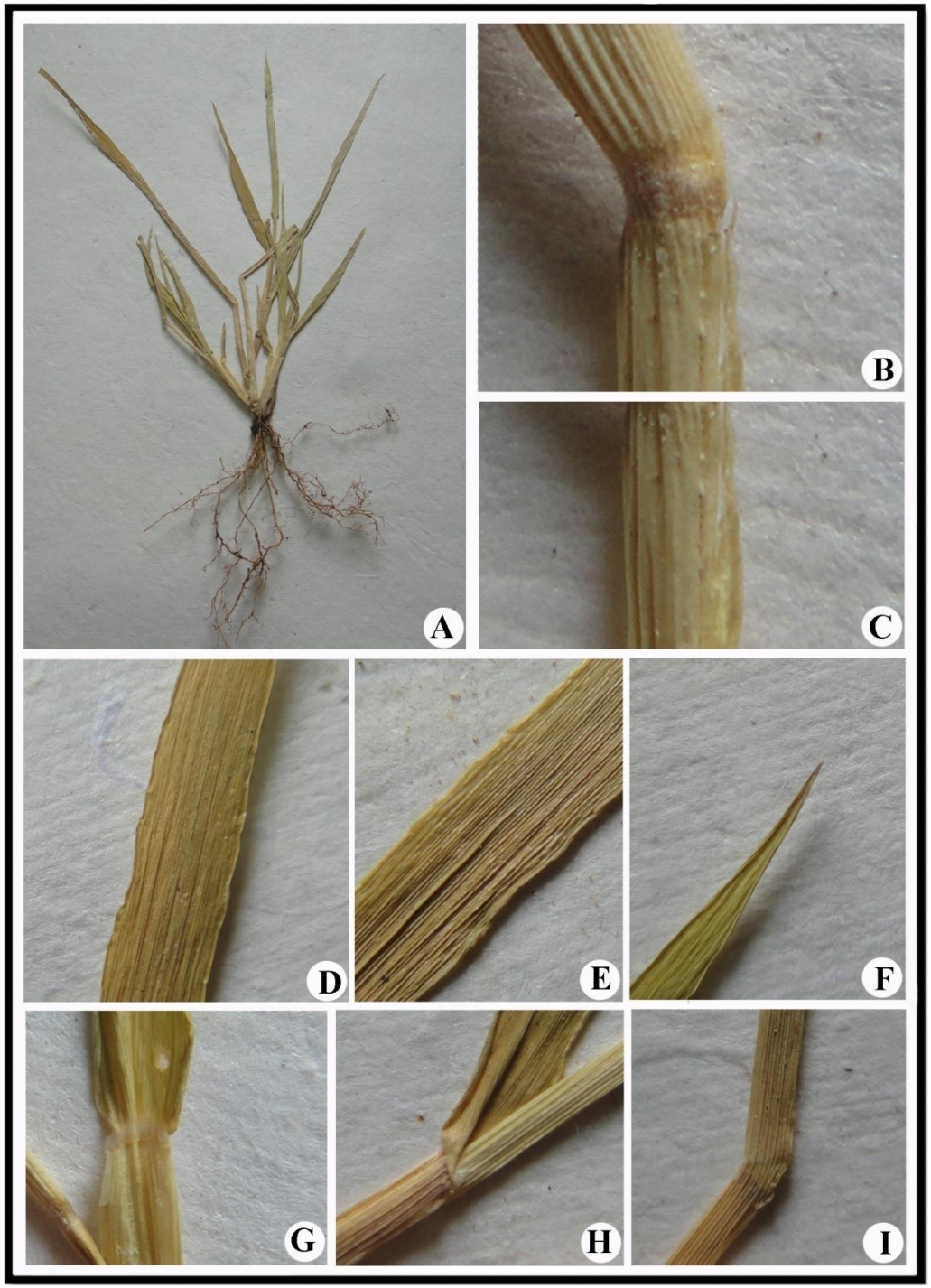


51. *Echinochloa stagnina*

Fig. 131

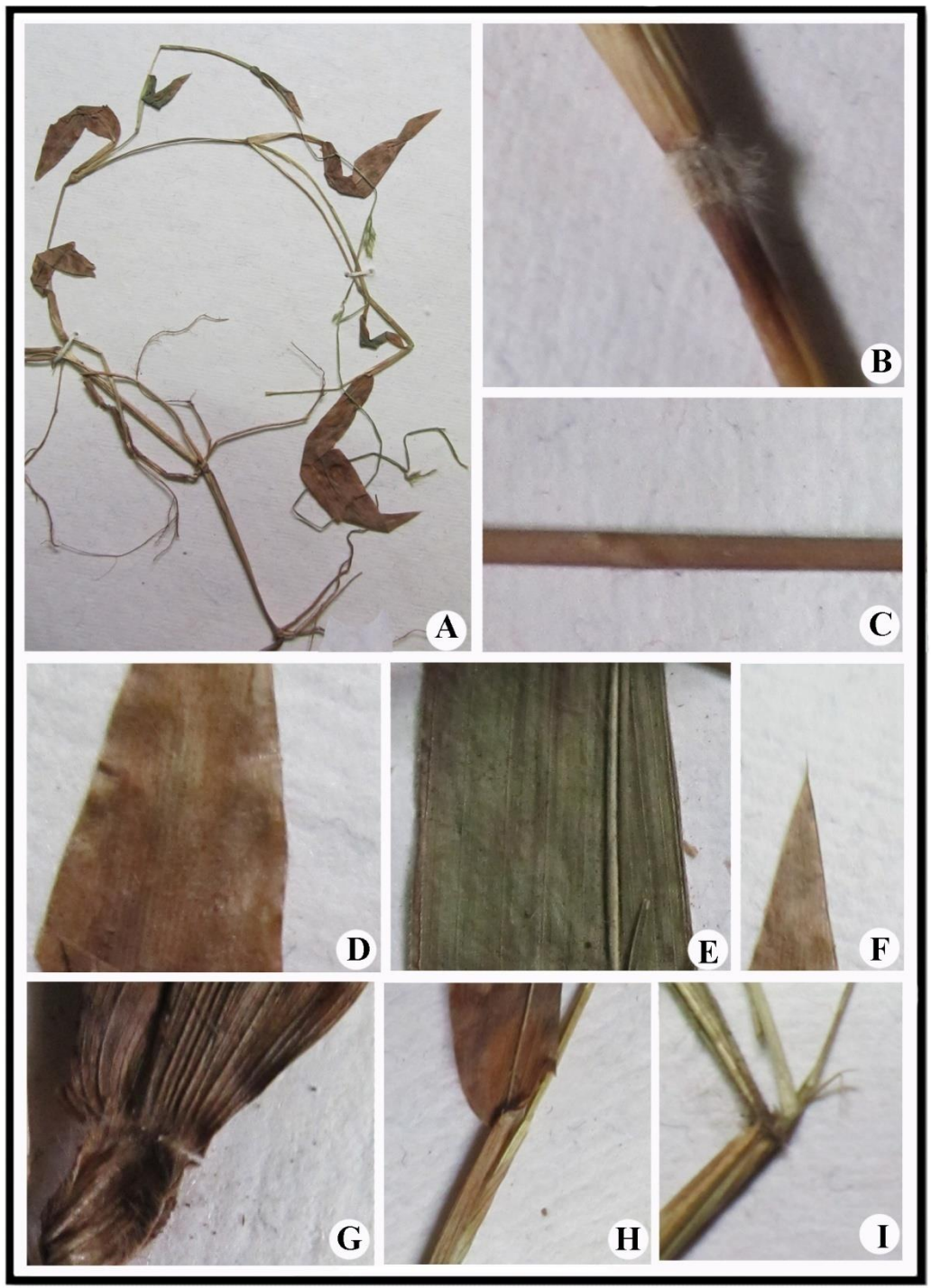


52. *Eremopogon foveolatus*

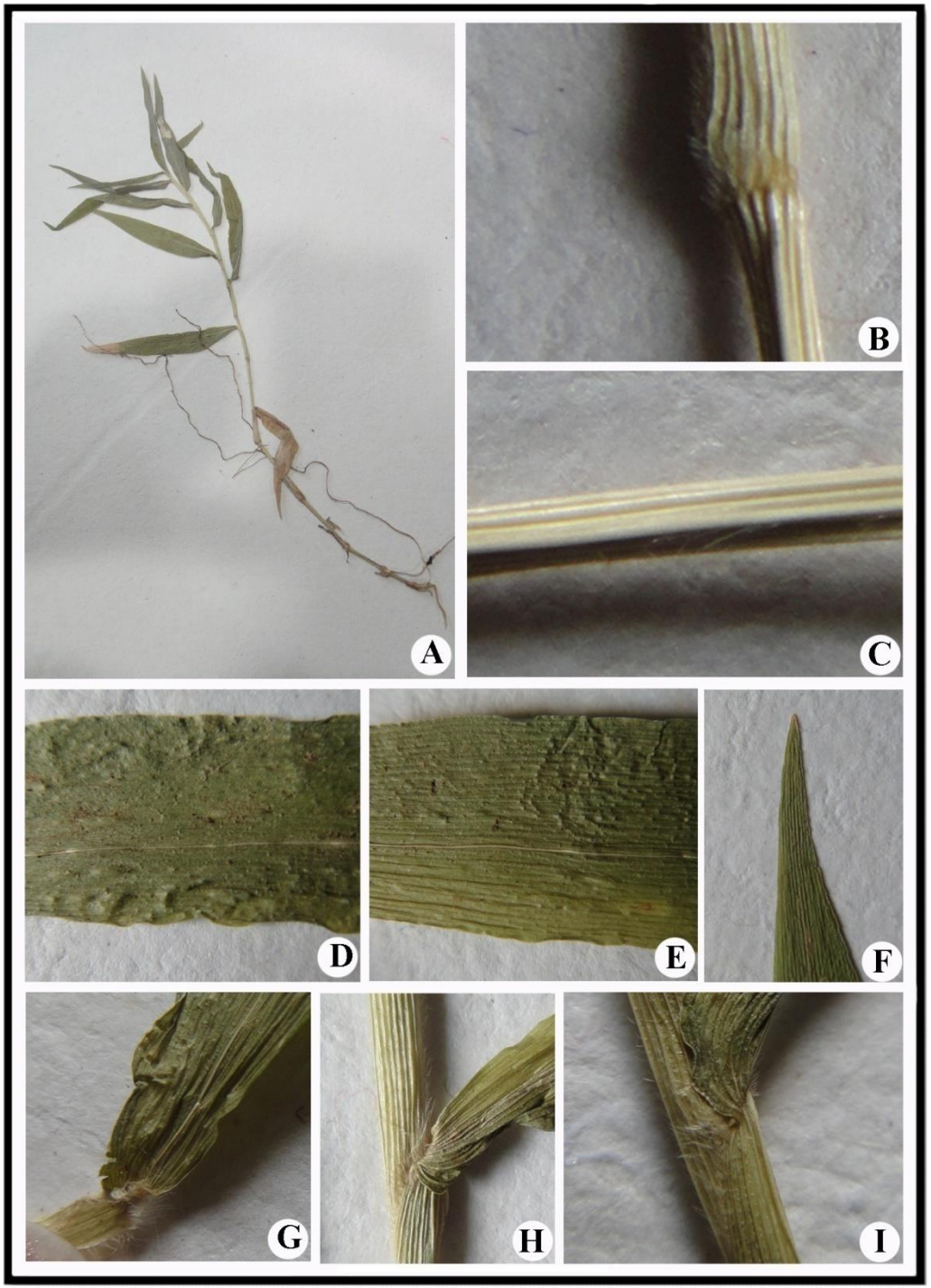


53. *Eriochloa procera*

Fig. 132

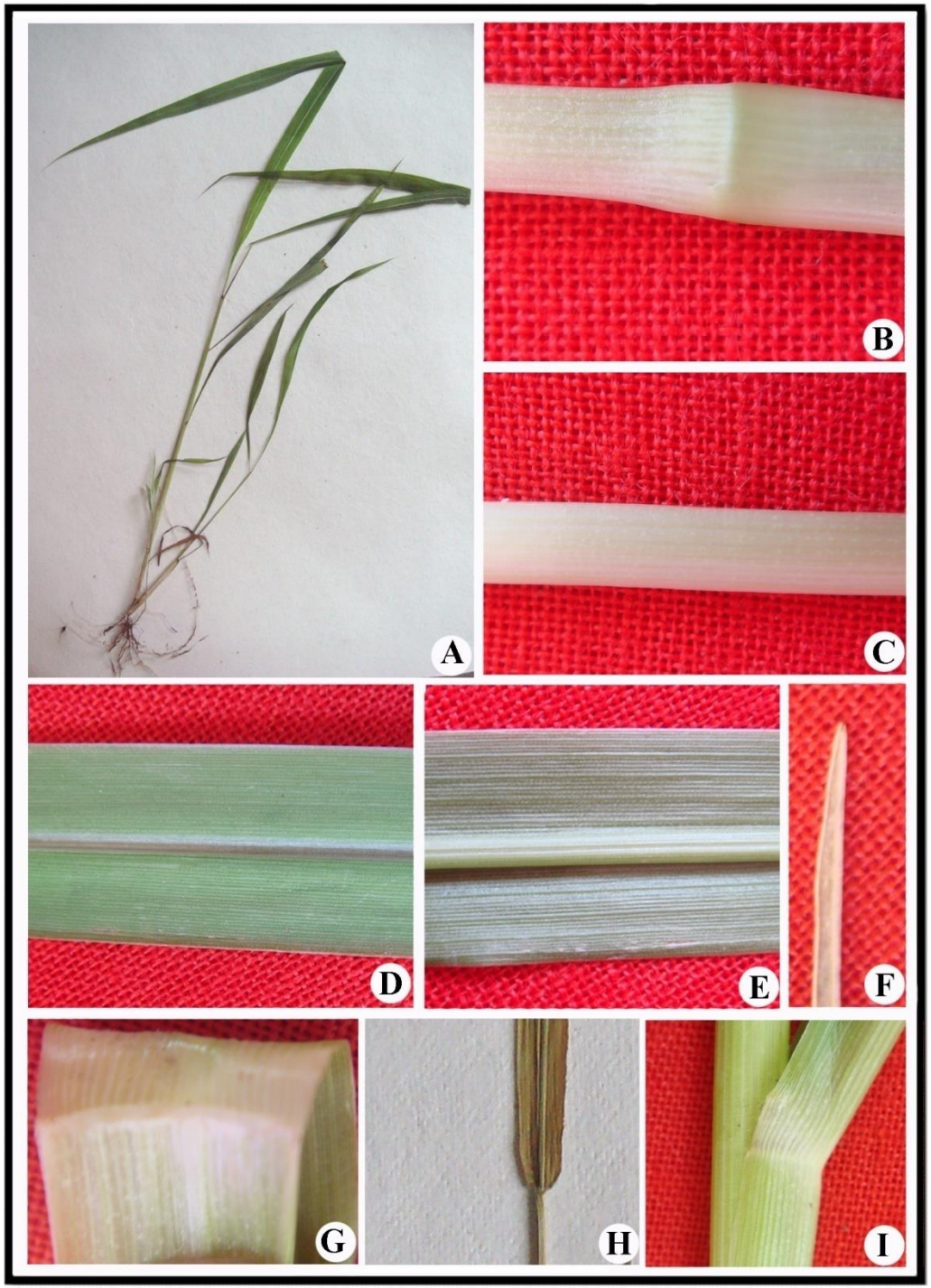


54. *Oplismenus burmannii*

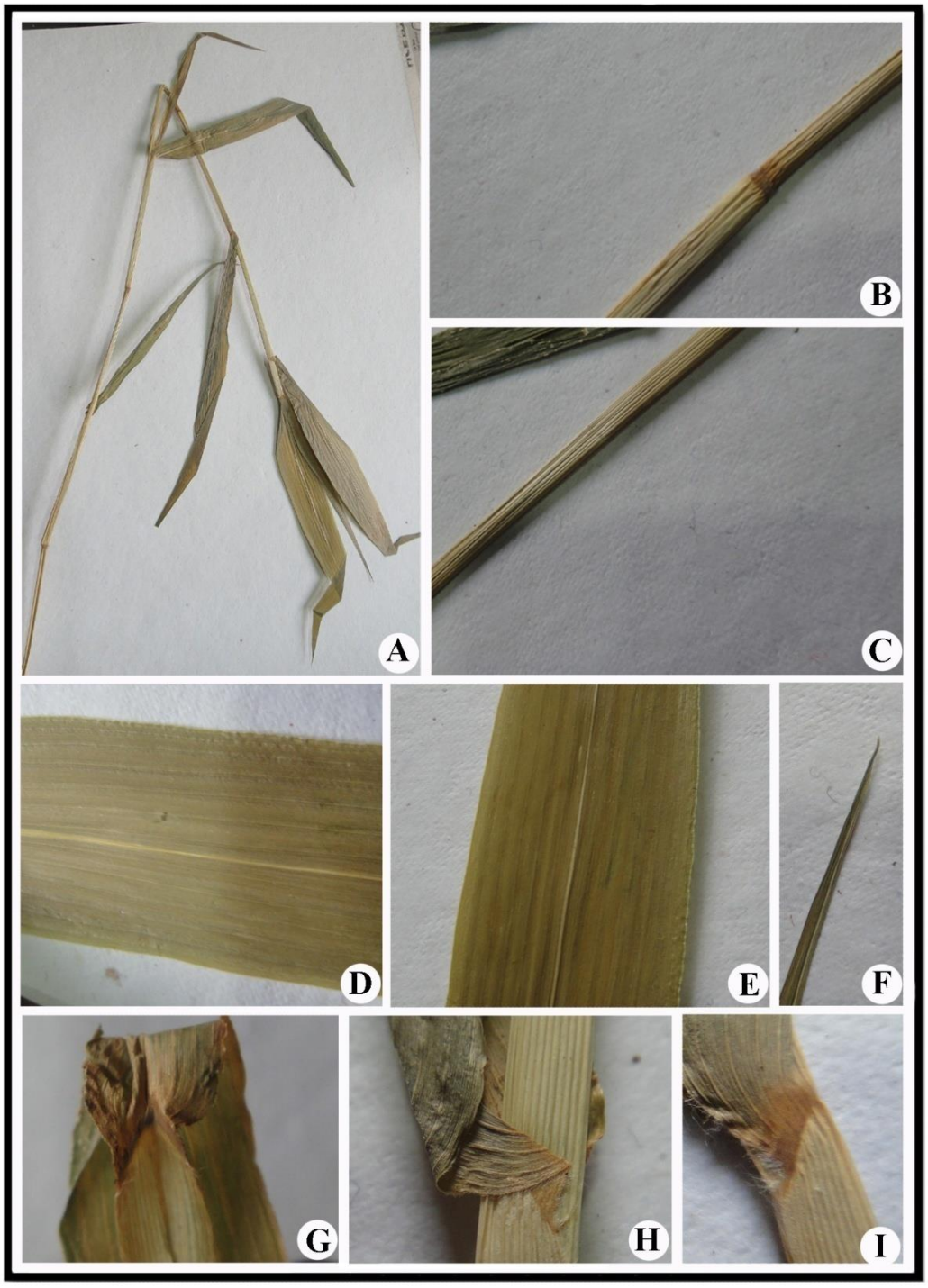


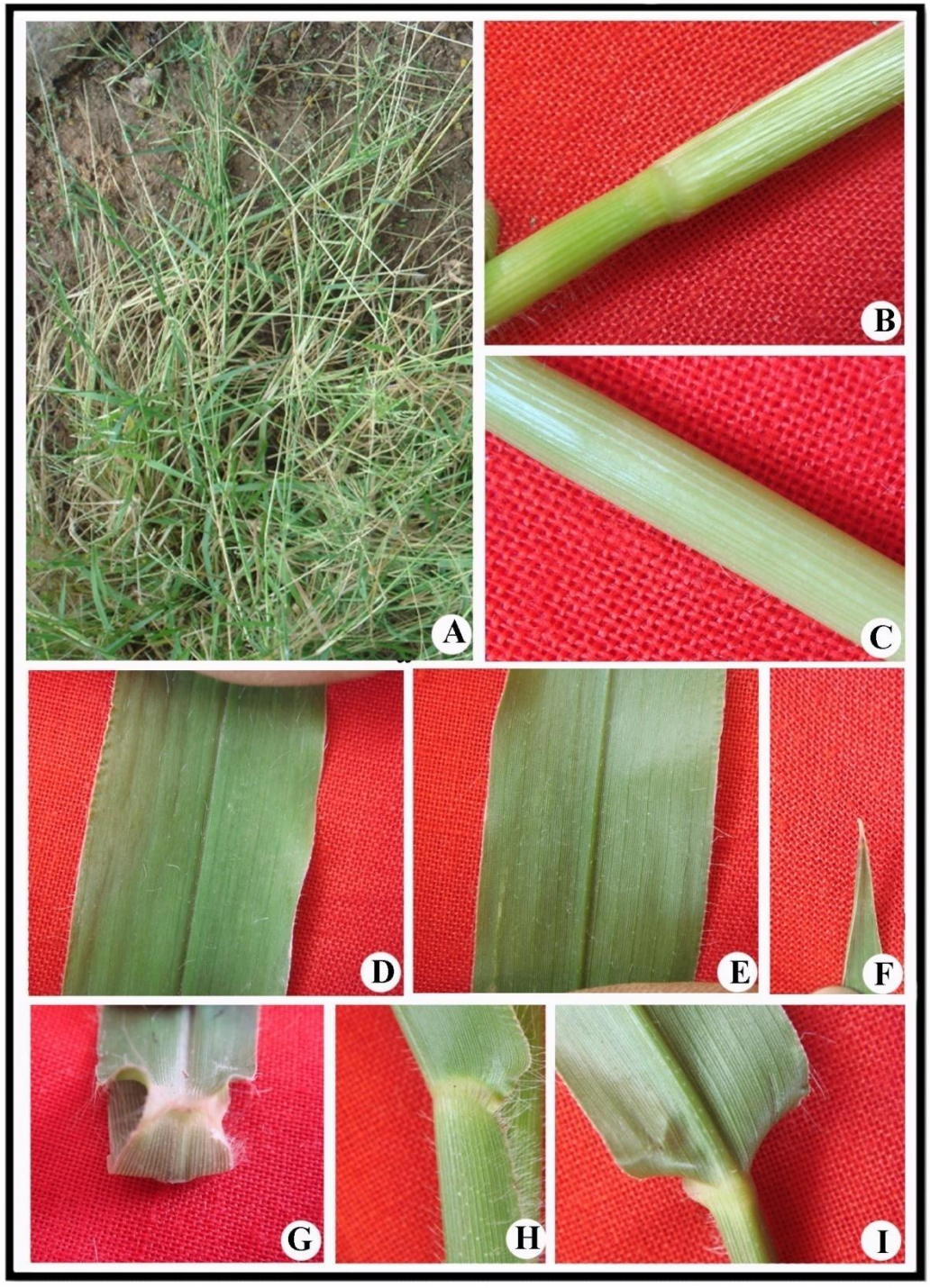
55. *Oplismenus composites*

Fig. 133



56. *Panicum antidotale*





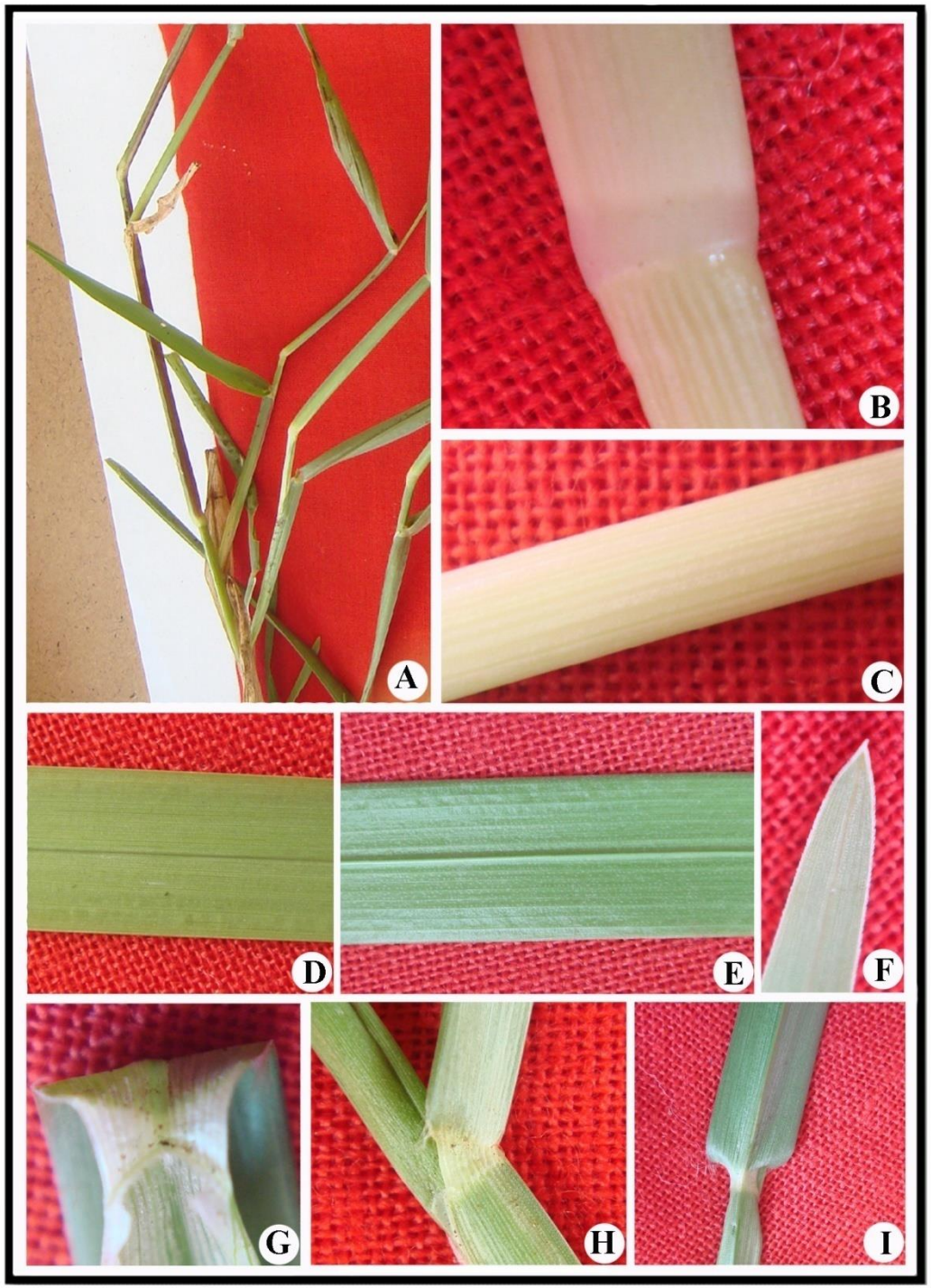
57. *Panicum maximum*

Fig. 134

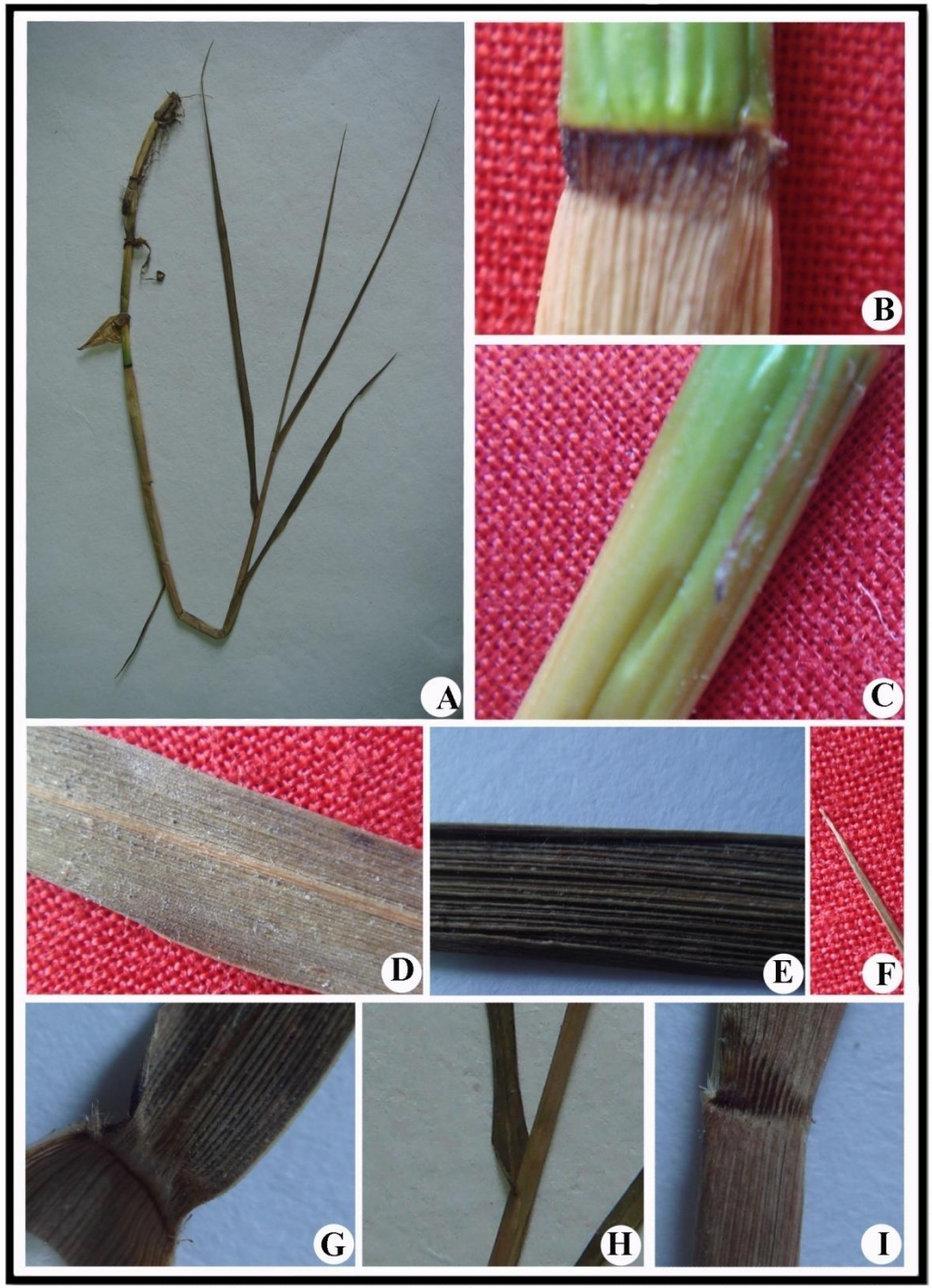
58. *Panicum miliaceum*

59. *Panicum trypheron*

Fig. 135

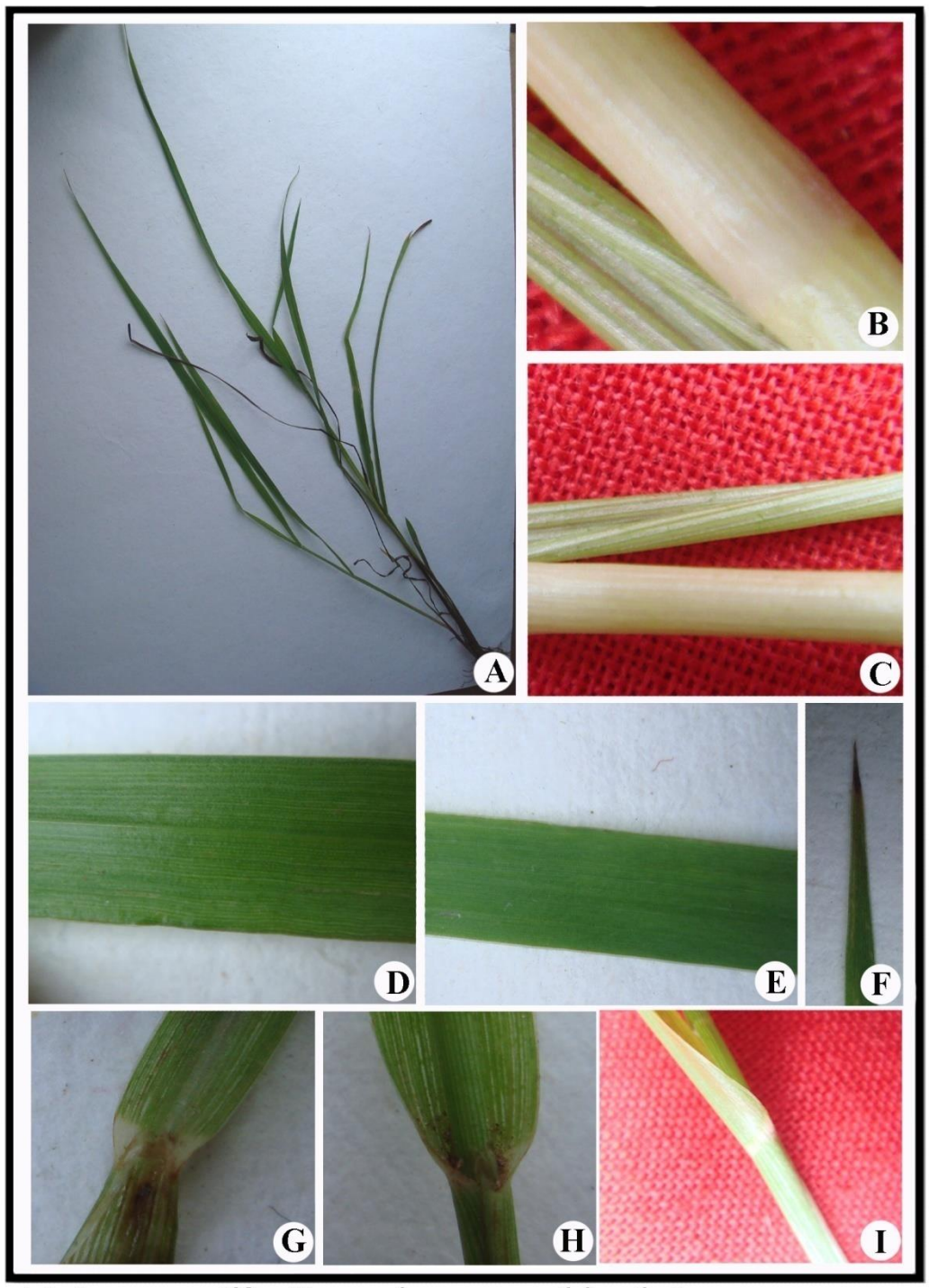


60. *Paspalidium flavidum*

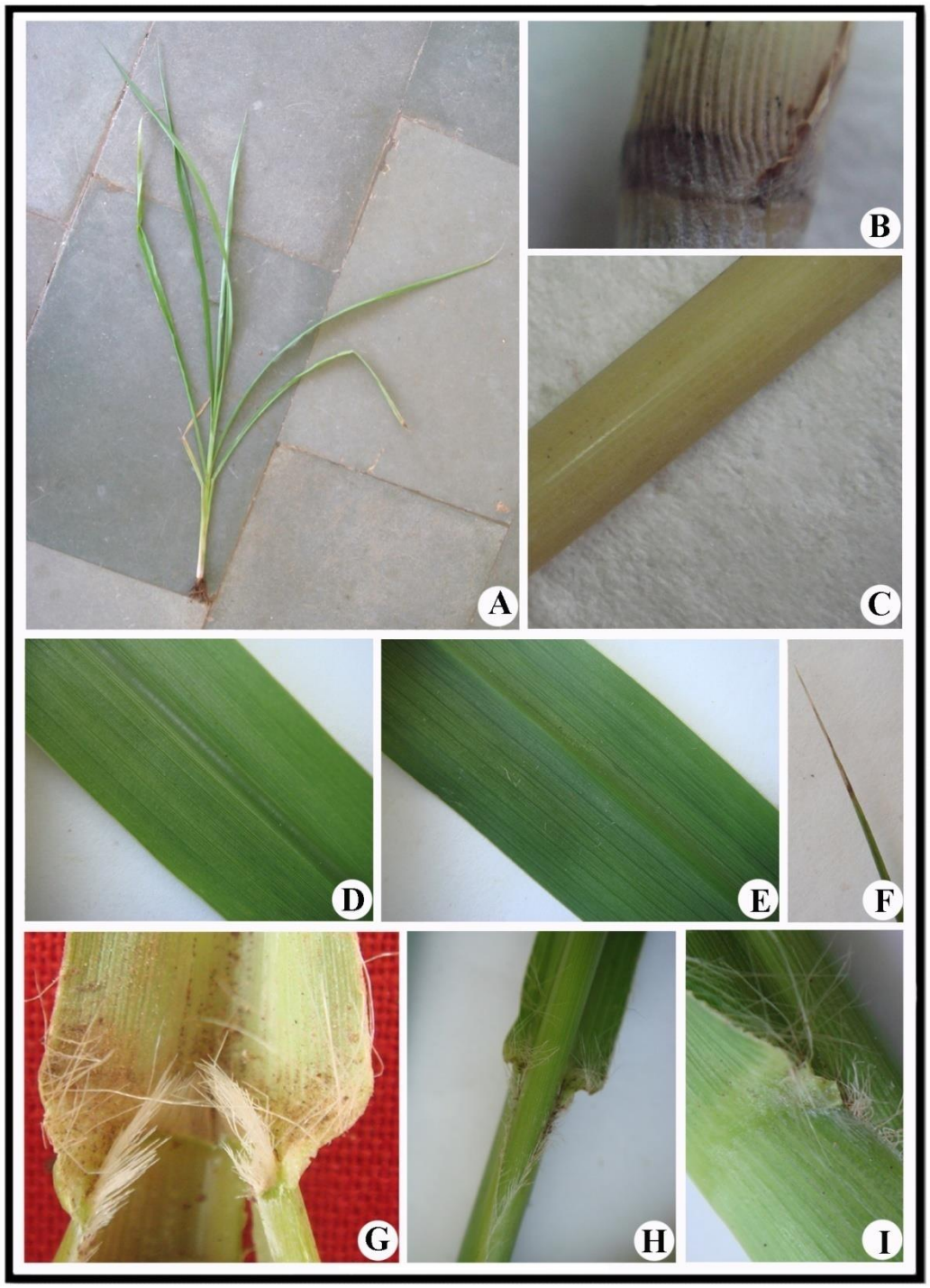


61. *Paspalidium geminatum*

Fig. 136

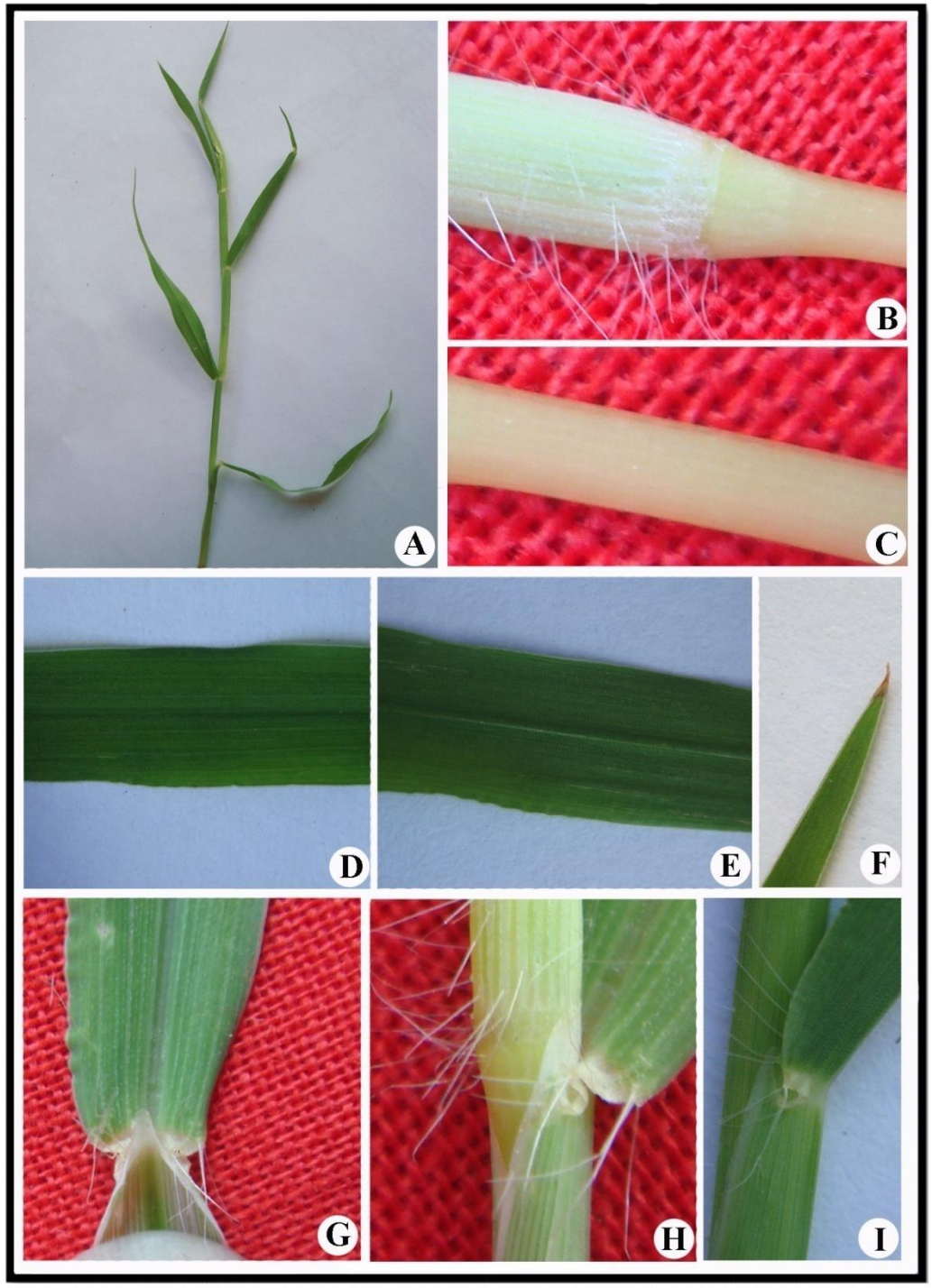


62. *Paspalum scrobiculatum*

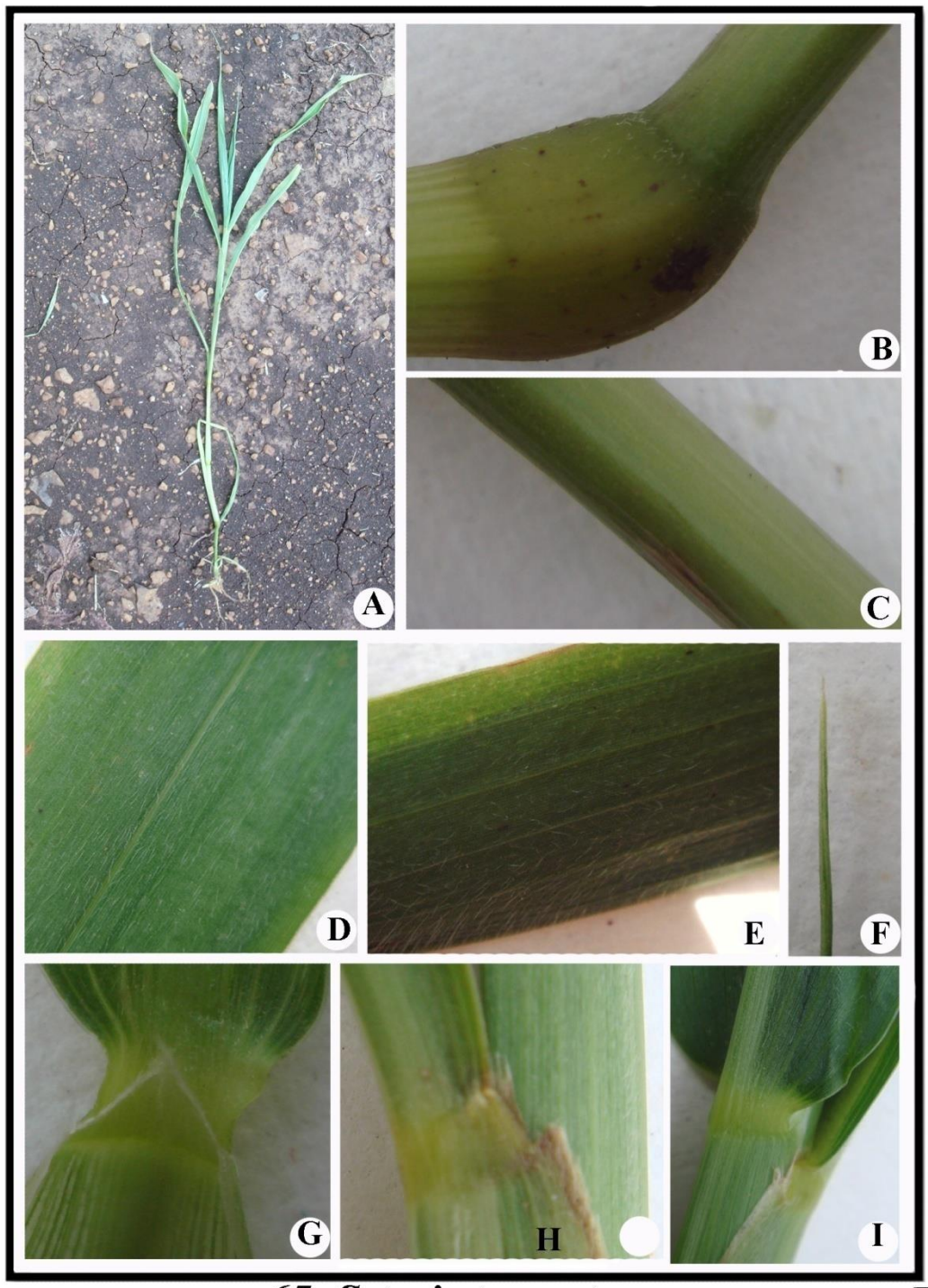


63. *Pennisetum setosum*

Fig. 137

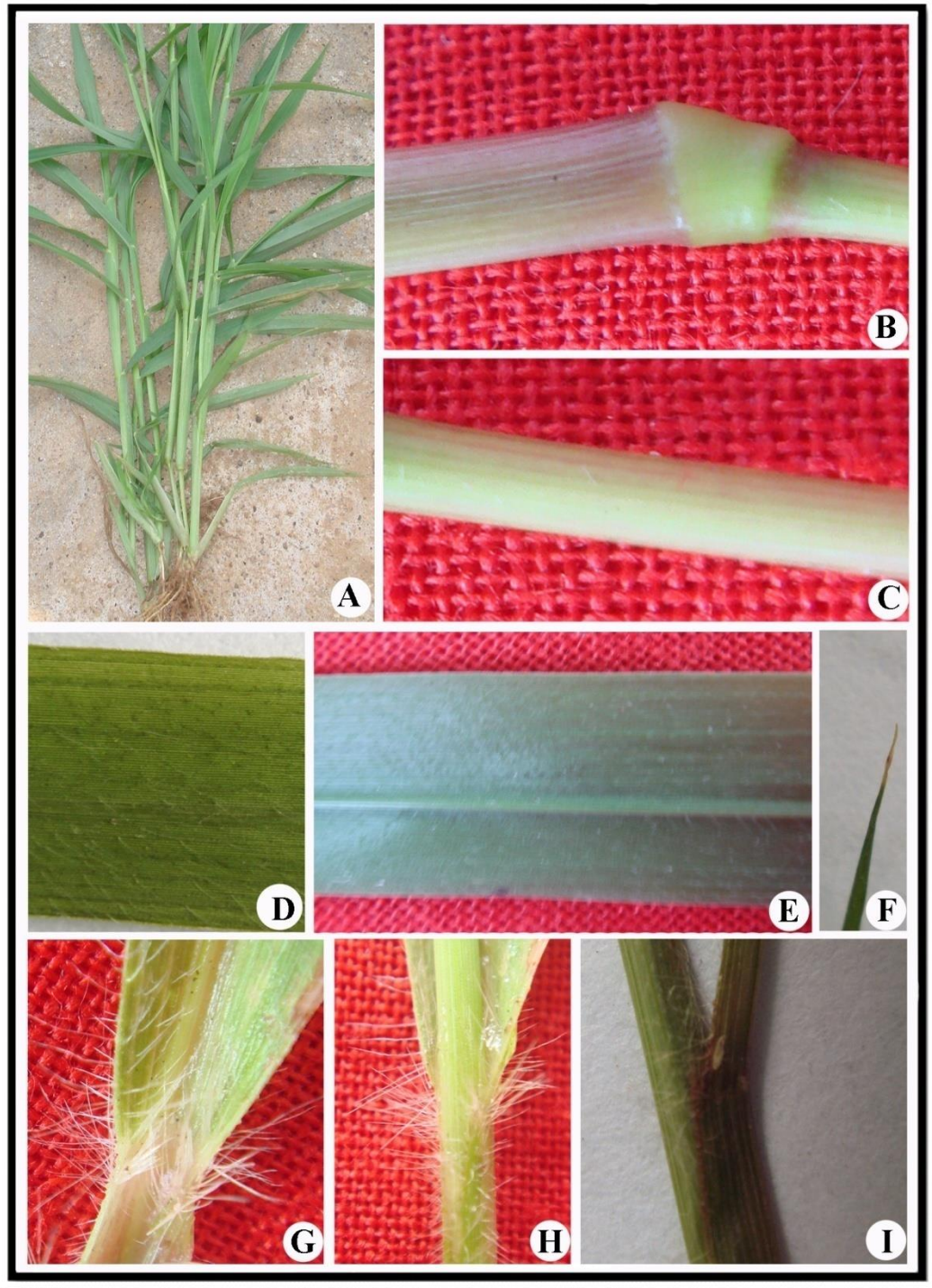


64. *Setaria glauca*

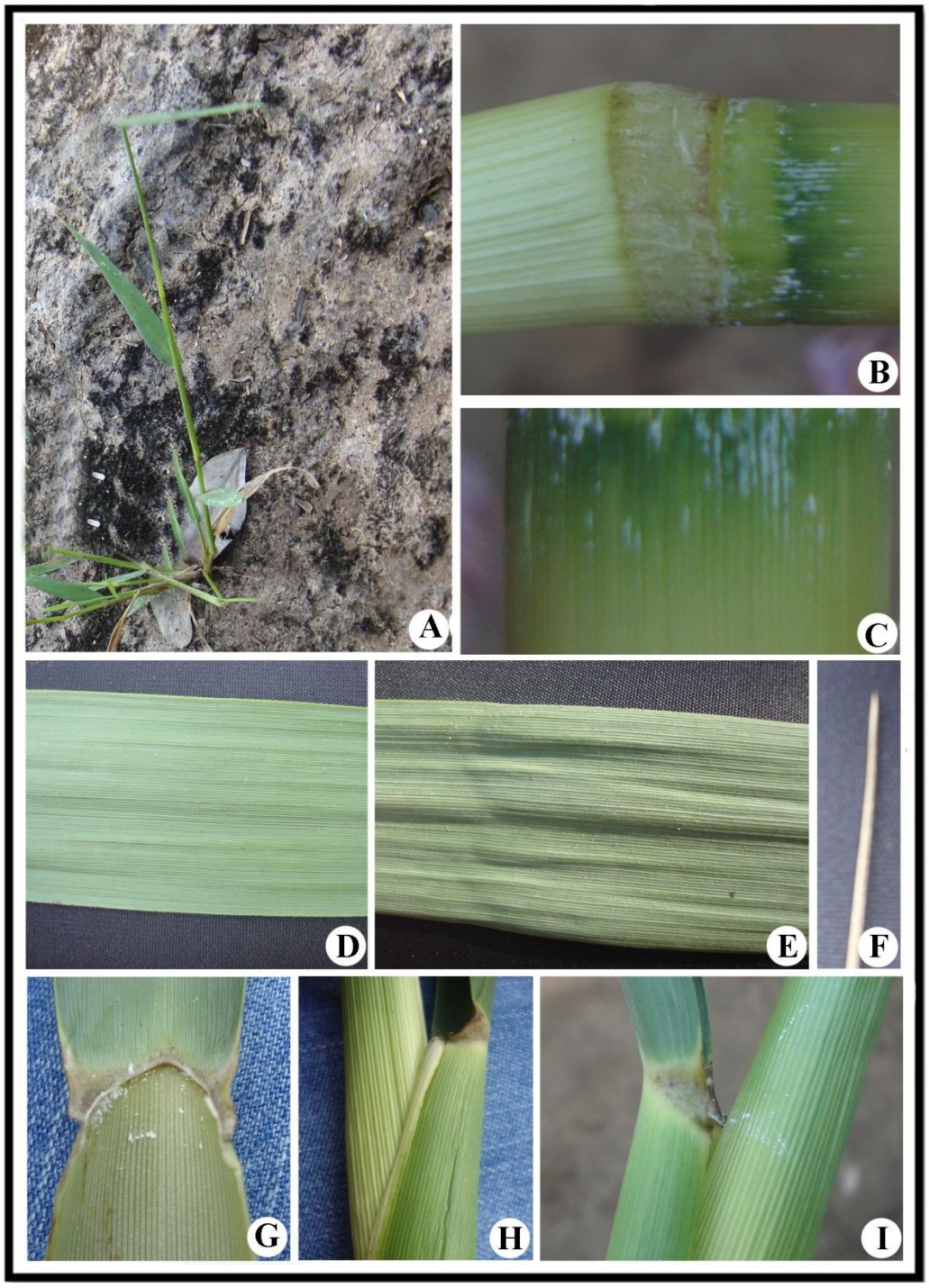


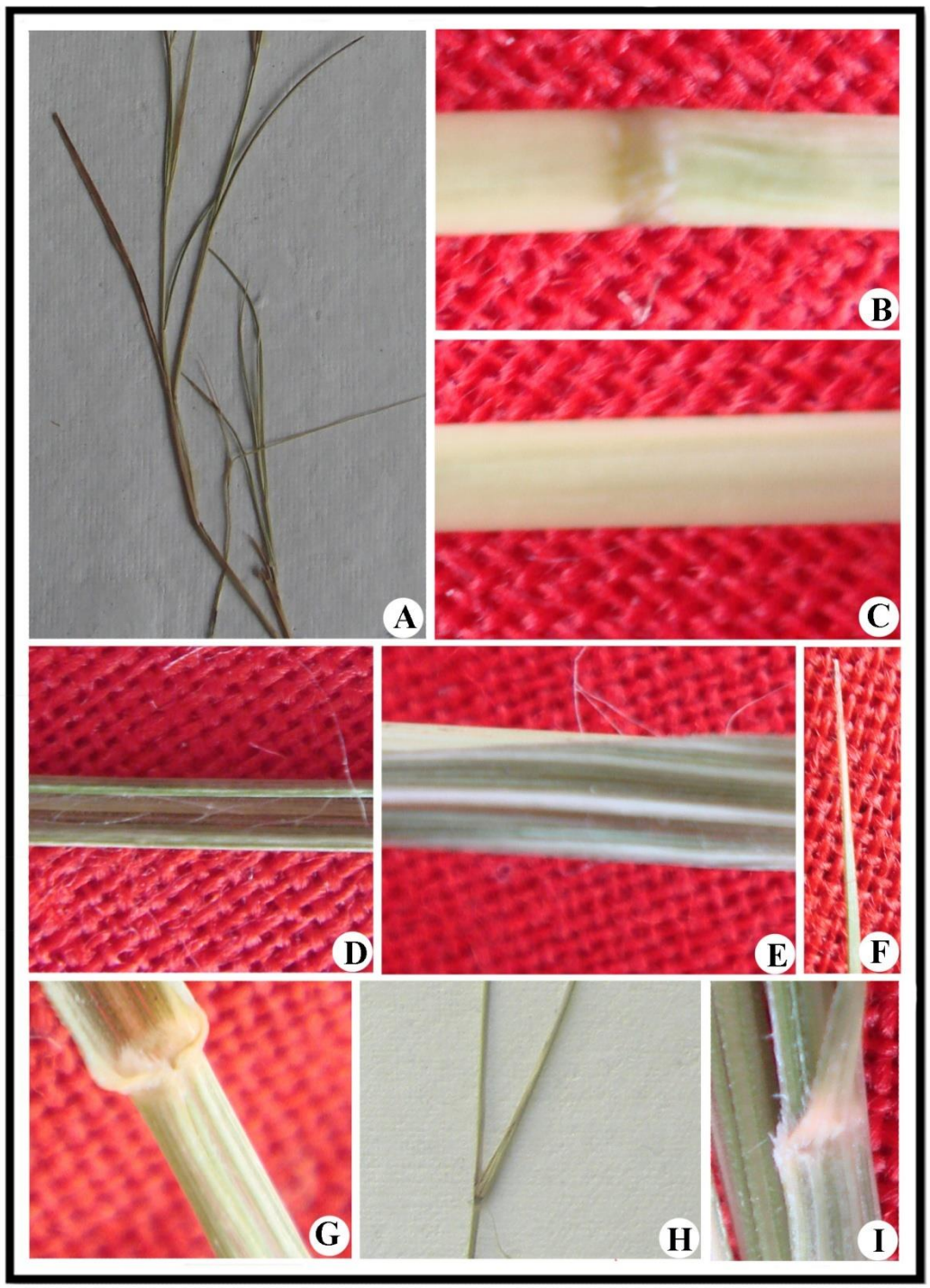
65. *Setaria tomentosa*

Fig. 138



66. *Setaria verticillata*

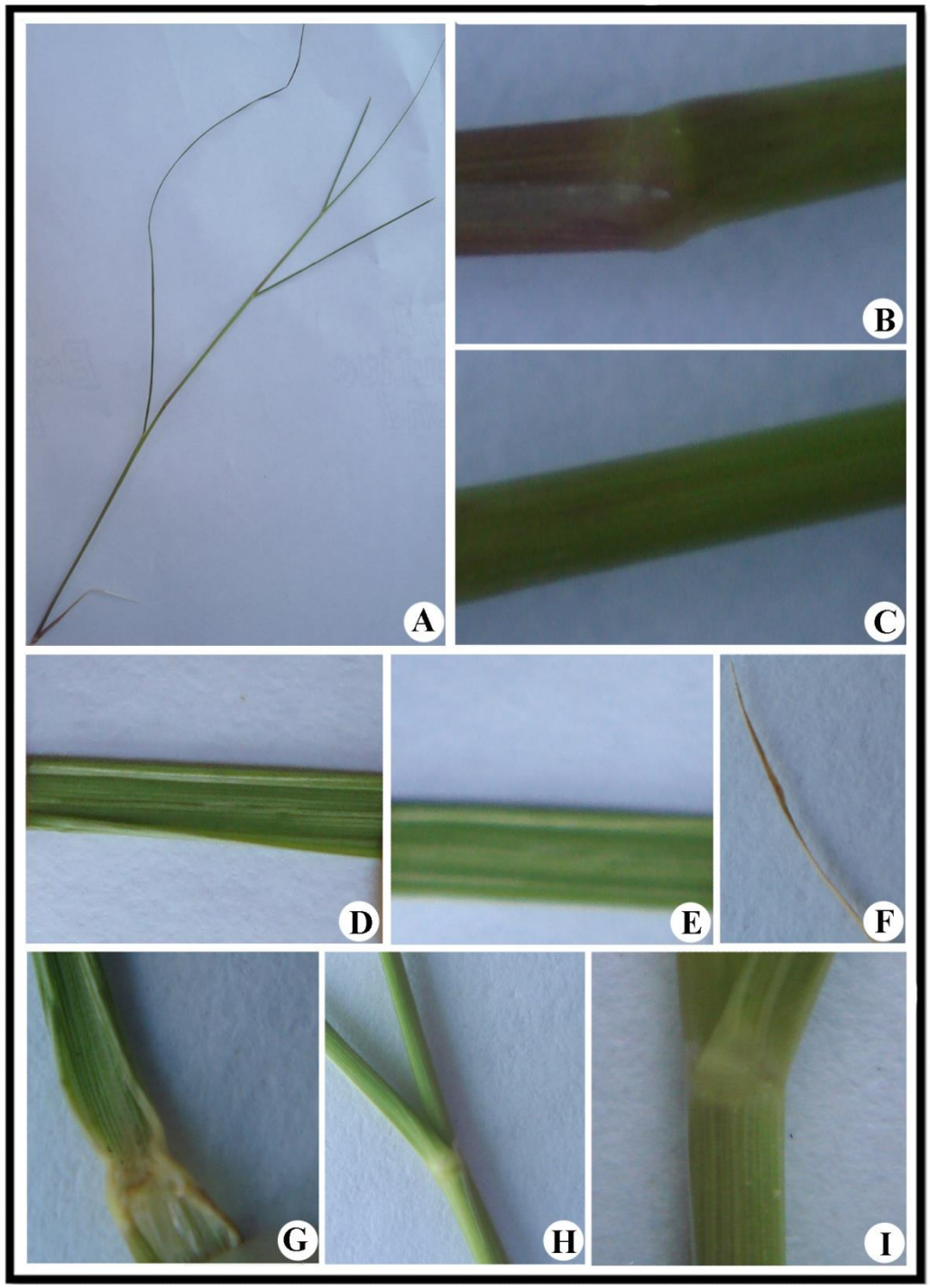




67. *Isachne globosa*

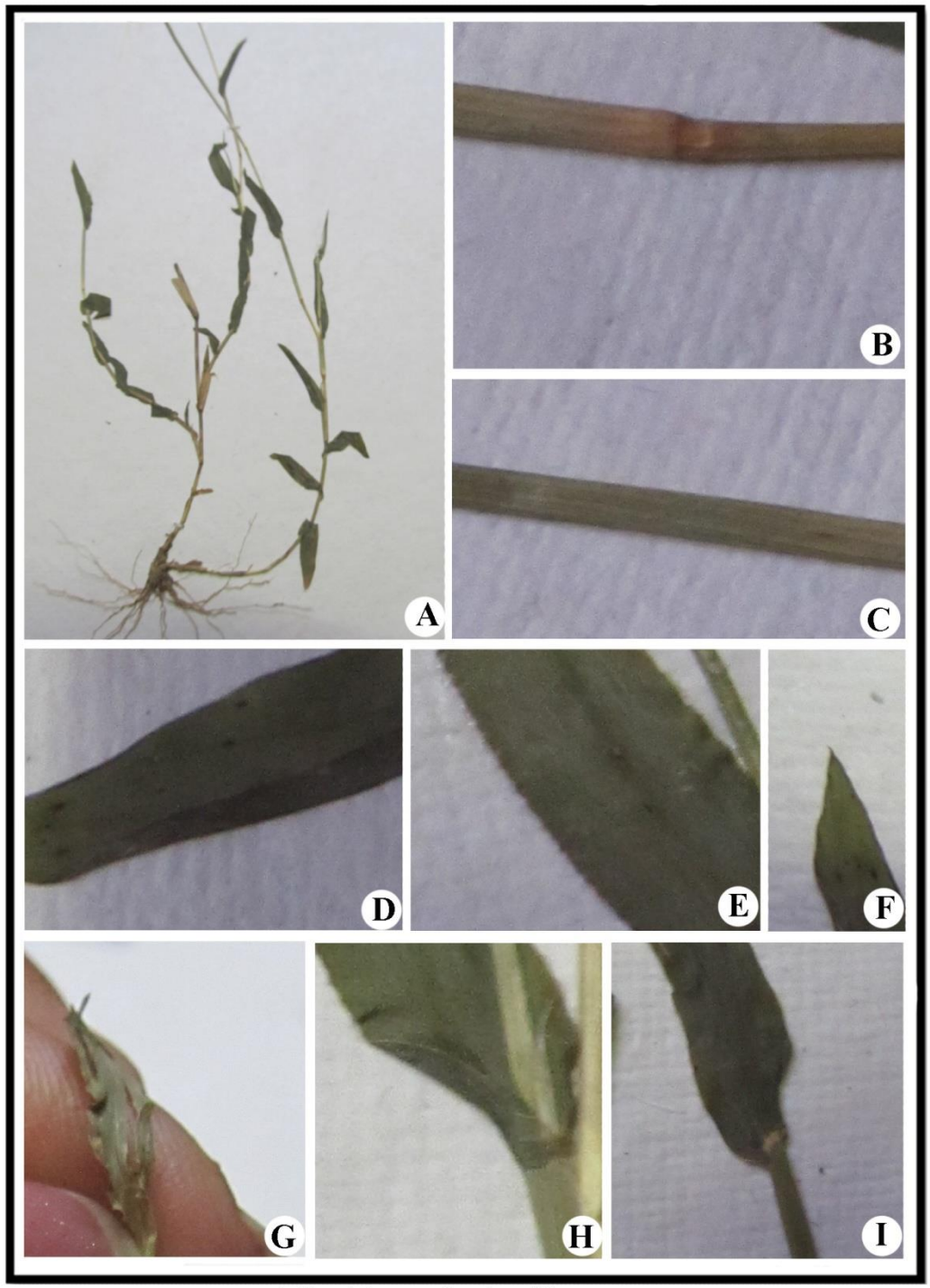
Fig. 139

68. *Aristida adscensionis*

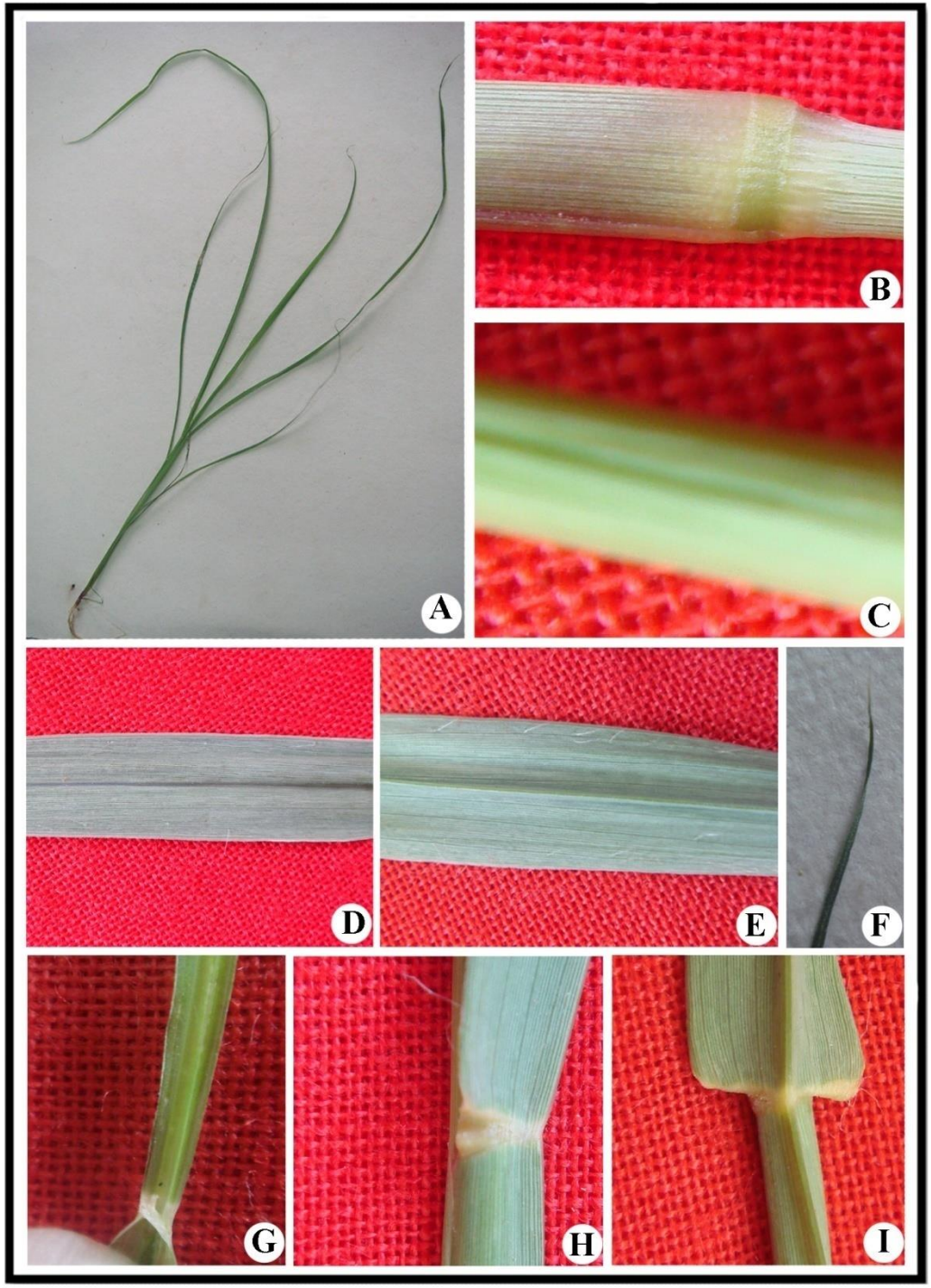


69. *Aristida funiculata*

Fig. 140

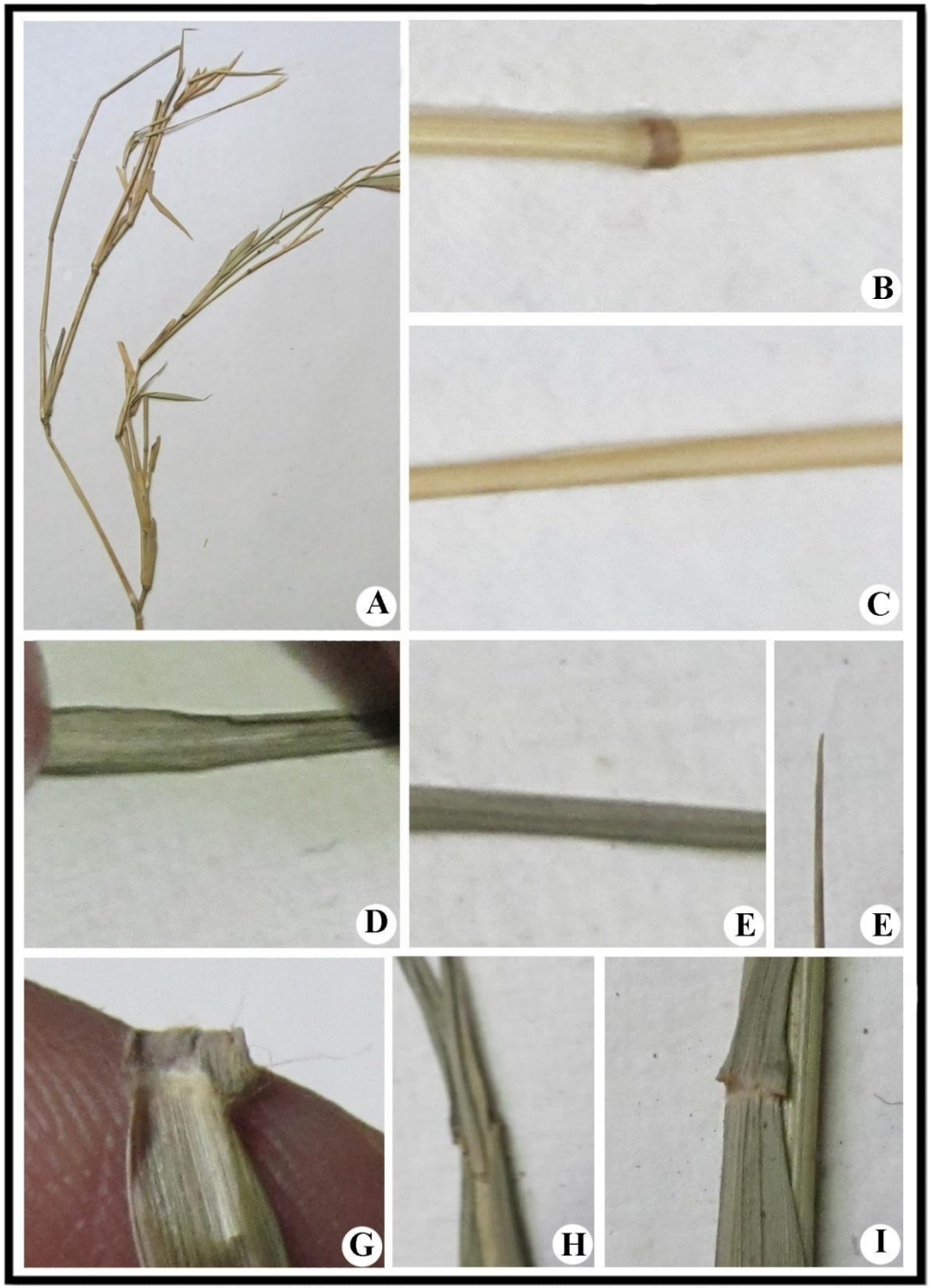


70. *Perotis indica*

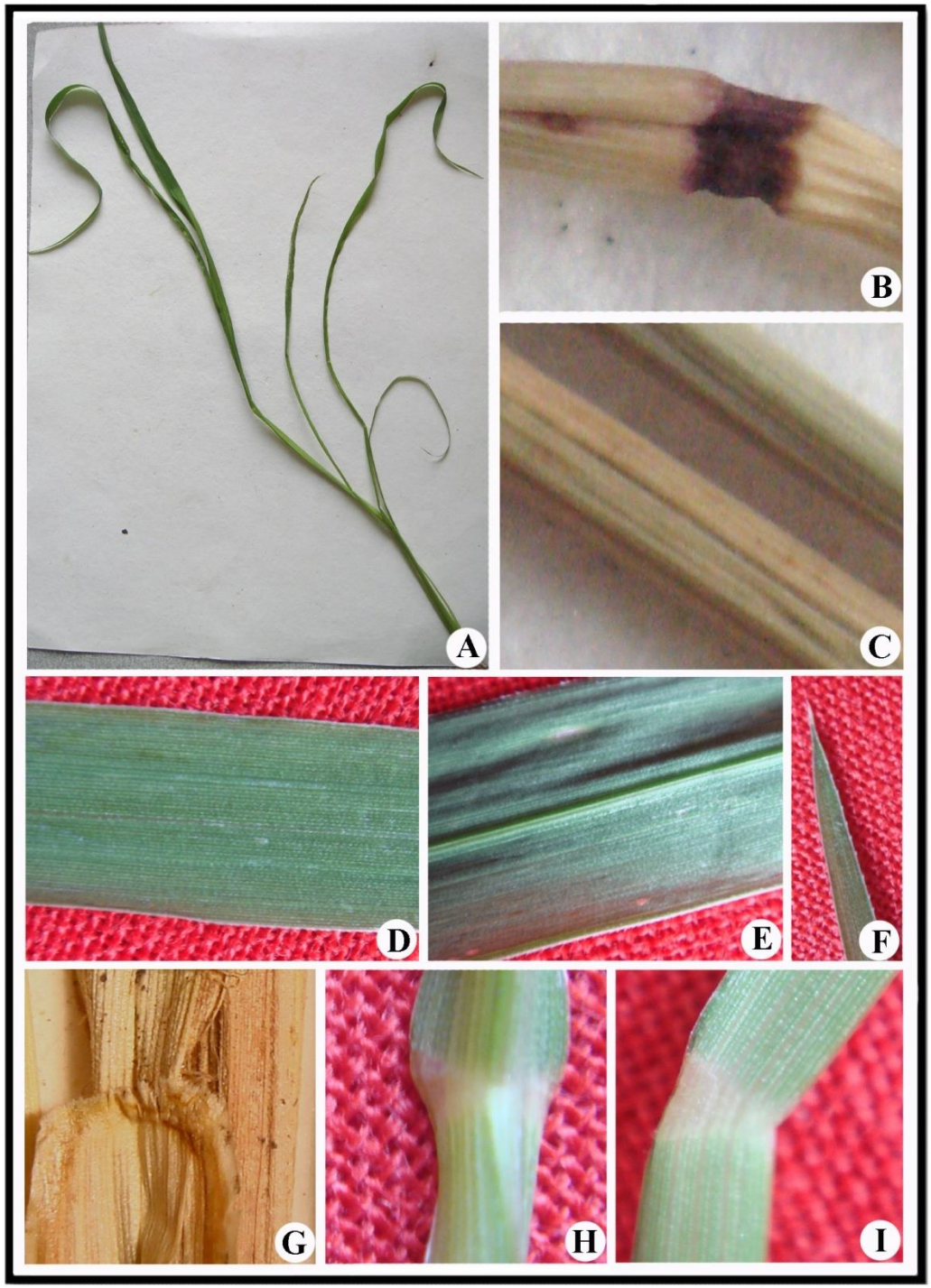


71. *Chloris barbata*

Fig. 141

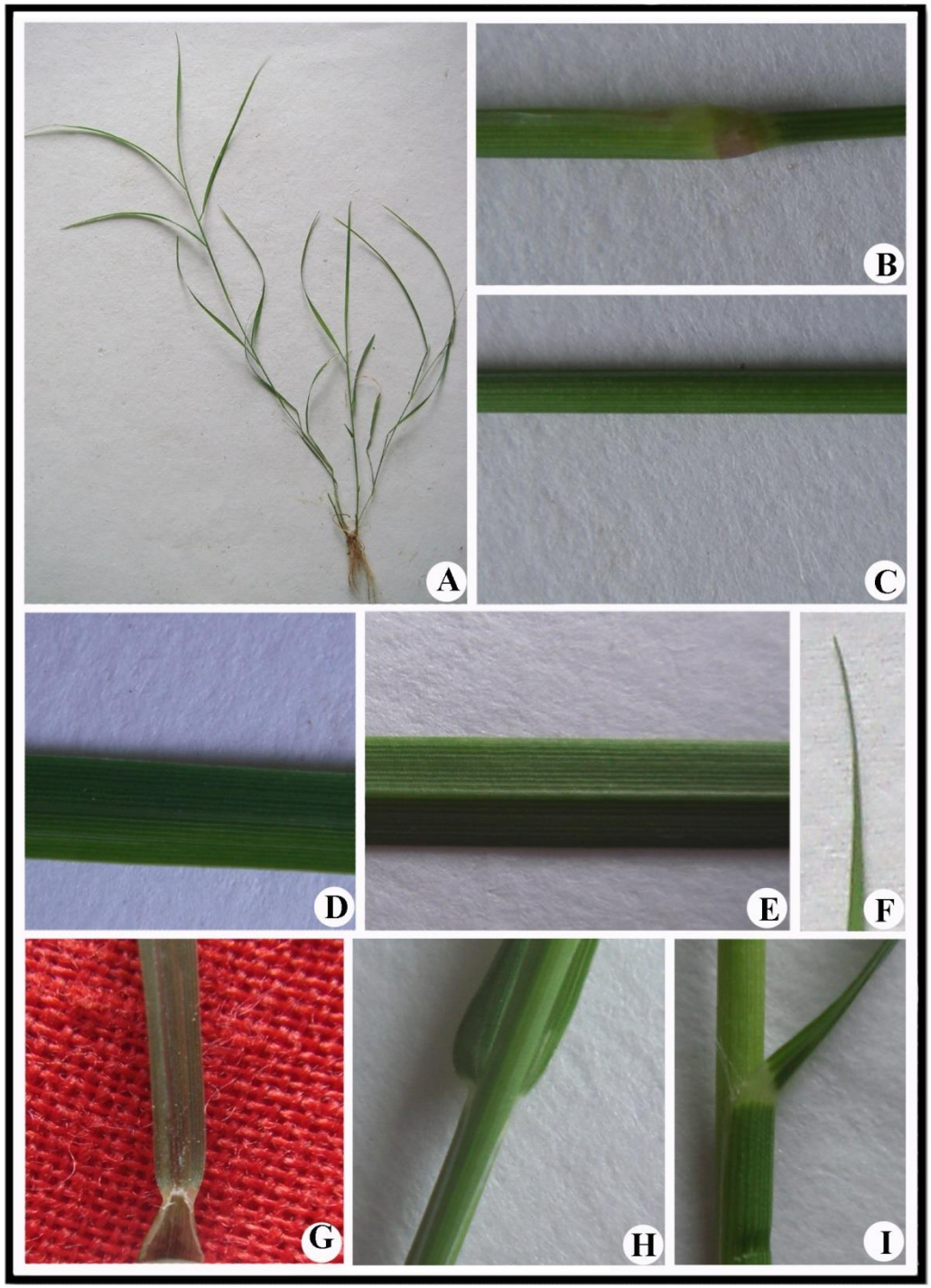


72. *Chloris montana*

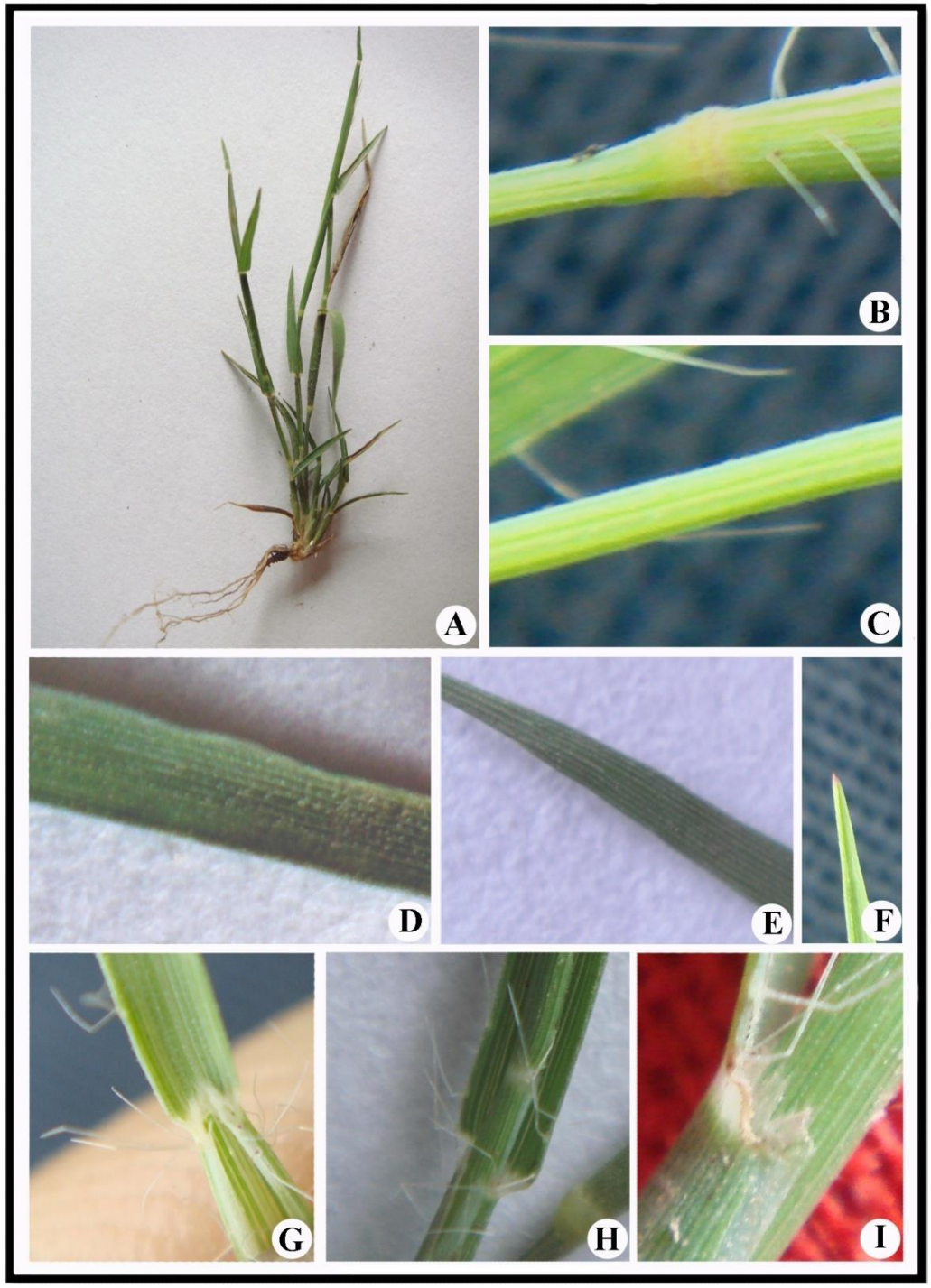


73. *Chloris virgata*

Fig. 142

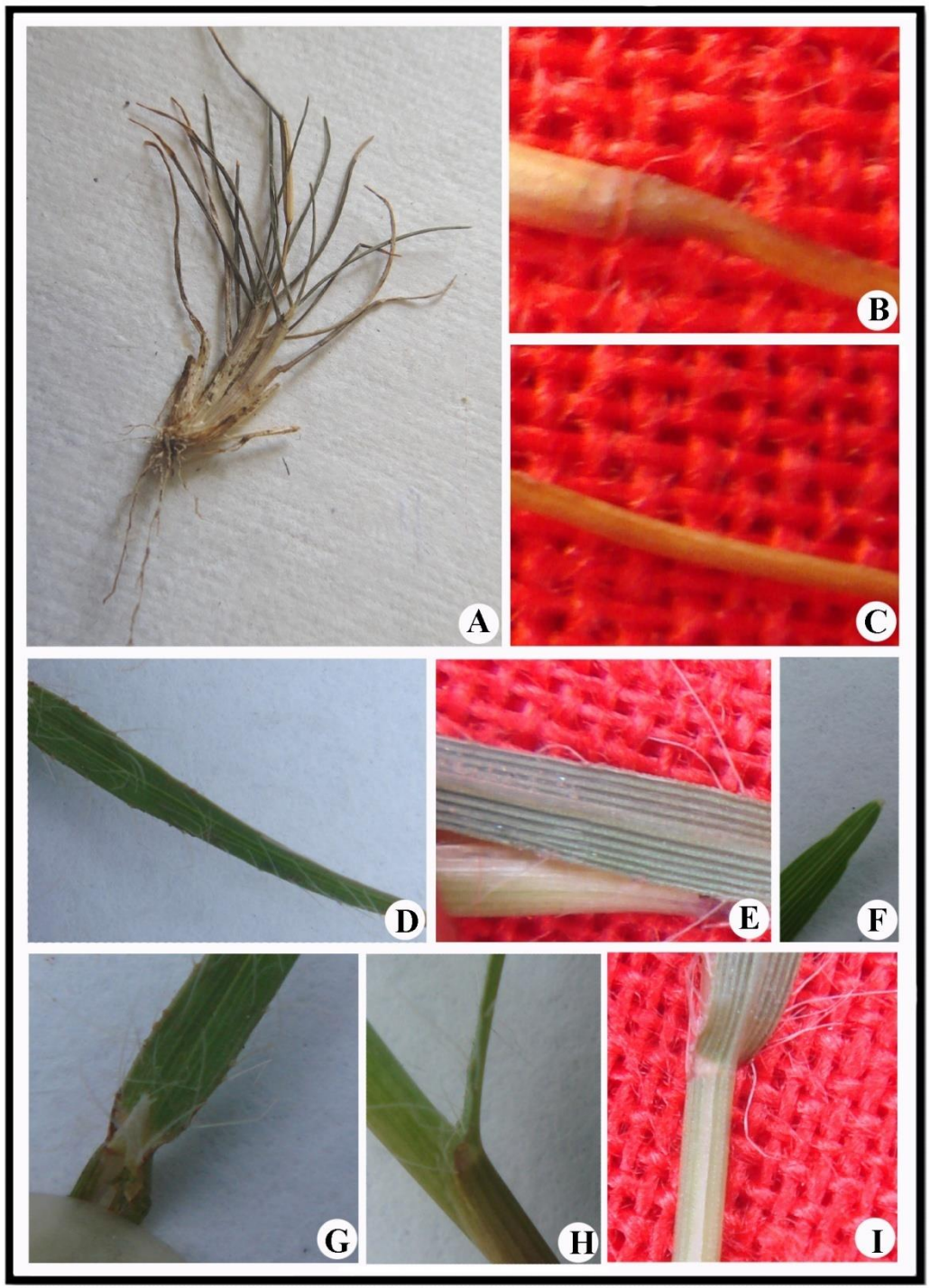


74. *Cynodon dactylon*

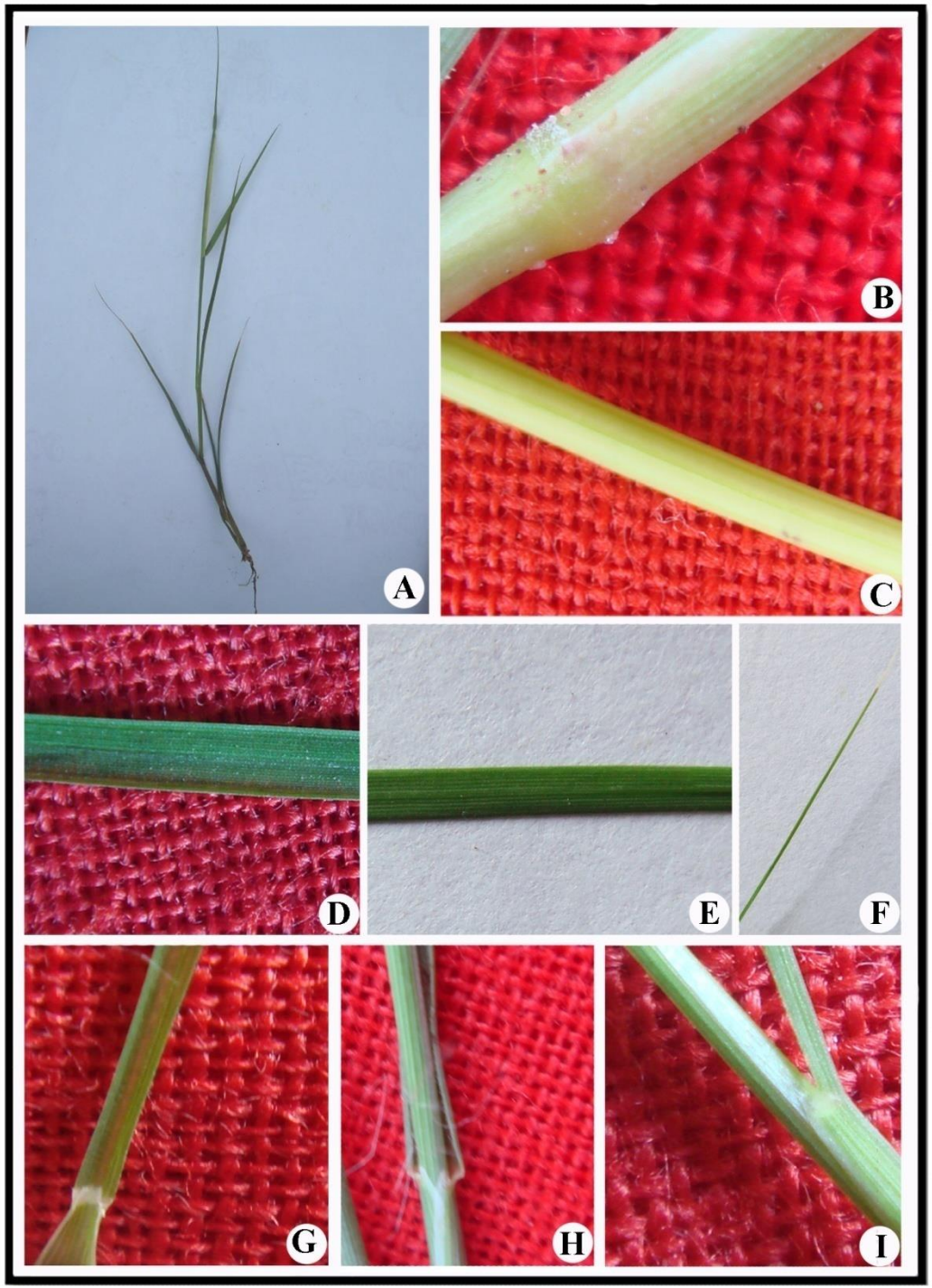


75. *Melanocenchris jacquemontii*

Fig. 143

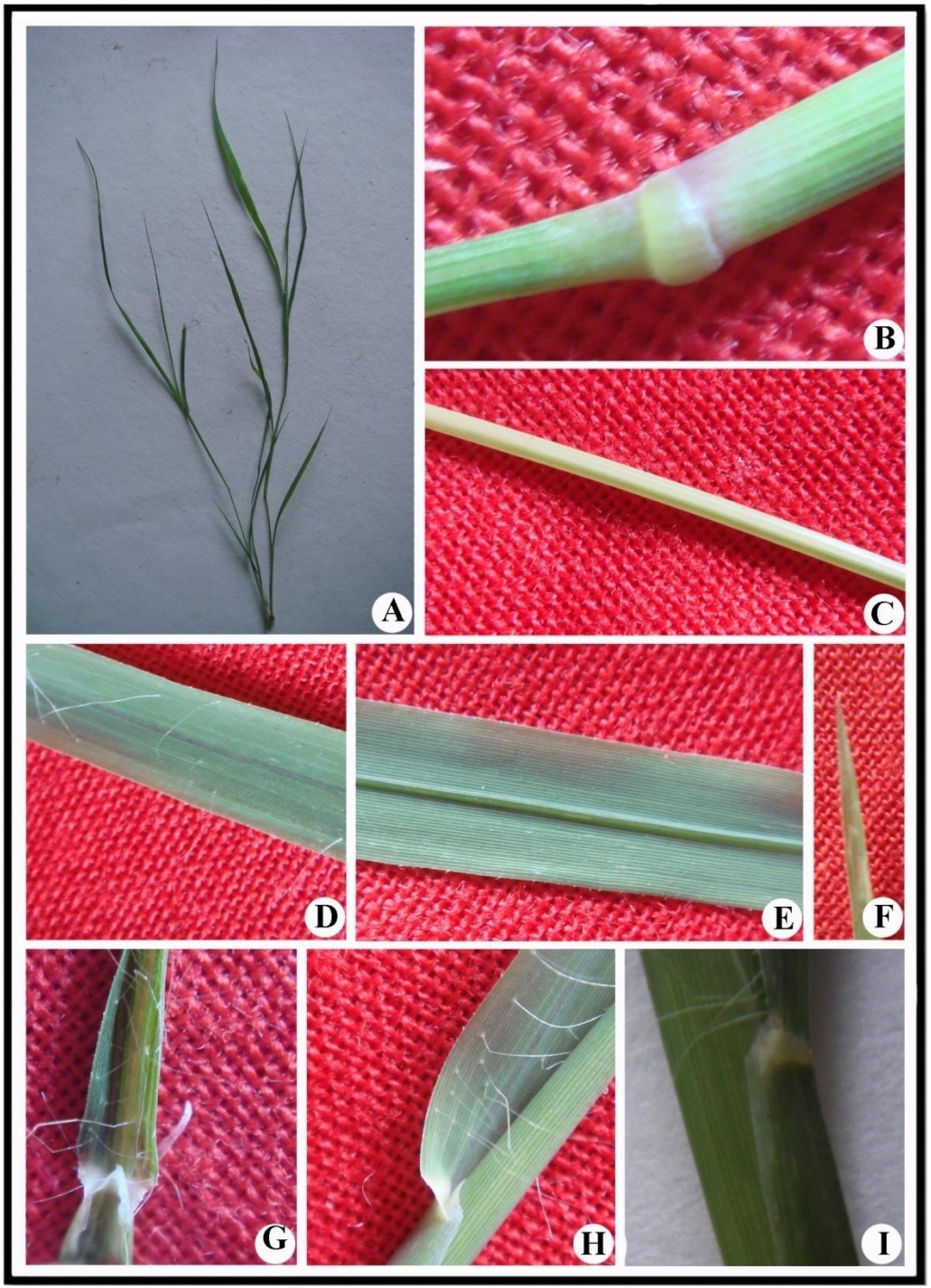


76. *Oropetium villosulum*



77. *Schoenefeldia gracilis*

Fig. 144

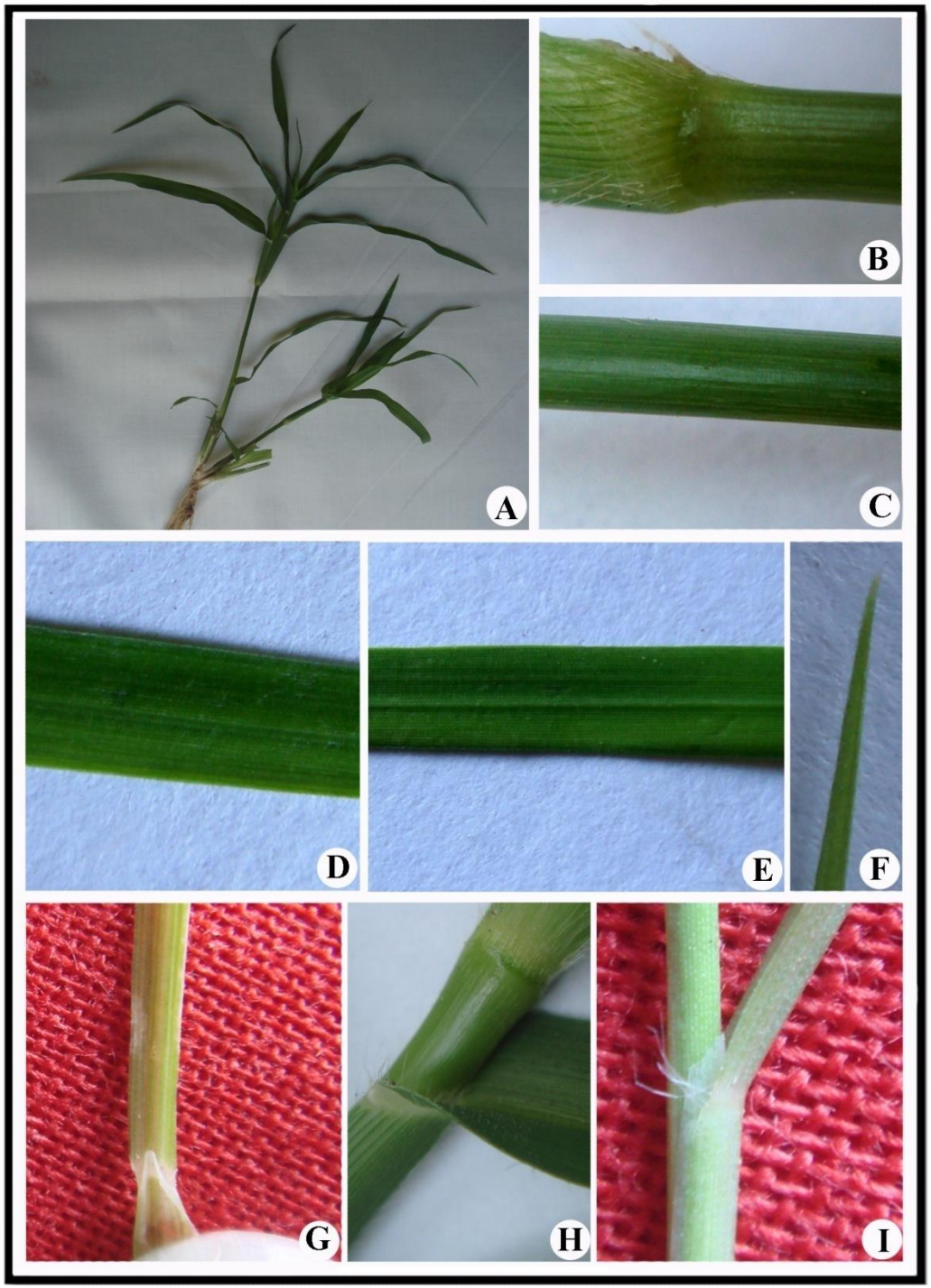


78. *Tetrapogon tenellus*

79. *Tetrapogon villosus*

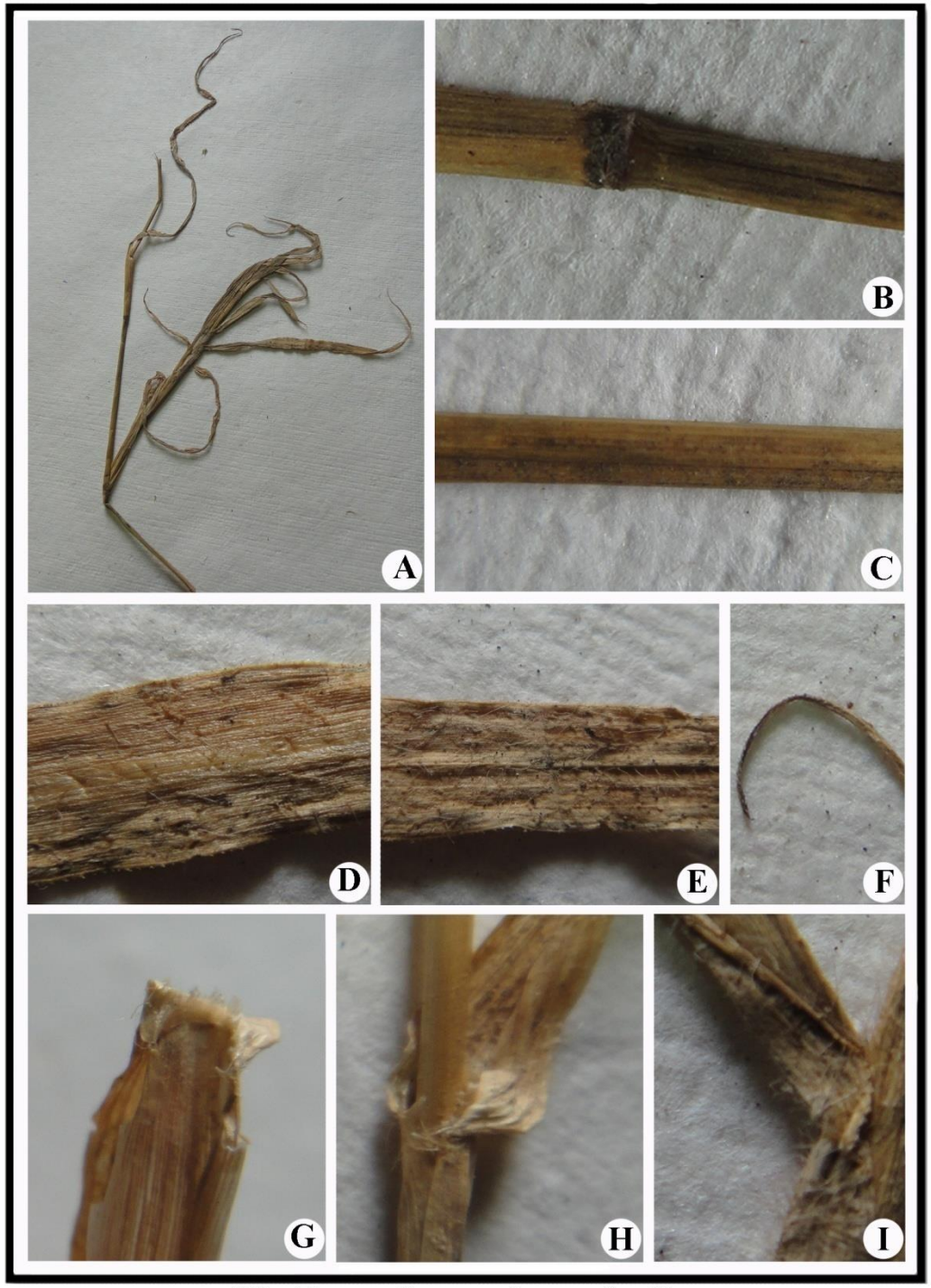
Fig. 145

80. *Acrachne racemosa*

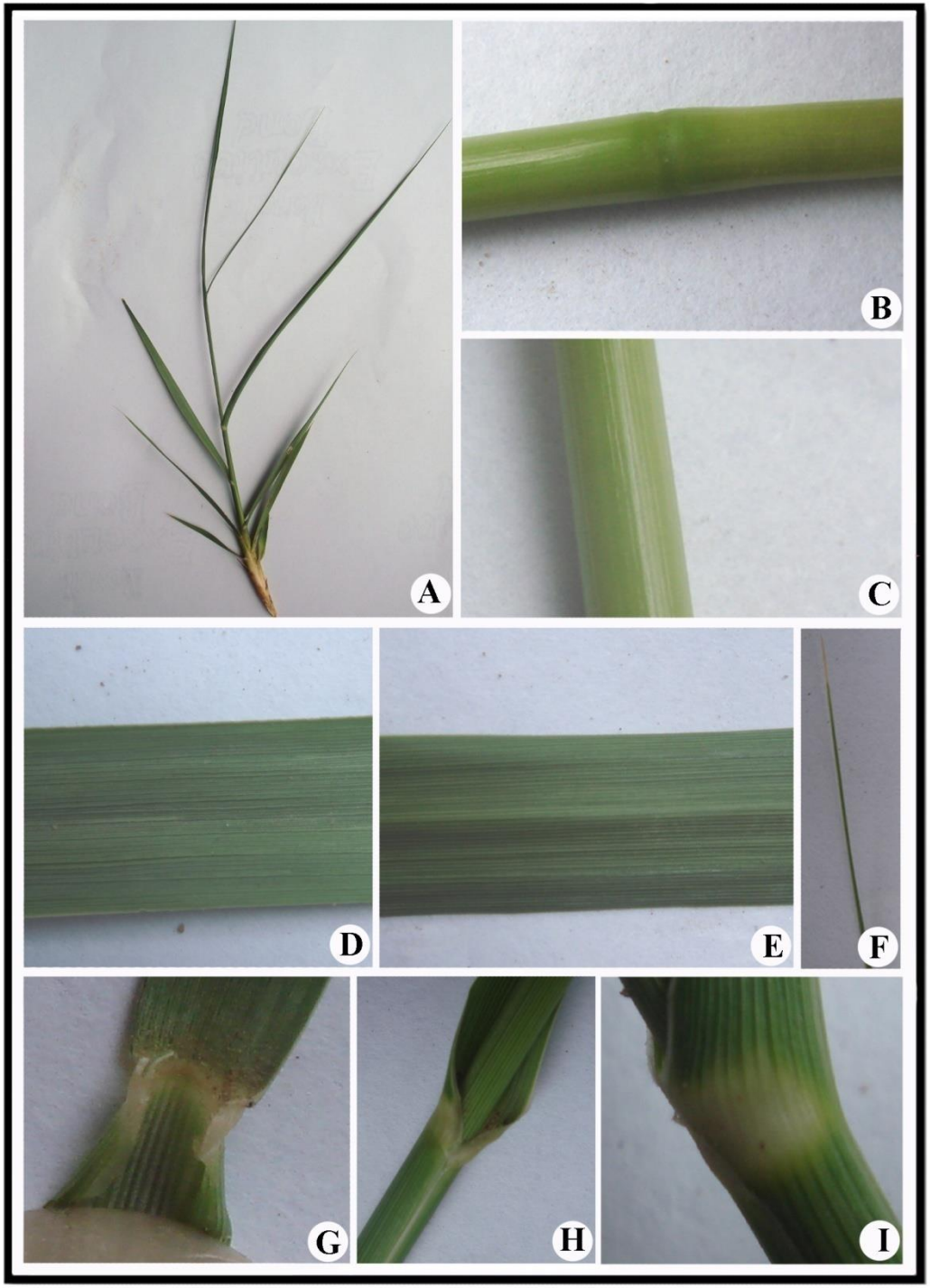


81. *Dactyaloctanium aegyptium*

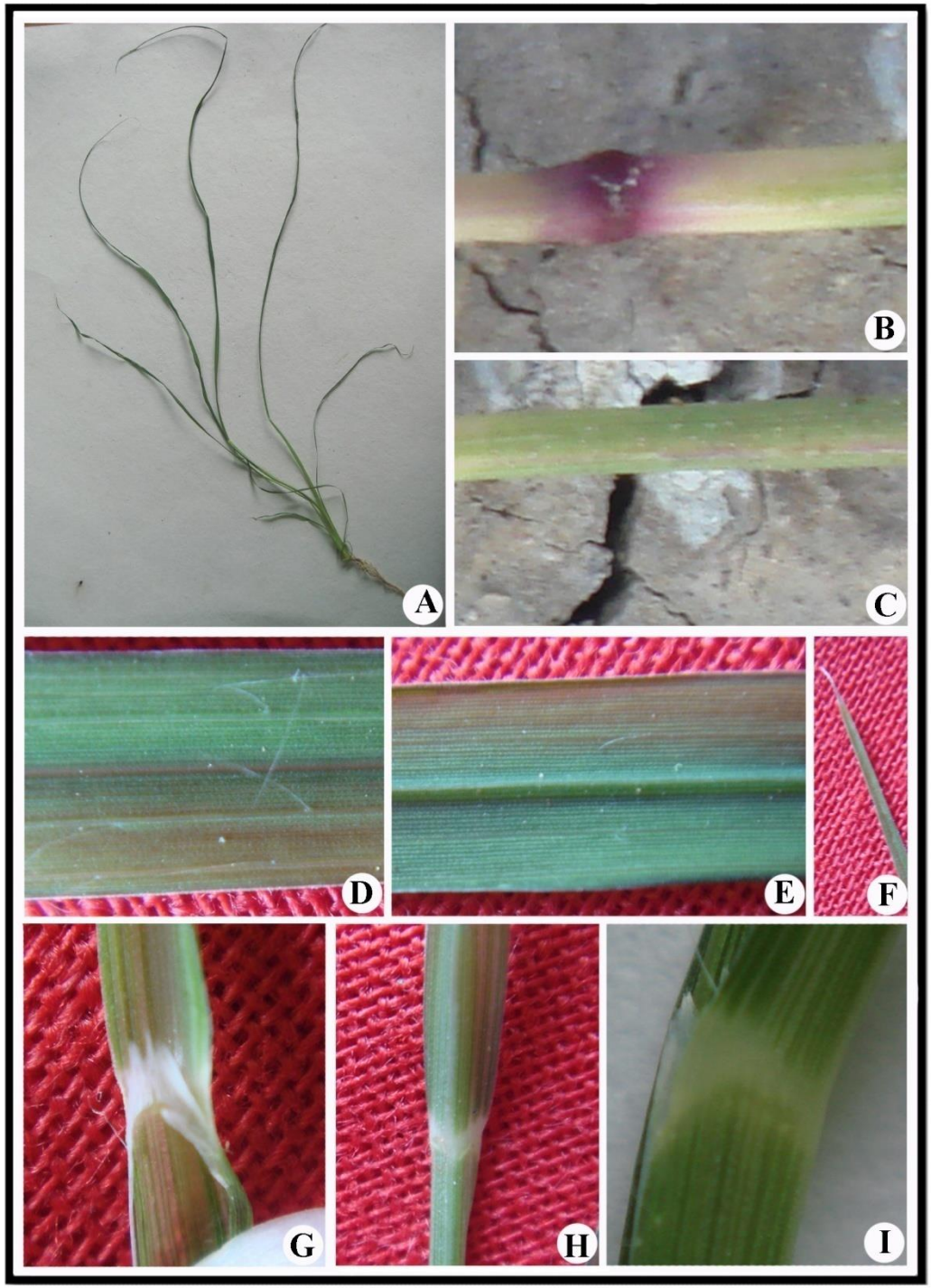
Fig. 146



82. *Dactyloctenium sindicum*

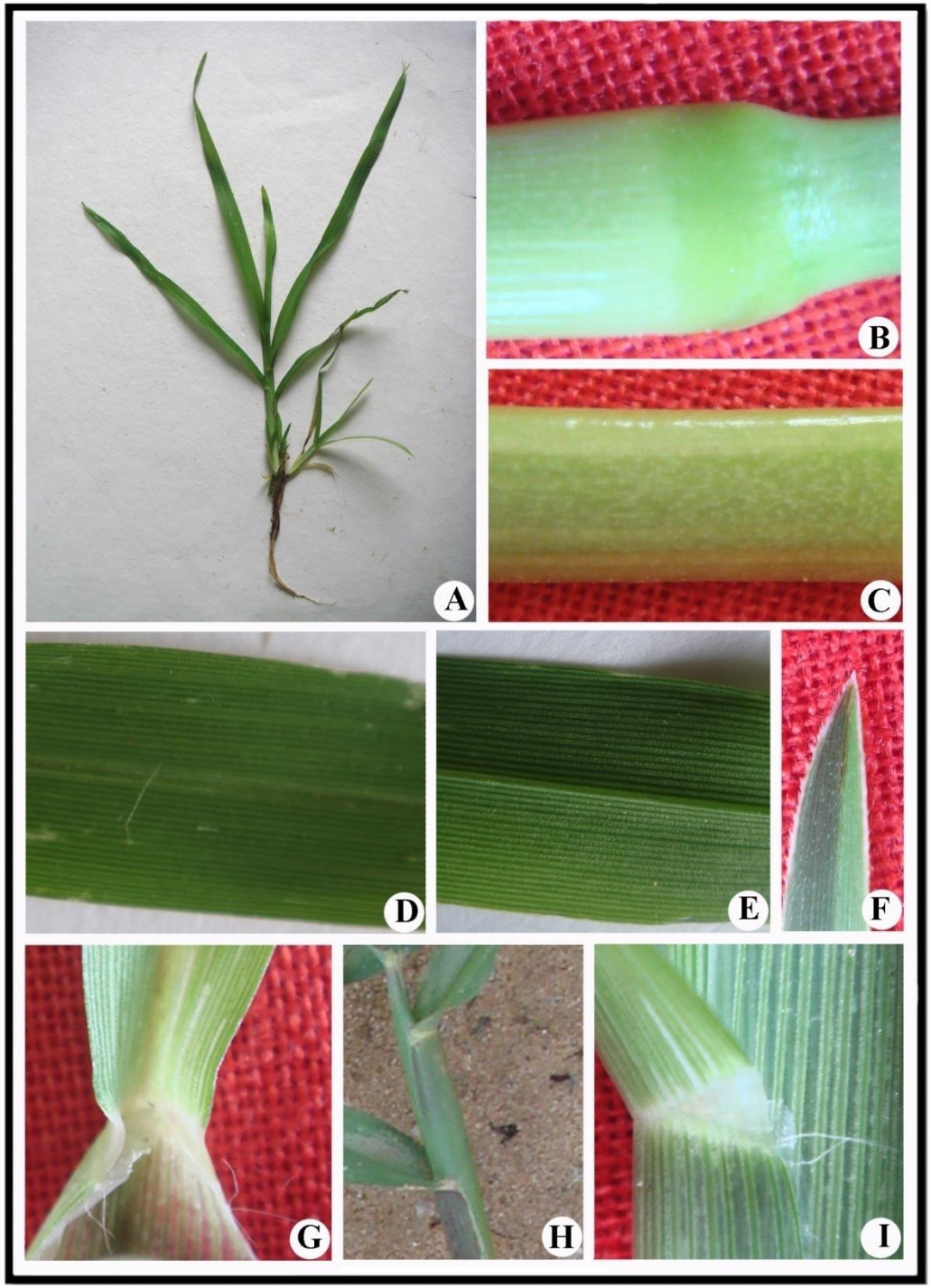


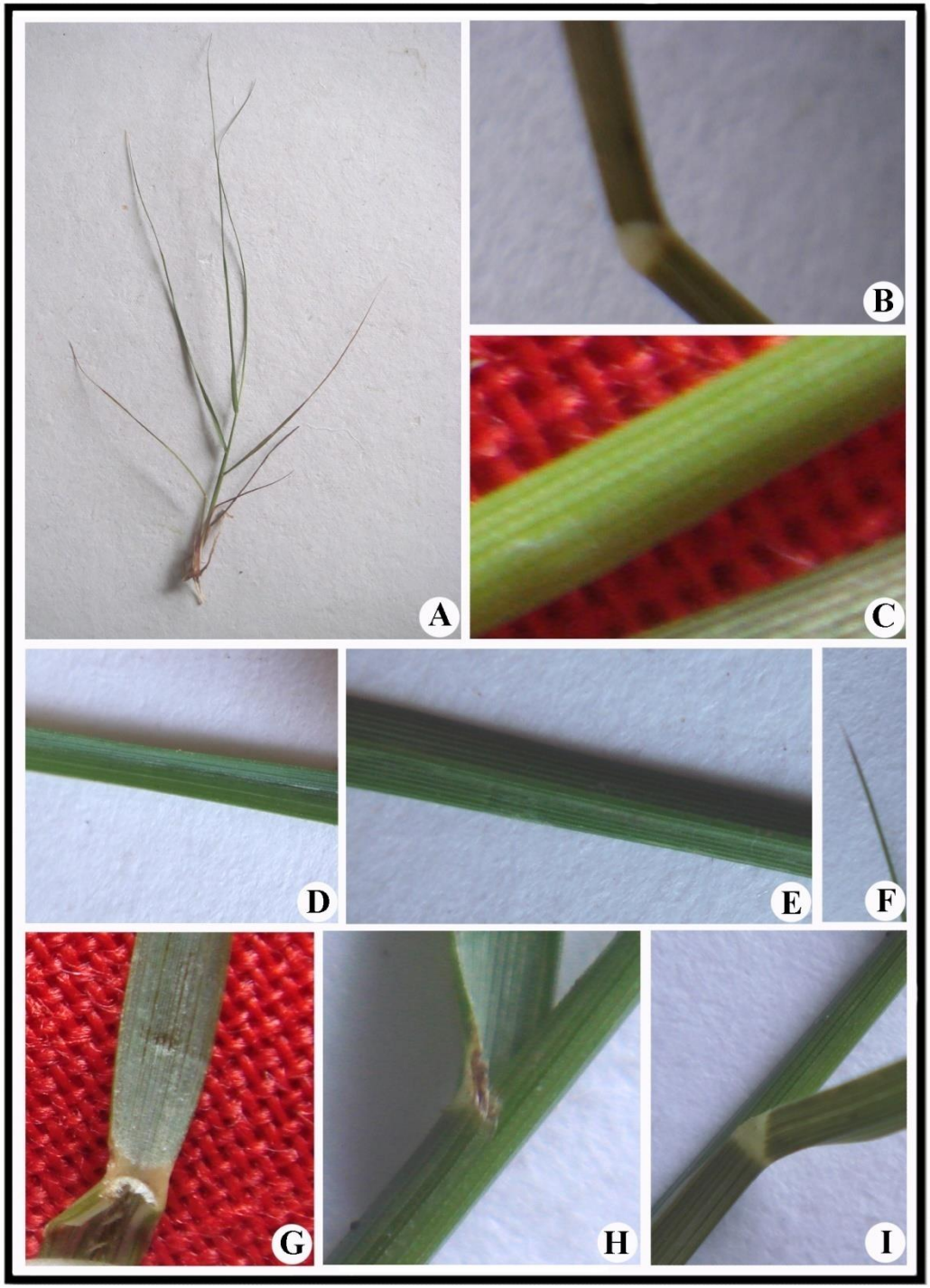
83. *Desmostachya bipinnata*



84. *Dinebra retroflexa*

Fig. 147

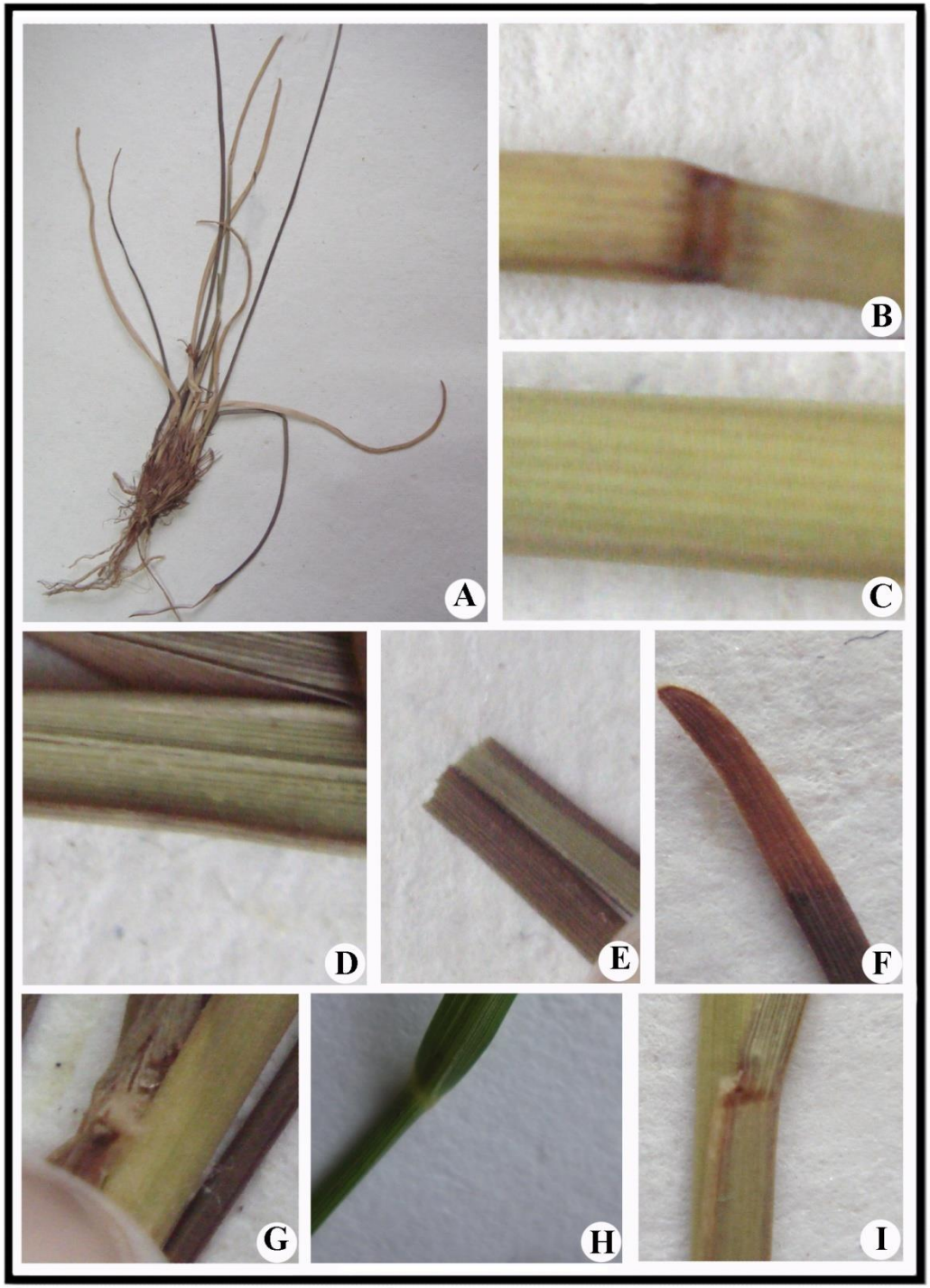




85. *Eleusine indica*

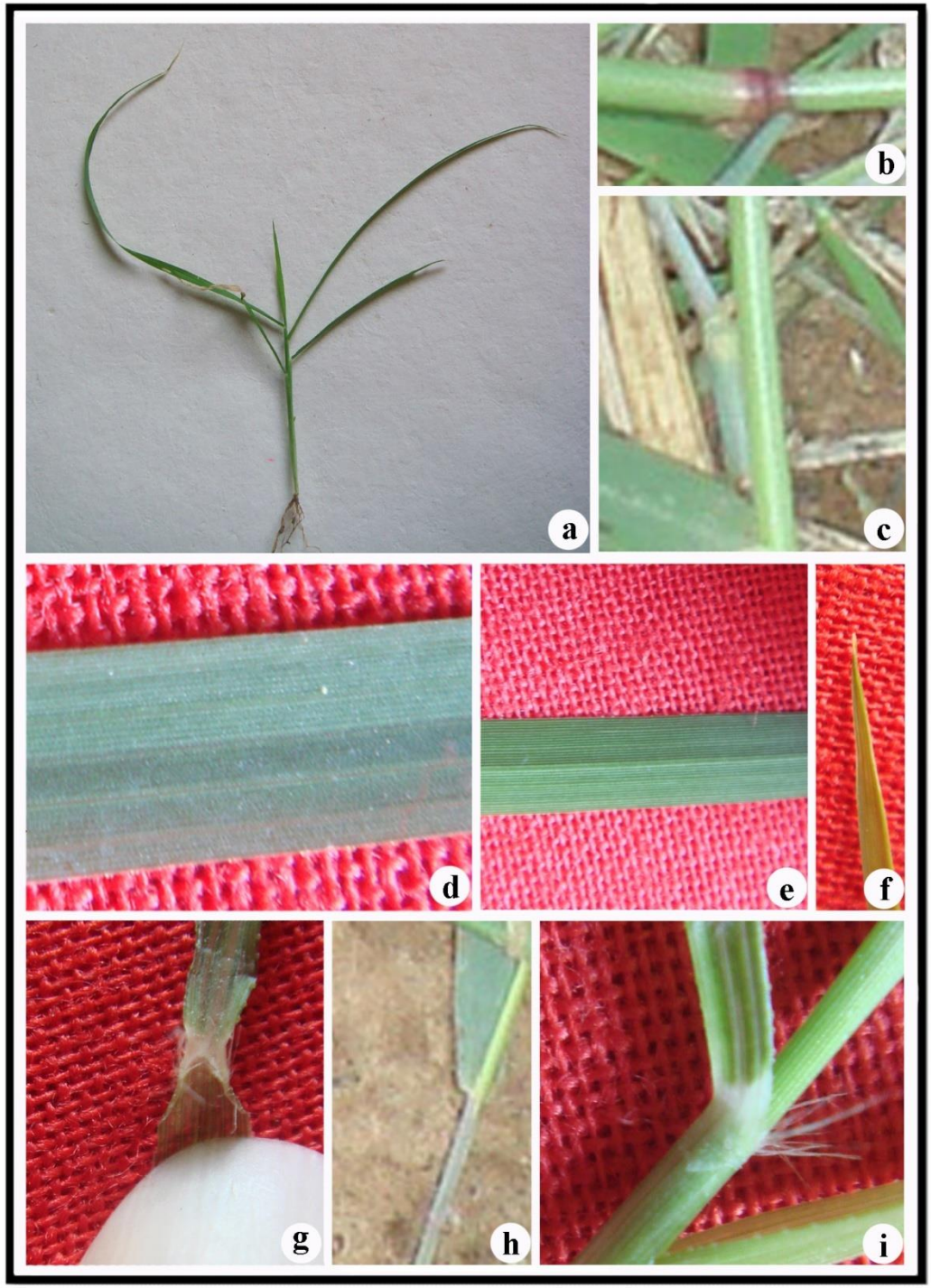
Fig. 148

86. *Eragrostiella bachphylla*

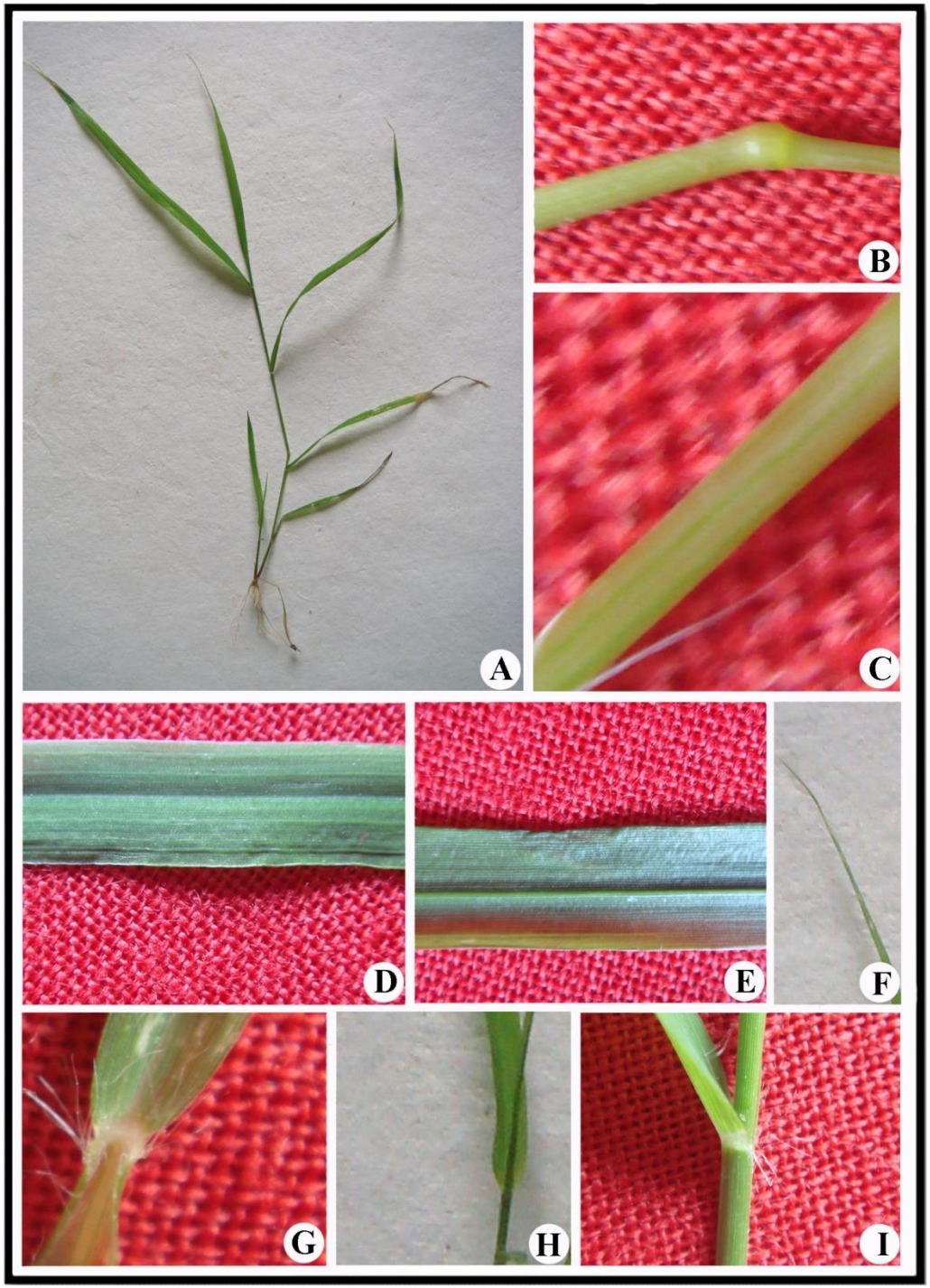


87. *Eragrostiella bifaria*

Fig. 149



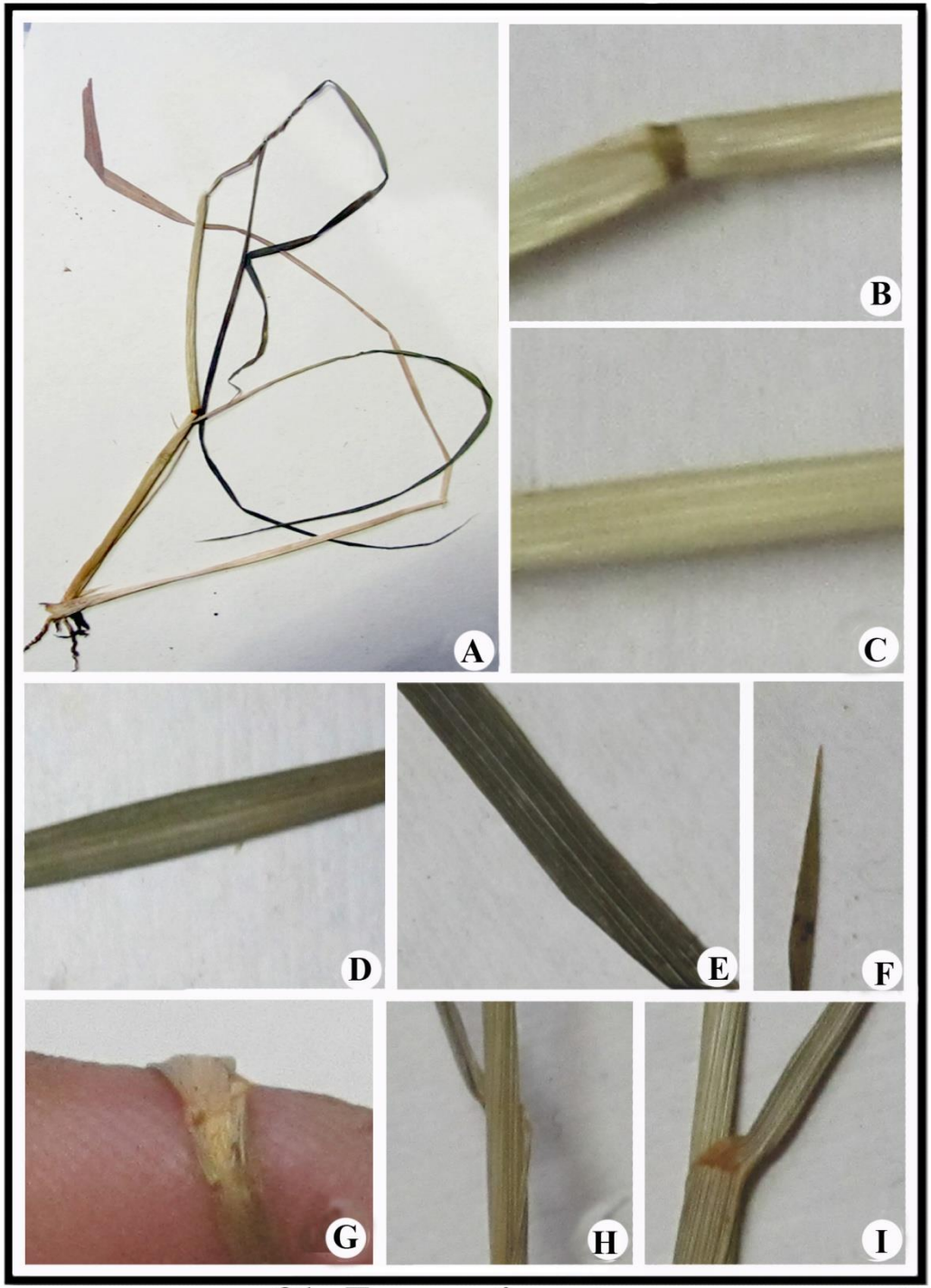
88. *Eragrostis cilianensis*



89. *Eragrostis ciliaris*

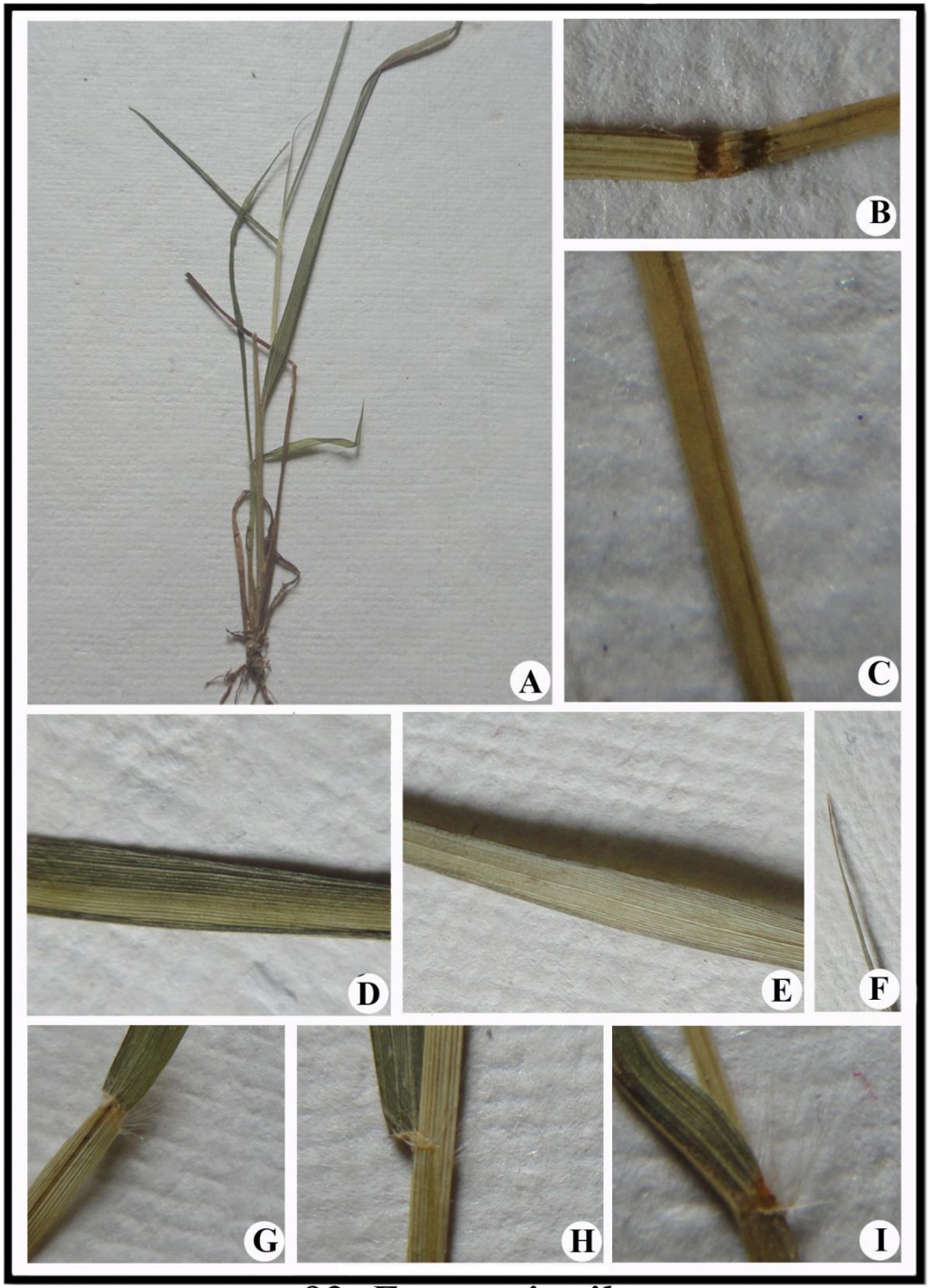
Fig. 150

90. *Eragrostis japonica*

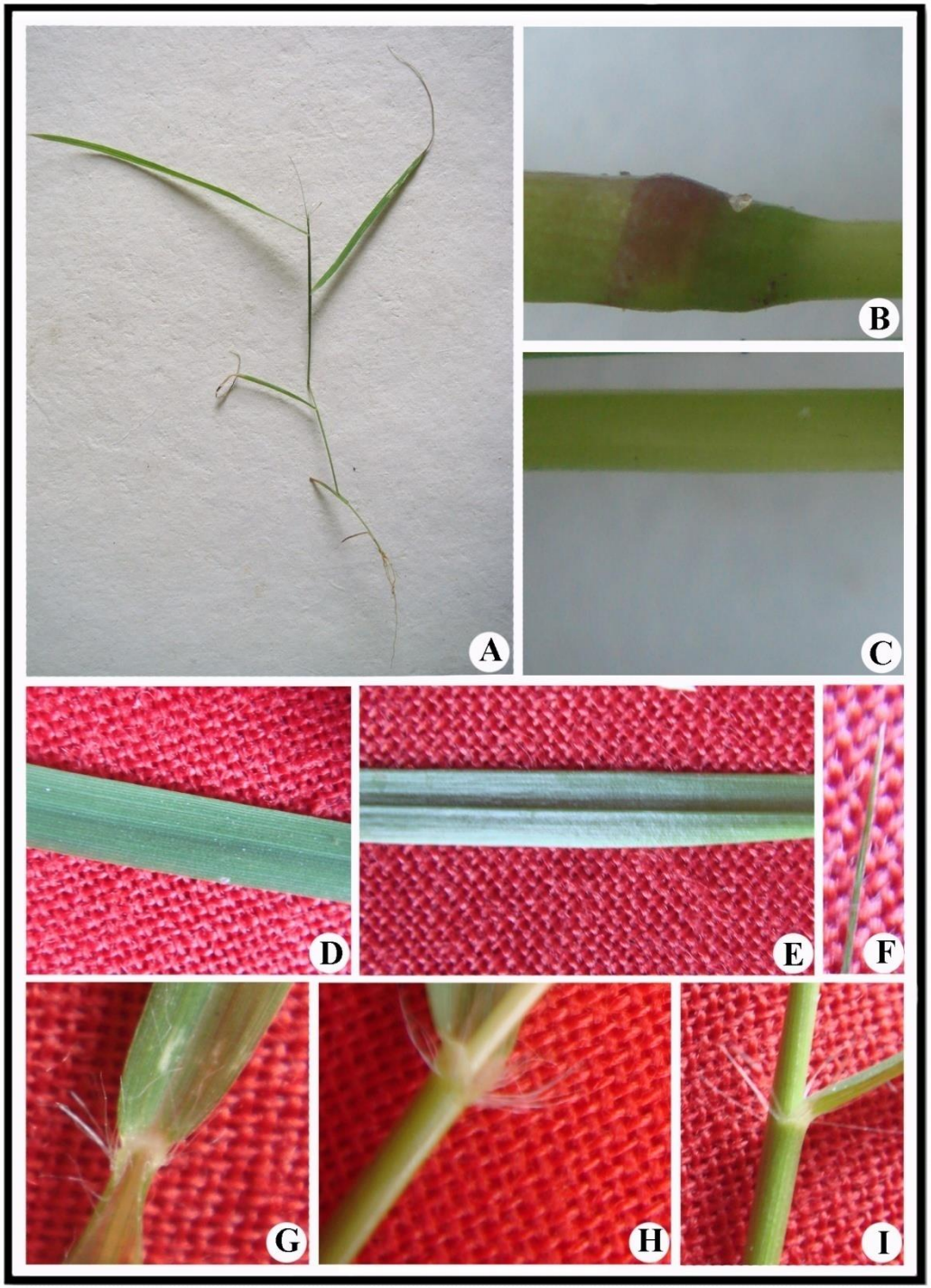


91. *Eragrostis nutans*

Fig. 151

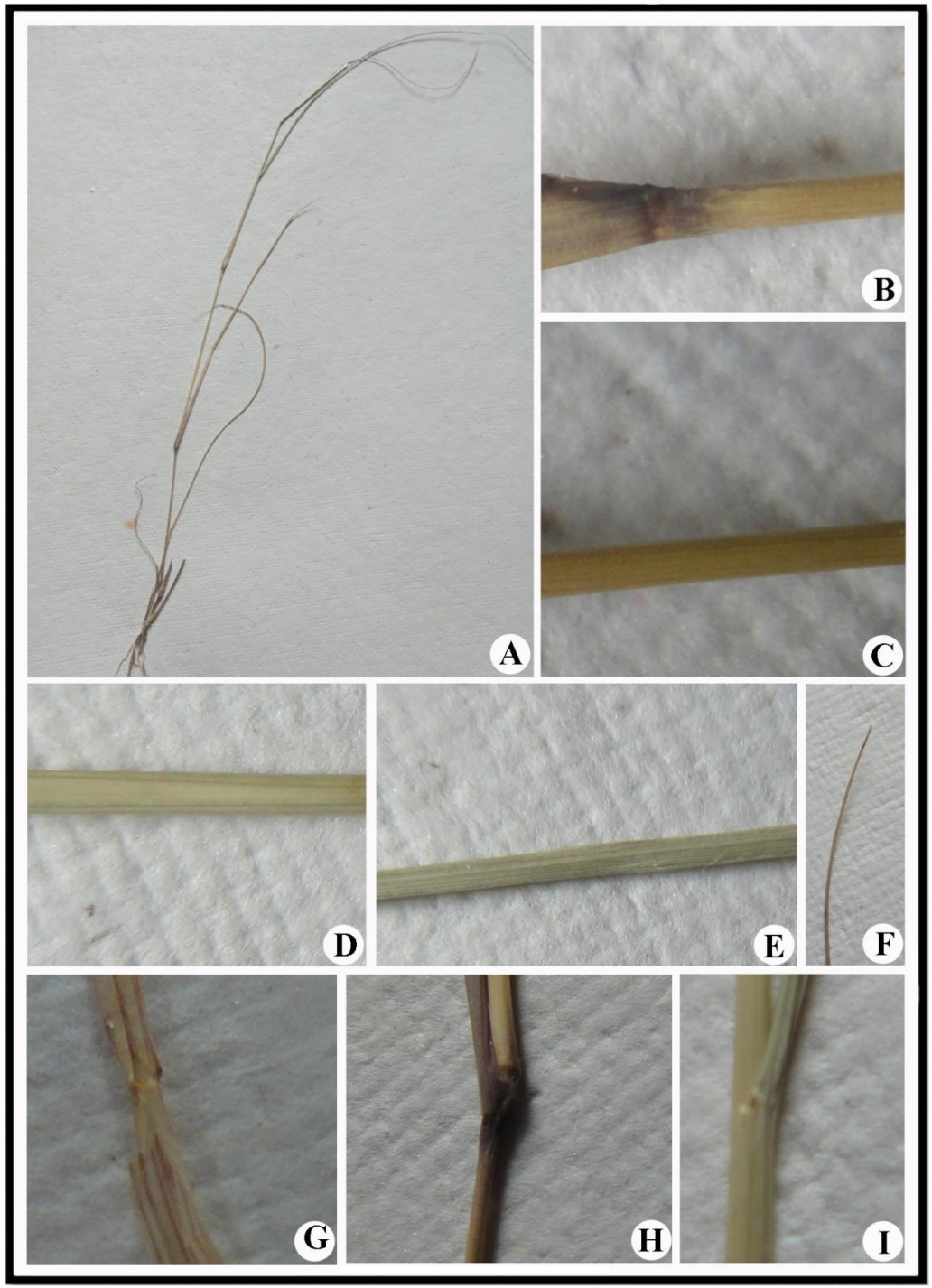


92. *Eragrostis pilosa*

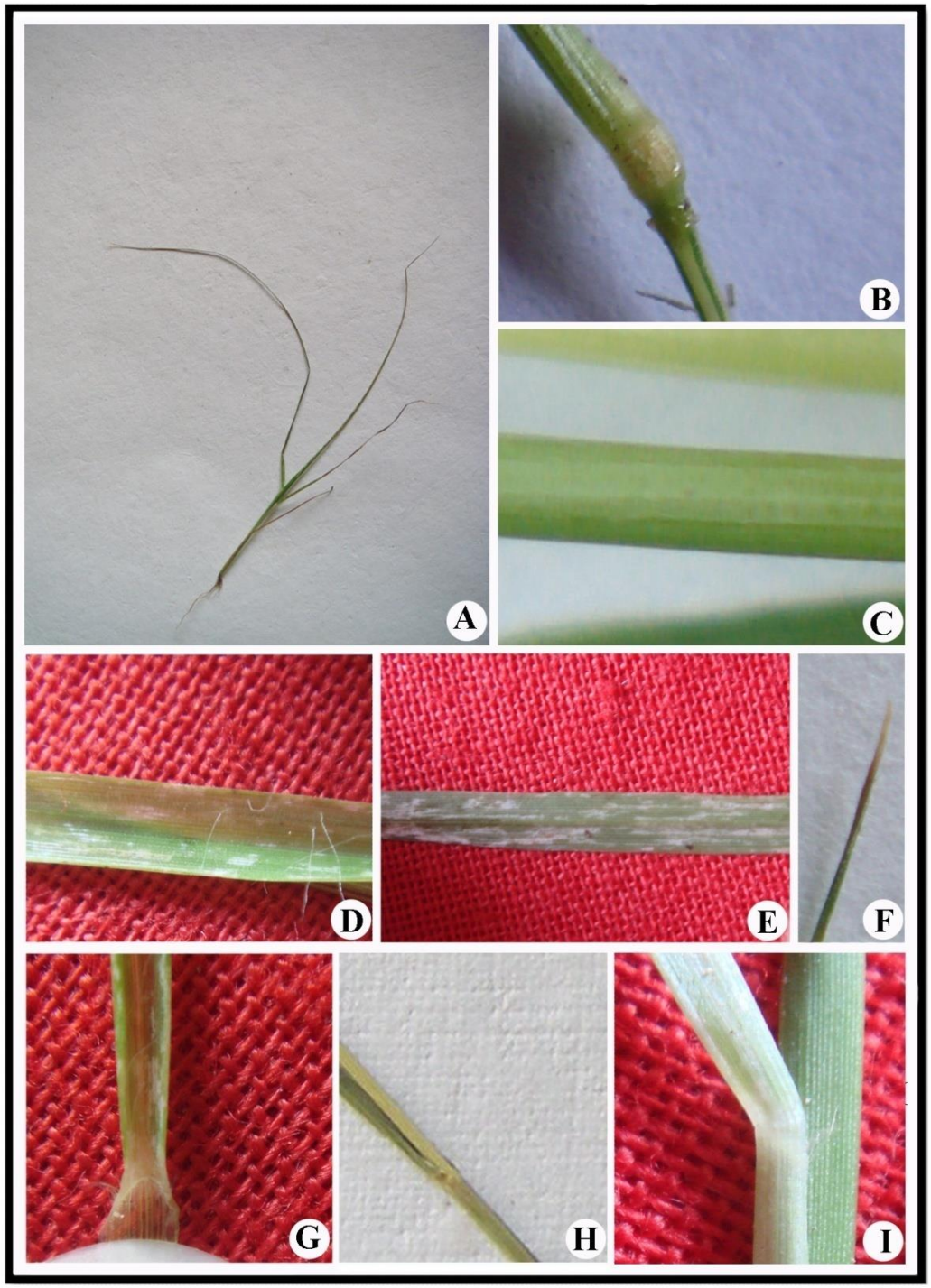


93. *Eragrostis tenella*

Fig. 152

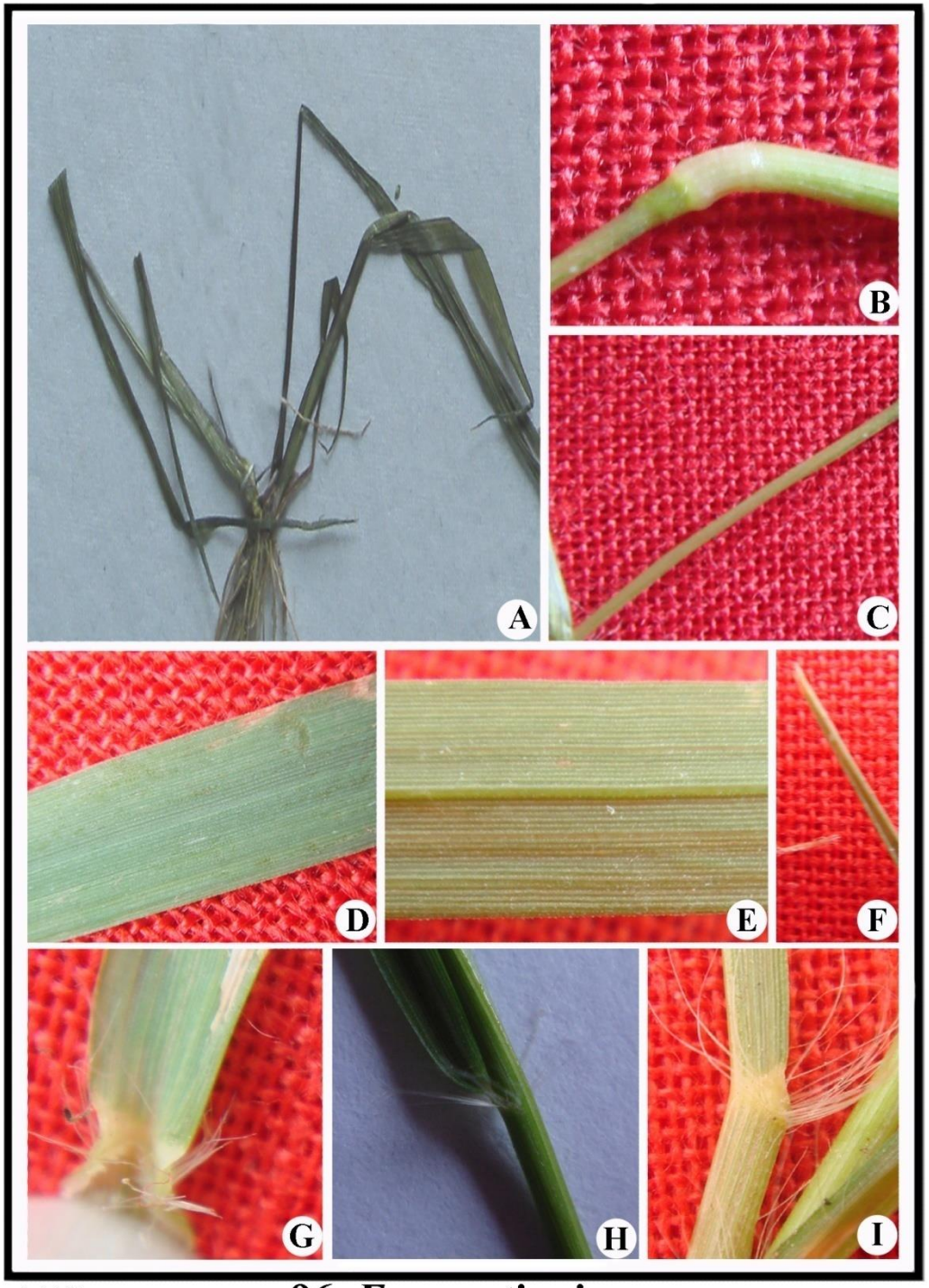


94. *Eragrostis tremula*

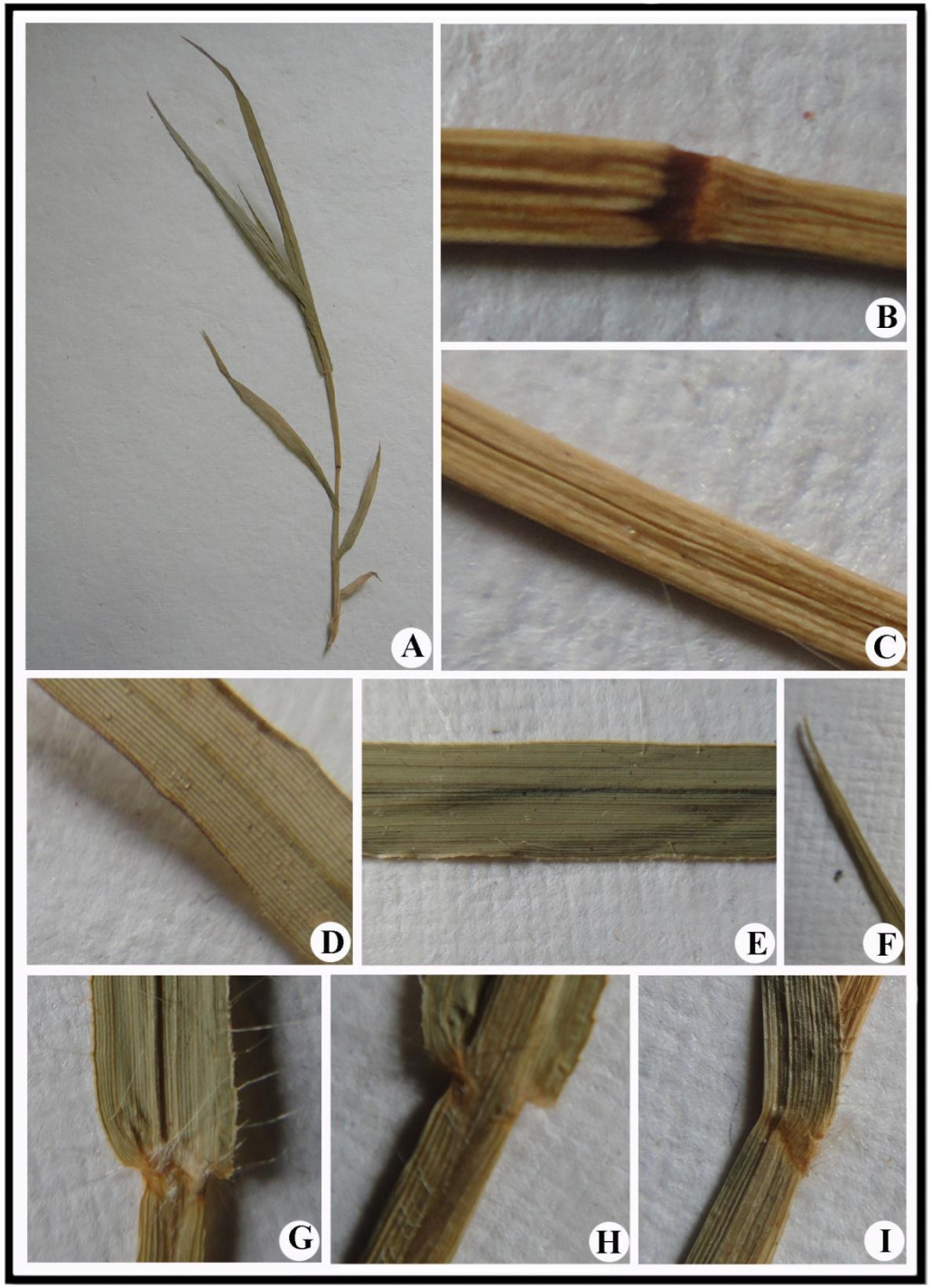


95. *Eragrostis unioloides*

Fig. 153

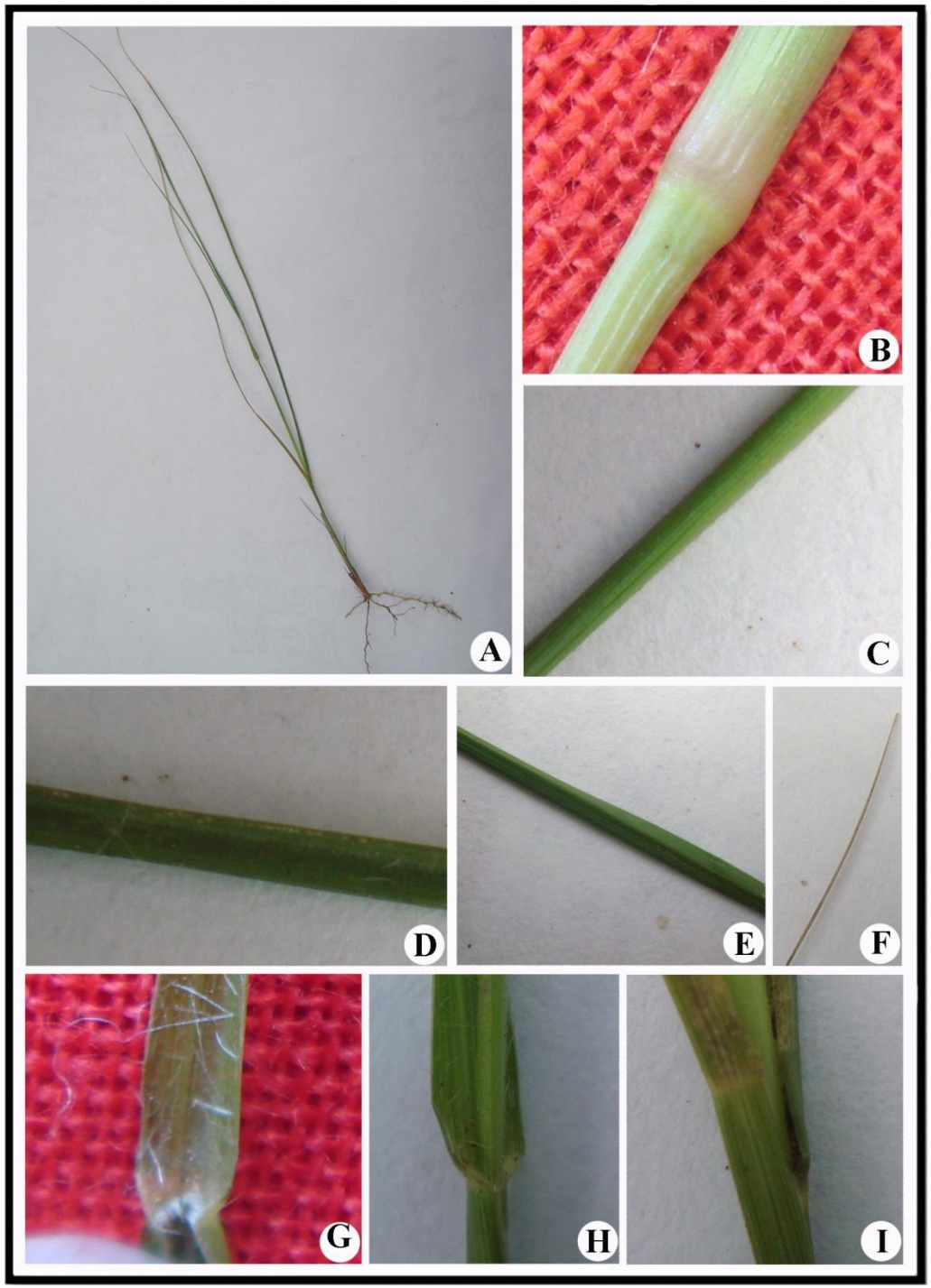


96. *Eragrostis viscosa*

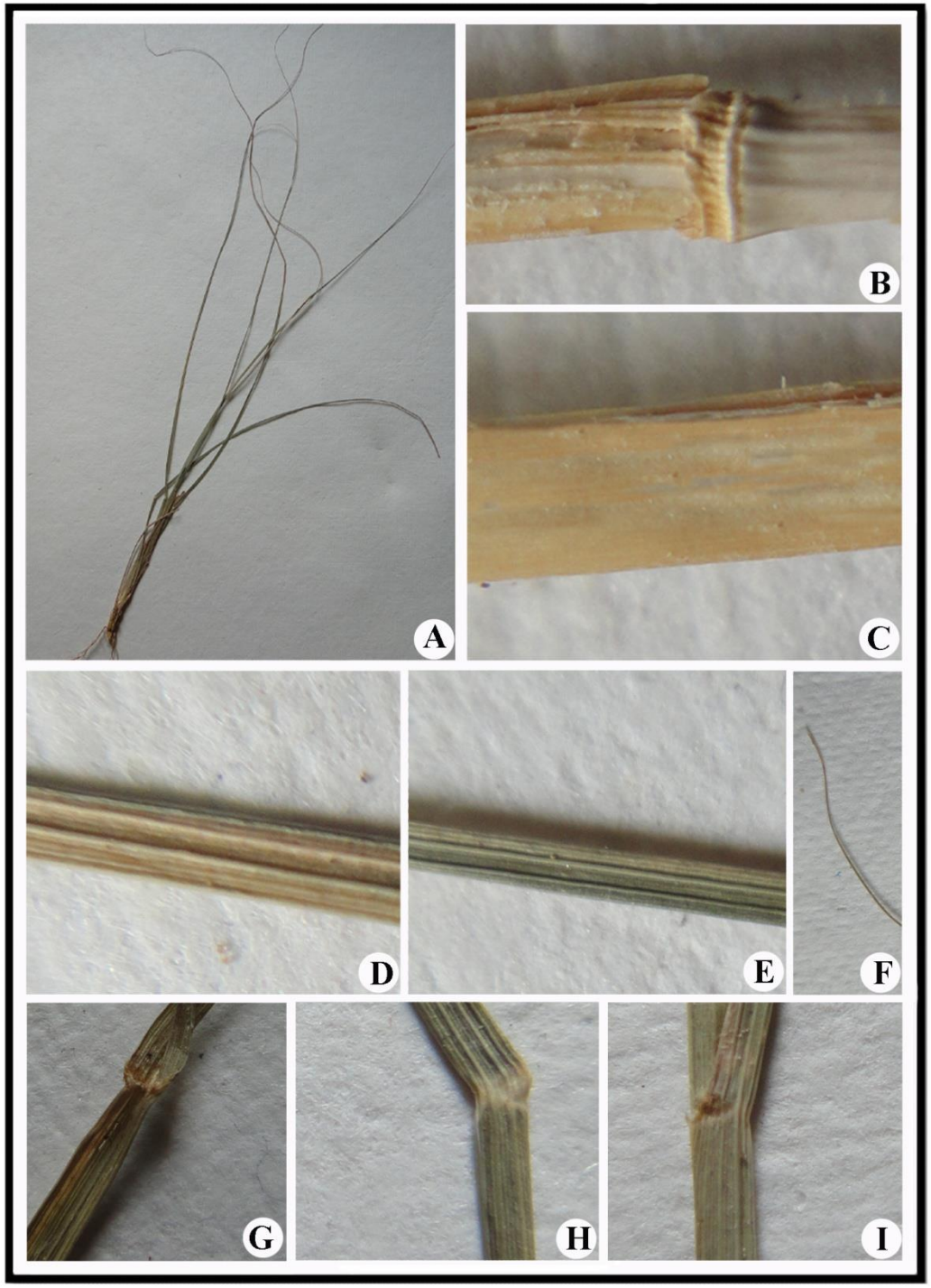


97. *Sporobolus coromardelianus*

Fig. 154

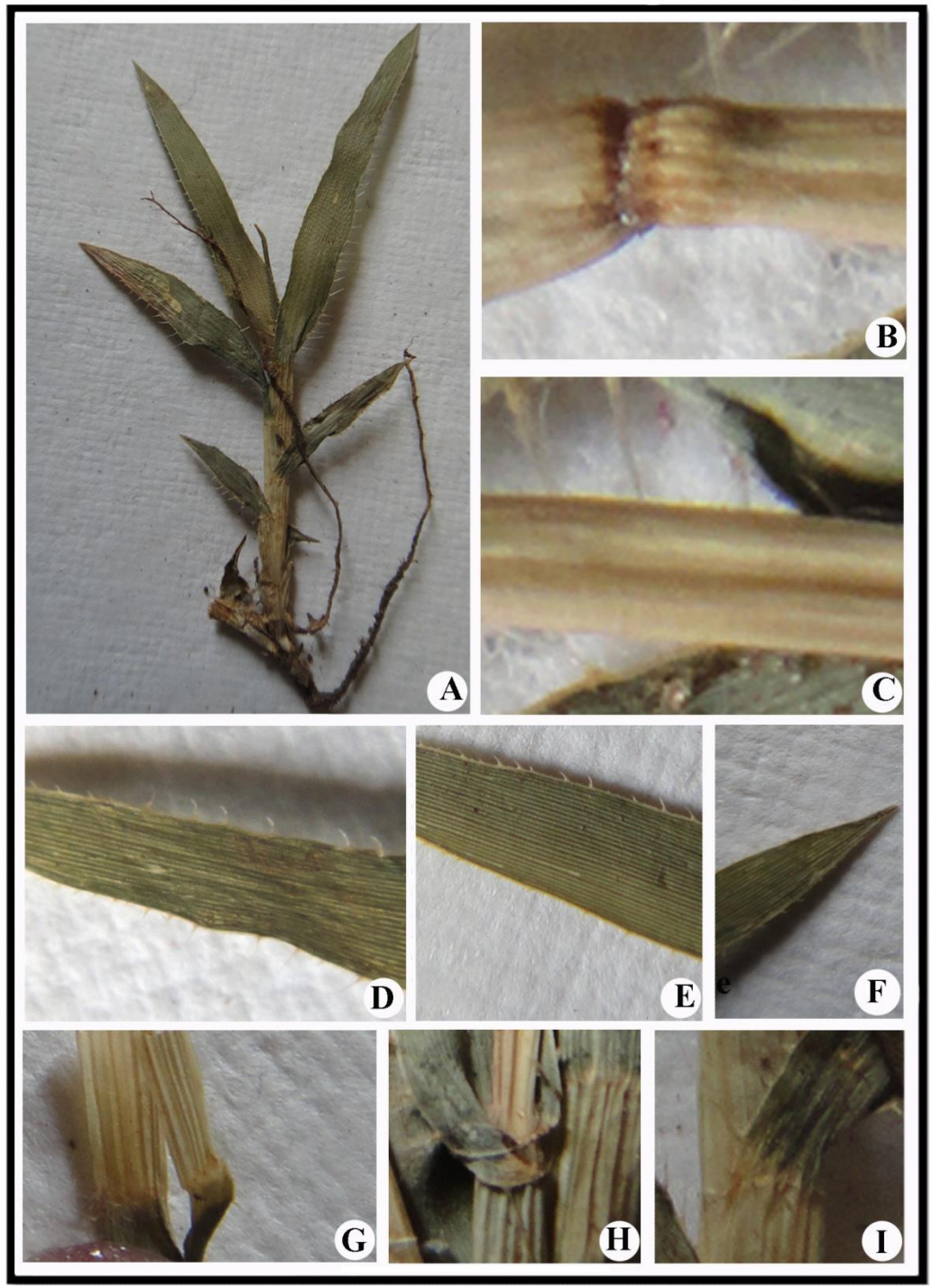


98. *Sporobolus diander*



99. *Sporobolus indicus*

Fig. 155



100. *Tragrus biflorus*

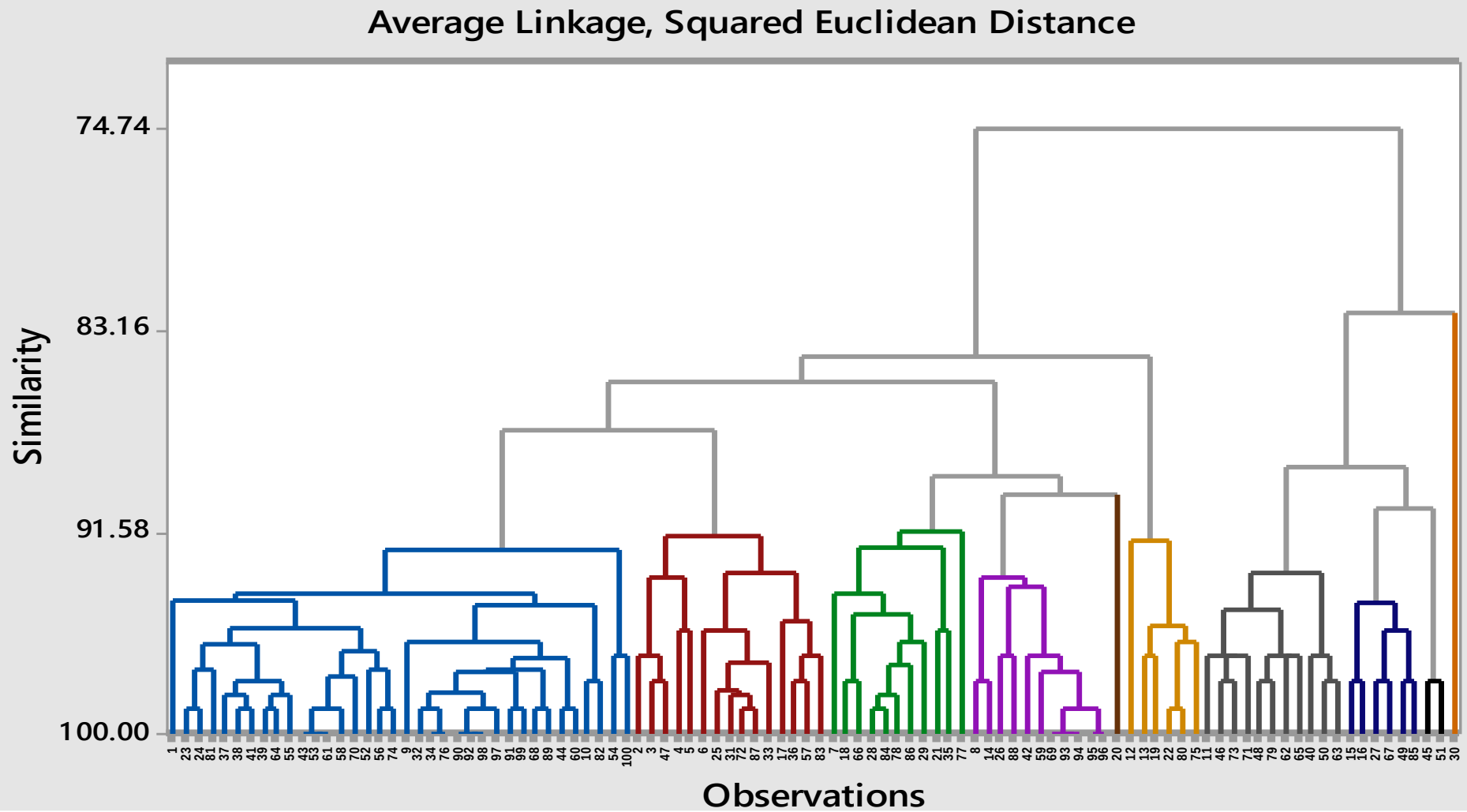


Fig. 156 A dendrogram showing clustering of grass seedlings

Discussion

The present study demonstrated that detailed studies of seedling morphology can provide morphological insights for identification of the grass species. Identification of grasses without floral parts can be a challenge. In challengeable when grasses had to identified at seedling stage.

Fishel and Bradly (2010) described 31 seedlings with one or two characters. They mainly concentrate on ligule, leaf and auricle. Among their studied plants *Cynodon dactylon, Sorghum halepense* and *Echinochloa crusgalli* were also studied in present study. According to them in *Cynodon dactylon* auricle was absent and short membranous ligule with hairs at margin but in present study found that ligule is present in form of fringe of hairs.

Guo and Clifford (1993) studied 201 species of 83 genera in Poaceae and they perform cluster analysis. They divided species into four clusters, namely, Festucoid, Panicoid, Bambusoideae and Eragrostidoid. Among their studied species 10 species from cluster Panicoid and 4 species from Eragrostidoid and Bambisoideae clusters were also studied in present study.

Hockenberry and Gaynor (2000) worked on 15 native grasses of St. Paul, MN. Out of his studies only one species was matched with present study, i.e. *Ecinochloa crusgalli.* There were many workers who specially work on *Echinochloa crusgalli* (Hockenberry and Gaynor, 2000; Spearman *et al.,* 2000;Bockenstedt *et al.,* 2001). This grass was native grass for many places. They described the characters like absence of ligule, absence of auricle, hairless leaf blades and sheaths, etc.Hockenberry and Gaynor (2000) only described about rolled stem/shot while other workers described flattened stem/shot. In the present study also found that *Echinochloa crusgalli* had rolled stem/shot. In the present study three species of *Echinochloa*were studied, namely, *Echinochloa colona*, *Echinochloa crusgalli*and*Echinochloa stagnina. Echinochloa colona*and *Echinochloa crusgalli* shows absence of ligule while *Echinochloa stagnina* shows prescence of hairy ligule. All of three shows absence of auricle.

Surrency *et al.* (2006) developed seedling identification guide for the native grasses in Southeast. Especially they worked on native warm season grasses of Alabama, Gerogia and South Carolina. They were studied only 5 native grasses.

Wintel *et al.* (2009) studied on subtropical grass seedlings. They worked on 7 grass seedlings. Out of them *Panicum maximum* was also described in present study. According to Wintle (2009) *Panicum maximum*had smooth leaf surface and erect growth habit, other features were not described. *Panicum antidotale, Panicum maximum, Panicum miliaceum* and *Panicum trypheron* were described in present study and they all showed glabrous nodal and leaf blade. In these species, *Panicum trypheron* hadrolled vernation while other showed folded vernation. Out of remaining species *Panicum miliaceum* showed acute leaf tip while other have acuminate leaf tip. *Panicum antidotale* showed short minute rim of hairs type of ligule while *Panicum maximum* had membranous, ciliolate ligule.

Spearman *et al.* (2000) worked on weeds of pastureds, hayfields and sprayfields. They studied around 9 grass seedlings. They observed characters like ligule, auricle and leaf. Among the studied species, four species (*Echinochloa crusgalli, Eleusine indica, Setaria gluca, Panicum maximum*) also studied in present study. In the present study three species of *Setaria* were studied. *Setaria glauca* and *Setaria tomentosa*, showed presence of membranous ligule while in *Setaria verticilalta* ligule had fringe of long hairs which matches with Paniceae members.

Bockenstedt *et al.* (2001) worked on field guide to wetland and buffer plant seedlings of Minnesota. They also studied *Echinochloa crusgalli* and *Setaria gluaca.* They reported that *Setaria gluca* had hairless sheath, flattened stem and long hairs are present at the base of the leaf blade. In present study also observed these characters. James (2009) studied on grass weeds of Arable crops. He studied few grass seedlings. Among them *Cynodon dactlon, Echinochloa crusgalli, Eleusine indica, Setaria verticillata, Panicum miliaceum* were also studied in present study. He observed that *Cynodon dactlon* had short ligule, auricle absent, rounded sheath,*Echinochloa crusgalli*showed absence of ligule, absence of auricle, flattened sheath, *Eleusine indica* had thin fringe ligule, flattened sheath, *Setaria verticillata*had flattened sheath, hairy ligule, absence of auricle, *Panicum miliaceum*had hairy ligule, absence of auricle, hairy sheath, rounded stem.

In *Dicanthium annulatum* and *Dicanthium caricosum* the type of ligule and the nodal features are same but there is a variation in the length and concentration of the hairs. In *Dicanthium annulatum* the hairs which are present at nodal region are short in length while in the *Dicantium caricosum* the length of hairs are more and the concentration of hairs are low in *Dicanthium caricosum* than the *Dicanthium annulatum.*

In, *Heteropogon contortus var. genuinus sub var. typicus, Heteropogon contortus var. genuinus sub var. hispidissimus,Heteropogon ritchiei, Heteropogon triticeus* nodal feature and the growth habit is same. *Heteropogon triticeus* has a divided collar while other three species have continuous collar. Than *Heteropogon ritchiei* has small and rudimentary auricle while remaining two species do not have auricle i.e. auricle is absent. The two varieties of *Heteropogon contortus* shows almost same features including the keeled leaf tip but the type of leaf tip is differ, *Heteropogon contortus var. genuinus sub var. typicus*has acuminate leaf tip and*Heteropogon contortus var. genuinus sub var. hispidissimus*have acute type of leaf tip.

In *Ischaemum* species, glabrous nodal region is a common feature. But these species are differentiated on the basis of their ligule, collar and leaf tip feature. *Ischaemum indicus*is differentiated from the *Iscaemum molle, Iscahaemum rugosum and Ischaemum pilosum* on the basis of the leaf tip feature which is acute. From remaining species *Ischaemum rugosum* is differentiated on the base of the collar region by the absence of hairs at the collar region while other two species are differentiated on the basis of ligule feature. In *Ischaemum molle* ligule is long while in *Ischaemum pilosum* ligule is divided.

In *Sehima nervosum* the ligule is membranous and short while in *Sehima sulcatum* and *Sehima ischaemoides,* ligule is membranous but the margin is somewhat hairy. The feature like glabrous nodal region is similar in all three species and leaf tip is totally different in all three species. *Sehima ischaemoides* has acute and keeled leaf tip, while *Sehima nervosum* has pointed leaf tip and *Sehima sulcatum* has acuminate and flat leaf tip.

In *Themeda cymbaria, Themeda laxa* and *Themeda triandra,* the common feature is ligule. All three species having membranous and short ligule. *Themeda cymbaria* having a long hair at the nodal region which differ feature form the other two species. *Themeda laxa* having pointed leaftip while *Themeda triandra* having acute leaftip.

In *Bracharia* species, *Brachiaria eruciformis, Brachiaria distachya, Brachiaria ramosa* and *Brachiaria reptans* have same type of leaf tip, that is acute and same features of sheath margin and type. *Brachiaria eruciformis* and *Bracharia ramosa* have hairy nodal region. These two species are differentiated on the basis of auricle. *Brachiaria eruciformis* have small, rudiment auricle is present while in *Brachiaria ramosa* auricle is absent. *Bracharia distachya* and *Brachiaria reptans* have glabrous nodal region. Both species can be differentiated on the bases of the leaf blade character. *Brachiaria distachya* leaf blade is glabrous and single prominent midvein is present and *Brachiaria reptans* leaf blade is pubescent surface and has no single prominent midvein present but all similar parallel veins are present.

In *Cenchrus* species, the common feature is glabrous node and the differentiated feature is ligule. In *Cenchrus biflorus,* ligule is somewhat membranous but the upper part of ligule is hairy while in *Cenchrus ciliaris* having a rim of hairs present and in *Cenchrus setigerus* the ligule is ciliated.

In *Paspalidium* species,*Paspalidium flavidum* and *Paspalidium geminatum* have glabrous node and auricle is absent. In between these two specis many features are different. In *Paspalidium flavidum* glabrous leaf blade, acuminate leaf tip and divided collar while *Paspalidium geminatum* have pubescent node, acute leaf tip and continuous collar region.

The tribe Aristideae includes member the only *Aristida.* The common feature is needle shape of leaf blade.Two species of *Aristida* i.e. *Aristida adscensionis* and *Aristida funiculata* are differentiated on the basis of collar region. *Aristida adscensionis* is having hairy collar region while *Aristida funiculate* is having glabrous collar region.

In the tribe Chlorideae 6 genera and 8 species are studied. It includes the species like *Chloris, Cynaodon, Melanocenchris, Oropetium, Sachoenefeldia* and*Tetrapogon.* The common feature for this tribe member is continous collar region and round leaf sheath type. *Sachoenefeldia gracilis have* small, rudiment auricle which the other species do not have. *Cynodon dactylon* is different from other species by its fine rim of hairs of ligule while other has membranous. *Melanocenchris jaequemontii* have splitted ligule margine while the other has entire. Now out of

remaining species *Chloris virgata* have folded vernation and other has rolled vernation. *Oropetium villosulum*is differing from the *Tetrapogon* by means of its growth habit. *Oropetium villosulum*is annual while other is perennial. *Tetrapogon tenellus* have tuberculated base hairs on the dorsal surface while *Tetrapogon villosus* do not have hairs but it has dotted structure on the leaf blade surface.

In the tribe Eragrosteae 6 genera and 15 species are studied. It includes species like *Dactyloctehnium, Desmostachya, Dinebra, Eleusine, Eragrostiella* and *Eragrostis.* Out of these 6 species only *Dactyloctehnium* have pubescent nodal region while others have glabrous node. Out of 5 species *Desmostachya* and *Eragrostiella* has perennial growth habit. But these two genera can be differentiated on the basis of the vernation. *Desmostachya* have folded vernation while *Eragrostiella* have rolled vernation. Remaining 3 genera are annual in their growth habit. Out of those *Eleusine* have flattened type of sheath and other 2 have round type of sheath. *Dinebra* have pubescent intermodal region while *Eragrostis* have glabrous intermodal region. In the species of *Eragrostis* the common feature is hairy ligule and presence of long cilia/hairs at the collar region. This is the main feature on the basis of which *Eragrostis* Genus is easily differentiated from the other genera and on the basis of the hairy ligule type, concentration of hairs, arrangement of hairs and length of hairs the different species of *Eragrostis* can be differentiated.

In the tribe Sporoboleae, only 4 species are studied. The *Sporobolus* species differentiated on the basis of their leaf tip. *Sporobolus coromardelianus* have acuminate leaf tip while *Sporobolus diander* and *Sporobolus indicus* has pointed leaf tip, but these two species can be differentiated on the basis of the leaf blade surface. Hairs are present on the leaf blade surface of the *Sporobolus diander* and *Sporobolus indicus* do not show the hairy structure.

Cluster analysis was done to see the relationship between different groups of species. First group consists 80 species while second group consists 20 species. In first group almost all species (61.25%) have membranous ligule and 31 species (38.45%) were having hairy ligule. Though these species showed difference in ligule character but species of clusters 2, 3, 6 and 8 had membranous ligule while clusters 1 and 4 had mixed species i.e. the species which were present have either membranous ligule or hairy ligule. Likewise second group also showed this type of mixture i.e. second group has total 20 species. Out of that around 3 species i.e. 15% species shows hairy ligule, 15 species i.e. 75% species shows membranous ligule and 2 species i.e. 10% species do not have ligule.

Cluster 8 and 9 are simplifolius i.e. having only a single species in cluster. *Ischaemum pilosum* form cluster 8, showed around 90% similarities with the characters while *Thelepogon elegans* form cluster 9, shows only 82% similarities of characters with other species.

Cluster 2, 3 and 6 constitute of the members with membranous ligule. Cluster 2 had 15 species which showed 91% similarity level. Out of that 7 species were annual and 8 were perennial. Cluster 3 had 11 species and showed similarity at around

90%. *Sachonelfeldia gracilis* which was belongs to cluster 3 having close leaf sheath while other species of cluster 4 have either open or split with overlapping margin type of leaf sheath. Cluster 6 had 6 species and showed similarity with other clusters at around 90.50%. Among the species of cluster 6 only *Hackelochloa granularis* have short, rudiment auricle while in other species auricle was absent. In this cluster *Isilema laxum* and *Acrachne ramosa* both have almost same characters but *Isilema laxum* had open type of leaf sheath while *Acrachne ramosa* had split with overlapping margin type of leaf sheath. On the basis of dendrogram it can be inferred that *Aristida funiculata, Eragrostis tenella* and *Eragrostis tremula* have hairy ligule and they showed almost 99% similarities in their vegetative characters. Like this *Eragrostis unioloides* and *Eragrostis viscosa* also showed 99% similarities with other clusters. The difference was that *Eragrostis viscosa* showed presence of long cilia at mouth of sheath.

Cluster 10 had only two species (*Digitaria ciliaris* and *Echinochloa stagnina*) and showed similarities at around 96%. Both the species having round leaf sheath margin, split with overlapping margin type of leaf sheath and auricle was absent. Cluster 7 had 6 species and showed 95% similarities with others. All the species of cluster 7 showed split with overlapping margin type of leaf sheath. *Heteropogon ritchei* and *Heteropogon triticeus* showed 98% similarities with other clusters. *Heteropogon ritcheii* had acute type of leaf termination point and continuous collar while *Heteropogon triticeous*had acuminate type of leaf termination point and divided collar.

Cluster 5 had 11 species and showed 92% similarities with other clusters. *Pennisetum setosum, Brachairia ramosa* and *Echinochloa crusgalli* showed continuous collar, round leaf sheath margin, absence of auricle and split with overlapping margin type of leaf sheath. *Pennisetum setosum* was perennial while other two species were annual. *Brachairia ramosa* had hairy ligule while *Echinochloa crusgalli* showed absence of ligule.*Digitaria stricta* and *Tetrapogon viollosus* were also showed similarity at around 92%. They showed continuous collar, membranous ligule, round leaf sheath type. *Digitaria stricta* had acute type of termination point with annual habit while *Tetrapogon villosus* had acuminate type of termination point with perennial habit.

Cluster 1 had 36 species and showed 93% similarities with others. In this cluster few species had membranous ligule while few species had hairy ligule. *Tragus biflorus* and *Oplismenus burmanii* showed 98% similarities with the cluster. But *Tragus biflorus* had rolled vernation, continuous collar and round leaf sheath type while *Oplismenus burmanii* had folded vernation, divided collar and flattened leaf sheath type. *Sporobolus dianer, Eragrostis japonica* and *Eragrostis nutans* showed 99% similarities with cluster. *Sporobolus dianer* showed continuous collar while other two had divided collar region. *Eragrostis japonica* hadannual habit while *Eragrostis nutans* had perennial habit.

Among 10 clusters, cluster 8 and 9 has 0.0 values from the centroid while other clusters have between 0.7 – 2.23 from centroid.

Based on the characteristic features a dichotomous key for identification of the studied species has been prepared.

Membranous ligule……...……...……Group I
Hairy ligule…….……..……..……Group II
No ligule……...…….,……...Group III

Group I

1. Folded vernation...……..**2**
1. Rolled vernation……..…….**21**
2. Single prominent midvein absent...……..……...….***Arthraxon lanceolatus***
2. Single prominent midvein present…...……...**3**
3. Flattened leaf sheath type……..……...……..**4**
3. Round leaf sheath type……..……...…**15**
4. Pubescent nodal region……..……..…**5**
4. Glabrous nodal region……..……..**6**
5. Close leaf sheath margin……...…***Hackelochloa granularis***
5. Split with overlapping margin……***Chionachnae koengii***
6. Short, rudiment auricle……..……...….***Heteropogon triticeus***
6. Auricle absent ……...…….**7**
7. Glabrous leaf blade surface……...…….**8**
7. Pubescent leaf blade surface……...……**12**
8. Narrow collar region…….……***Triplopogon ramosissimus***
8. Divided collar region……...……...**9**
9. Termionation point is acute……..…….....***Iseilema laxum***
9. Termination point is acuminate/pointed……...……..…..**10**
10. Termination point is acuminate……...***Acrachne racemosa***
10. Termination point is pointed needle like……..**11**
11. Long leaf, whilte colour band present at midvein……..…***Vetiveria zinzanoides***
11. Small leaf, no white band present at midvein……..…..***Chloris montana***
12. Leaf sheath margin open……..……***Chloris barbata***
12. Leaf sheath margin is split with overlapping margins……..……..…..**13**
13. Termination point is acuminate…….....……
……***Heteropogon contortus*var.*geninus* subvar.*typicus***
13. Termination point is acute……..……..…..**14**
14. Annual growth habit……..……..….. ***Eleusine indica***
14. Perennial growth habit ……..……
……***Heteropogon contortus*var.*geninus*subvar. *hispidismuss***
15. Annual growth habit……...……**16**
15. Perennial growth habit……...…..……**17**
16. Divided collar region……....……***Capillepedium hugelii***

16. Continous collar region……..……..……***Chloris virgata***
17. Keeled termination point……..…..…***Heteropogon ritchei***
17. Flat termination point……..……**18**
18. Short, rudiment auricle……..…….***Sorghum halepense***
18. Auricle absent……...……..……**19**
19. Pubescent nodal region……...……***Imperata cylindrica***
19. Glabrous nodal region……..……...…**20**
20. Pointed needle like termination point……....***Desmostachya bipinnata***
20. Acuminate termination point……..…...…….***Panicum maximum***
21. Perennial growth habit……...……..**22**
21. Annual growth habit……...…….**37**
22. Pubescent nodal region……**23**
22. Glabrous nodal region……..**26**
23. Flattened leaf sheath type……..……..***Themeda cymbaria***
23. Round leaf sheath type……..……..**24**
24. Short, rudiment auricle……..……***Dicanthium annulatum***
24. Auricle absent……...……..……..**25**
25. Acuminate termination point…….***Dicanthium caricosum***
25. Acute termination point……...……***Dactyloctenium aegyptium***
26. Flattened leaf sheath type……..……..…….**27**
26. Round leaf sheath type……..……...……**29**
27. Leaf sheath margin is open……..……...… ***Chrysopogon fulvus***
27. Leaf sheath margin is split with overlapping margins…….……**28**
28. Auricle is absent……..…***Eragrostiella bifaria***
28. Short, rudiment auricle……..…….…***Saccharum spontanum***
29. Leaf sheath margin close ……....***Ophiuros exaltatus***
29. Leaf sheath margin is split with overlapping margin…….…**30**
30. Glabrous leaf blade surface…….**31**
30. Pubescent leaf blade surface……...**33**
31. Acute termination point……..... ***Themeda triandra***
31. Pointed needle like termination point…….....……**32**
32. Continuous collar region……..……..…***Eragrostiella bachyphylla***
32. Divided collar region……...……..…….. ***Cymbopogon martinii***
33. Short, rudiment auricle……...……...……..***Rottboelia exaltata***
33. Auricle absent……...……...……**34**
34. Pointed termination point……..……..……..***Sehima nervosum***
34. Acute to acuminate termination point……..……..…..**35**
35. Angled nodal region……...……..***Tetrapogon villosus***
35. Bearded nodal region……...……**36**
36. Ligule shape is acute……..……***Tetrapogon tenellus***
36. Ligule is ciliate……...…… ***Sehima sulcatum***
37. Pubescent leaf blade surface……...……**38**

37. Glabrous leaf blade surface……..…..**48**
38. Flattened leaf sheath type……....**39**
38. Round leaf sheath type……..……..**42**
39. Leaf sheath margin open.……***Bothriochloa pertusa***
39. Leaf sheath margin is split with overlapping margin……..……...….**40**
40. Continuous collar region……..…...…….. ***Cenchrus biflorus***
40. Divided collar region……...……..…...……**41**
41. Ligule is membranous, acute……..…….. ***Setaria tomentosa***
41. Ligule is membranous, ciliate…..……..……***Setaria verticillata***
42. Short, rudiment auricle…….***Sachoenefeldia gracilis***
42. Auricle absent……...……..……**43**
43. Keeled termination point……...……***Melanocenchris jaequemontii***
43. Flat termination point……..……**44**
44. Pubescent internode……...…….……..***Dinebra retroflexa***
44. Glabrous internode……..……....**45**
45. Divide collar region……..……...…***Digitaria granularis***
45. Continuous collar region……..……...……**46**
46. Acuminate termination point…….….***Oropetium villosum***
46. Acute termination point……...……**47**
47. Pubescent, bearded nodal region……..……..***Thelepogon elegans***
47. Glabrous, angled nodal region……..***Digitaria stricta***
48. Short, rudiment auricle ……..….**49**
48. Auricle absent……..…**54**
49. Acuminate to pointed termination point…….……**50**
49. Acute termination point……..……**51**
50. Simple nodal region……***Apluda mutica***
50. Angled nodal region……..…….***Ischaemum pilosum***
51. Pubescent nodal region……..***Setaria gluca***
51. Glabrous nodal region……...……..**52**
52. Bearded nodal region…….……***Ischaemum indicus***
52. Simple nodal region……...…….……**53**
53. Pubescent collar region……...……...***Digitaria longiflora***
53. Glabrous collar region……...…….……***Paspalum scorbiculatum***
54. Pubescent nodal region……...……...…….**55**
54. Glabrous nodal region……..……..**57**
55. Pointed termination point…...…….....…..***Isachane globosa***
55. Acute termination point…….……**56**
56. Leaf sheath margin open……..……..***Coix lachryma-jobi***
56. Leaf sheath margin is split with overlapping margin……...….***Digitaria ciliaris***
57. Falttened leaf sheath type……..….**58**
57. Round leaf sheath type……..……**60**
58. Leaf sheath margin is split with overlapping margin…..***Andropogon pumilus***

58. Leaf sheath margin open……..…….**59**
59. Continuous, broad collar region…….…...……***Ischaemum molle***
59. Continuous narrow collar region….……...…….……***Ischaemum rugosum***
60. Keeled termination point……...……..***Sehima ischaemoides***
60. Flat termination point…….……**61**
61. Divided collar region……...……***Themeda quadrivalvis***
61. Continuous narrow collar region……..***Themeda laxa***

Group II

1. Pubescent nodal region…..……..…...……...……..**2**
1.Glabrous nodal region……..……..**9**
2. Glabrous surface of leaf lamina……..…….……***Alloteropis cimiciana***
2. Pubescent surface of leaf lamina…..……..**3**
3. Pointed termination point……..……..……..……***Dactyloctenium sindicus***
3. Acute to acuminate termination point……....……..……**4**
4. Perennial growth habit and folded vernation…..……***Eremopogn foveolatus***
4. Annual growth habit ……..……**5**
5. No single prominent midvein is present……..…….…..**6**
5. Single prominent midvein is present……..……**7**
6. Leaf sheath margin is split with overlapping margin.…***Brachiaria eruciformis***
6. Leaf sheath margin close……..……..***Tragus biflorus***
7. Continuous narrow collar region.……....……..…***Brachiaria ramosa***
7. Divided collar region…….……..……...…..**8**
8. Folded vernation……...……***Oplismenus burmanii***
8. Rolled vernation…….……..***Oplismenus composites***
9. Short, rudiment auricle……...……**10**
9. Auricle absent……...…….**12**
10. Leaf sheath margin close…….……....……***Panicum trypheron***
10. Leaf sheath margin is split with overlapping margins……...**11**
11. Glabrous leaf blade surface……..…….***Panicum miliaceum***
11. Pubescent leaf blade surface……..……...…… ***Brachiaria reptans***
12. Pubescent leaf blade surface……...……...……**13**
12. Glabrous leaf blade surface……...…….**21**
13. Leaf sheath margin is close……**14**
13. Leaf sheath margin is split with overlapping margins……...**15**
14. Termination point is acute……..……..***Perotis indica***
14. Termination point is pointed needle like……...…***Aristida adscensionis***
15. Perennial growth habit……...……**16**
15. Annual growth habit……...…..……..**18**
16. Pointed needle like termination point…….***Sporobolus indicus***
16. Acute to acuminate termination point…...……**17**
17. Presence of hairs on the dorsal surface of leaf blade…….
…….……..…....***Paspalidium geminatum***

17. Hairs are absent on the dorsal surface of leaf blade…..……***Cenchrus ciliaris***
18. Flattened leaf sheath type……..….***Cenchrus setigerus***
18. Round leaf sheath type……..……**19**
19. Acuminate termination point……..***Sporobolus coromandliens***
19. Pointed termination point……..…...……..**20**
20. Bearded nodal region……...…….***Eragrostis unioloides***
20. Simple nodal region……...***Sporobolus diander***
21. Perennial growth habit……..……..**22**
21. Annual growth habit……...**26**
22. No single prominent midvein is present on the leaf blade….***Erichloa procera***
22. Single prominent midvein is present……..……**23**
23. Folded vernation……...…..***Panicum antidotale***
23. Rolled vernation……..……..……**24**
24. Leaf sheath margin open……..***Cynodon dactylon***
24. Leaf sheath margin is split with overlapping margins...……..…...……..**25**
25. Divided collar region……..……***Eragrostis nutans***
25. Conitnuous collar region……***Pennisetum setosum***
26. Folded vernation……..……..***Paspalidium flavidum***
26. Rolled vernation……..……..……**27**
27. Single midvein is present on the leaf blade surface……...……**28**
27. No single midvein is present…….….**32**
28. Keeled termination point……...……***Echinochloa stagnina***
28. Flat termination point……..……..……**29**
29. Leaf sheath margin is split with overlapping margins.……..**30**
29. Leaf sheath margin is close……**31**
30. Termination point is acute……***Brachiaria distachya***
30. Termintion point is pointed needle like…….…..***Eragrostis japonica***
31. Pointed termination point……...……..…….***Eragrostis ciliaris***
31. Acuminate termination point……...……..***Eragrostis cilianensis***
32. Simple nodal region……***Eragrostis pilosa***
32. Bearded nodal region…...……...……**33**
33. Leaf sheath margin is split with overlapping magins……...***Eragrostis viscosa***
33. Leaf sheath margin close……..…..**34**
34. Curved margin of leaf blade……***Aristida funiculata***
34. Simple margin of leaf blade……..…….**35**
35. Long hairs are present at mouth of collar region……..……***Eragrostis tenella***
35. No hairs are present at mouth of collar region……...***Eragrostis tremula***

Group III

1. Acute, keeled termination point…..…..…..……***Echinochloa colona***
1. Pointed, flat termination point…….…….……***Echinochloa crus-galli***