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SUMMARY

Two preliminary-evaluation experiments were conducted with 147 accessions of *Stylosanthes viscosa* at Santander de Quilichao, Cauca, Colombia. All accessions showed good adaptation to an acid Oxisol with a high Al level (pH 4.1, 89% Al saturation). Considerable variation was detected among accessions for growth habit, days to plot cover and flowering onset, seed production, plant stickiness and relative acceptability to cattle. Variation was also found in plant vigour, which was affected by susceptibility to anthracnose (*Colletotrichum gloeosporioides*).

Agronomic performance of 14 accessions of *S. viscosa* selected from the preliminary evaluation experiments was assessed in a small-plot cutting experiment conducted at the same site. Variation in dry-matter yields was not significant for most of the accessions. Mean nutrient concentrations were 2.2% N, 0.15% P and 0.43% Ca. None of the accessions proved to have a high level of anthracnose tolerance. Plant survival 22 months after transplanting ranged between 4% and 65% and seemed to be influenced by disease susceptibility. Collecting more *S. viscosa* germplasm is considered, and areas for future collections are identified.

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Preliminary agronomic evaluation of a *Stylosanthes viscosa* Sw. collection

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INTRODUCTION

The legume genus *Stylosanthes* comprises about 40 species which are native to tropical, subtropical and warm temperate regions of the Americas, tropical Africa and Southeast Asia ('t Mannetje 1984). Several species have attained importance as pasture plants, such as *S. capitata, S. guianensis, S. hamata, S. humilis, S. macrocephala* and *S. scabra*. Considering additional species of potential agronomic importance, Edye *et al.* (1984) mention, among others, *S. viscosa*, which is rather widespread in the New World tropics, where it occurs within the latitudinal boundaries of 29° N and 29° S under a great range of climatic and edaphic conditions (Williams *et al.* 1984). *Stylosanthes viscosa* is closely related to *S. scabra* (Mohlenbrock 1958; Burt 1984) and both species have various agronomic features in common, but the lack of a floral axis rudiment in the case of *S. viscosa* and its pod characteristics make it clearly distinguishable (Burt 1984). Considerable ecotypic variation has been observed among *S. viscosa* collections (Mohlenbrock 1958; Ferreira and Costa 1979; Costa and Ferreira 1984), which can be explained by the species' widespread distribution ('t Mannetje 1984).

Information on agronomic performance of *S. viscosa* is quite scarce and is based mainly on Australian evaluations of relatively small numbers of accessions. Burt *et al.* (1974) observed good performance of this species in dry tropical conditions where previously only the annual *S. humilis* had been considered adapted. Edye *et al.* (1973, 1974) found considerable variation for morphological characteristics and flowering time in the 11 accessions of *S. viscosa* evaluated as spaced plants; most of them persisted well but had relatively low dry-matter yields. Six accessions of this species evaluated in small sward experiments under different environmental conditions produced less dry matter than *S. scabra* cvs. Seca and Fitzroy and *S. hamata* cv. Verano (Burt *et al.* 1974; Edye *et al.* 1975).

Stylosanthes viscosa as well as several other species of the genus are known to have glandular trichomes which produce a sticky secretion. This may affect the species' acceptability to cattle. In a cafeteria grazing experiment performed in Colombia, Schultze-Kraft *et al.* (1989) observed low relative palatability for *S. viscosa* in comparison with *Centrosema acutifolium*, *Desmodium velutinum* and *Zornia glabra*. The *S. viscosa* accessions evaluated in Australia are extremely viscid and have shown lack of palatability to cattle in some areas (Edye and Cameron 1984; Gardener 1984). In a grazing experiment conducted in the semi-arid tropics of northwestern Australia with a mixture of *S. viscosa* (CPI 34904) and *S. scabra* (cvs. Seca and Fitzroy) in association with native perennial grasses, *S. viscosa* showed an ability to increase presentation yields at low fertility (Winter *et al.* 1989). In the same experiment, consumption of *S. viscosa* was not very high but liveweight gains obtained in the *S. viscosa*-*S. scabra* mixture were similar to those recorded for the other two legume treatments of *S. humilis* cv. Paterson (Townsville stylo) and *S. hamata* cv. Verano

(Caribbean stylo). Thus Winter *et al.* (1989) state that further evaluation of *S. viscosa* is warranted. Burt *et al.* (1983) had already suggested further studies on *S. viscosa* since the collections tested in Australia are quite inadequate and represent only a fraction of the abundant variation existing in the species. In the meantime, a germplasm collection of more than 250 accessions is available (Schultze-Kraft *et al.* 1984).

This paper presents the results of a preliminary evaluation of 147 accessions and an agronomic evaluation of 14 selected accessions conducted on an acid, infertile Oxisol in Colombia.

MATERIALS AND METHODS

Experimental Site

Experiments were conducted on the CIAT research station at Santander de Quilichao, Cauca, Colombia, at latitude 3°06' N, longitude 76°31' W and altitude 990 m.a.s.l. Mean annual rainfall is 1845 mm and with a bimodal distribution from March to June and September to December. The mean annual temperature is 23.4° C, with a mean maximum of 29.4° C and a mean minimum of 18.5° C. The soil has recently been reclassified (J.M. Kimble, personal communication) as a deep, well-drained Oxisol (very-fine, kaolinitic, isohyperthermic, plintic, kandiudox). It has a pH of 4.1; an Al saturation of 89%; an available phosphorus content (Bray II) of 1.6 ppm; calcium, magnesium and potassium contents of 0.43, 0.07 and 0.12 meq/100 g soil, respectively; and an organic matter content of 6%.

Accessions Studied

One hundred and fourty-seven accessions were characterised by two preliminary-evaluation experiments. They originated from a broad range of geographical, climatic and ecological conditions representative of the natural distribution of *S. viscosa* as described by Williams *et al.* (1984) except for the accessions from Panama (Figure 1). Since seed of all accessions was not available at the beginning of the studies, two experiments were established side by side, the first (Experiment I) in February 1981, and the other (Experiment II) in July 1981. Tables 1 and 2 show the origins of the accessions evaluated in Experiments I and II, respectively.

The collecting sites extend between latitudes 23° N in Baja California, Mexico, and 23° S in São Paulo, Brazil, and between longitudes 35° W in Pernambuco, Brazil, and almost 110° W in Baja California, Mexico. Collection sites are concentrated between 6° and 10° N in Venezuela and between 10° and 15° S in Brazil.

Annual precipitation and the number of dry months (mean monthly rainfall < 60 mm) exhibit considerable variation among collecting sites. Total annual rainfall ranges from 230 mm in Baja California, Mexico, to 3200 mm in Cayenne, French Guiana. Most accessions originate from subhumid sites with precipitations between 1000 and 1750 mm and a dry season of 4 to 5 months. Collecting sites were located at altitudes between

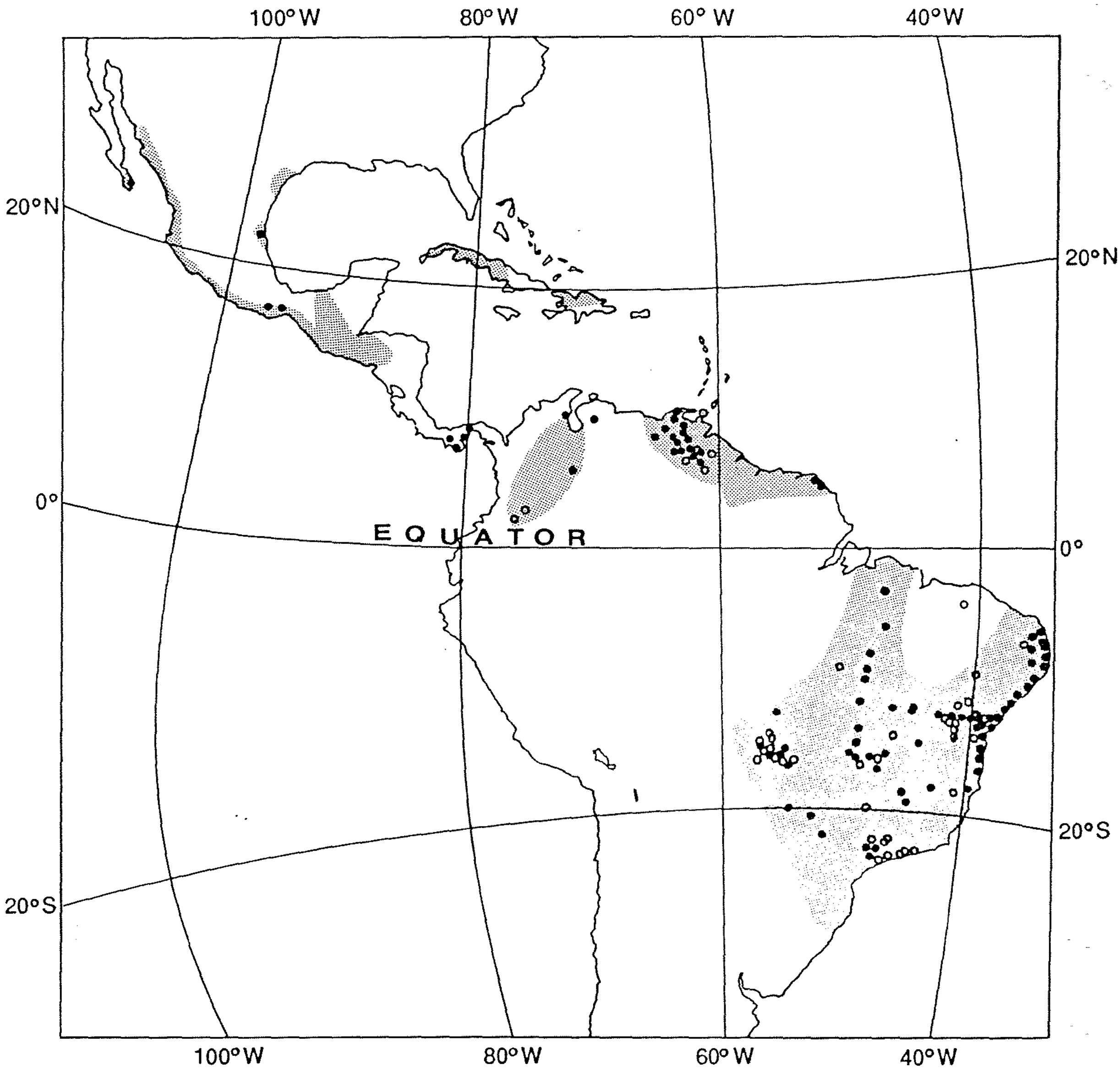

Figure 1. Natural distribution of *Stylosanthes viscosa* and locations of collection sites of accessions in the CIAT collection.

- ░ Natural distribution of *S. viscosa* (adapted from Williams *et al.* 1984).
- ● Locations of accessions used in the preliminary evaluation experiments.
- ○ Locations of other CIAT accessions.

Table 1. Origin of *Stylosanthes viscosa* accessions included in the preliminary evaluation (Experiment I).

CIAT no.	Other accession nos.	Country	Province, state	Latitude	Longitude	Altitude (m.a.s.l.)	Annual rainfall (mm)	Dry months <60 mm (no.)
08	CPI 34904	Brazil	São Paulo	22°04'S	77°53'W	650	1400	4
09	CPI 40264	Brazil	Bahia	12°59'S	38°21'W	10	1910	0
1011	CPI 33436	French Guiana	Kourou	05°10'N	52°48'W	20	3100	2
1051		Brazil	Bahia	12°11'S	38°24'W	240	1530	1
1070		Brazil	Bahia	13°01'S	38°42'W	10	1790	0
1094*		Brazil	Bahia	13°10'S	39°26'W	260	970	4
1132		Belize						
1216		Brazil	Goiás	16°29'S	47°48'W	700	1600	5
1346		Venezuela	Monagas	08°30'N	62°43'W	100	980	4
1348		Venezuela	Bolívar	07°22'N	61°42'W	190	1320	4
1349		Venezuela	Bolívar	06°56'N	61°34'W	180	1280	4
1353*		Venezuela	Bolívar	07°42'N	63°42'W	130	1130	5
1430		Brazil	Mato Grosso Do Sul	20°30'S	52°42'W	90	1170	4
1435		Brazil	São Paulo	22°00'S	51°38'W	430	1150	4
1436		Brazil	São Paulo	22°00'S	51°38'W	430	1150	4
1439		Brazil	São Paulo	22°00'S	51°38'W	430	1150	4
1512		Venezuela	Bolívar	08°09'N	63°33'W	60	1020	5
1524		Venezuela	Monagas	09°23'N	63°02'W	200	1120	5
1527		Venezuela	T.F. Delta Amacuro	09°05'N	63°00'W	150	1300	2
1538*		Venezuela	Bolívar	06°50'N	61°45'W	230	1260	2
1541		Venezuela	Bolívar	07°20'N	62°20'W	290	1330	4
1544		Venezuela	Bolívar	07°15'N	62°10'W	290	1290	4
1547		Venezuela	Bolívar	07°45'N	62°40'W	100	1170	3
1593	CF 108	Belize	Cayo	18°58'N	90°89'W	30	1260	6
1638		Brazil	São Paulo	22°57'S	47°04'W	800	1350	5
1661		Brazil	Mato Grosso	19°56'S	54°23'W	600	1430	3
1695		Brazil	Mato Grosso	15°54'S	55°14'W	580	1410	5
1697		Brazil	Mato Grosso	15°40'S	55°21'W	250	1390	5
1703*		Brazil	Mato Grosso	15°43'S	55°44'W	250	1380	5
1716		Brazil	Mato Grosso	12°31'S	55°44'W	440	1550	5
1764		Brazil	Mato Grosso	16°34'S	54°34'W	200	1590	5
1785*		Brazil	Mato Grosso	15°41'S	56°06'W	220	1390	5
1795		Venezuela	Zulia	10°18'N	72°20'W	80	1200	4
1807		Belize						
1812		French Guiana	Cayenne	04°56'N	52°20'W	10	3200	2
1817	CPI 33831	Mexico	Tamaulipas	22°13'N	97°50'W	10	980	7
1841		Panama	Coclé	08°34'N	80°17'W	150	2710	2
1851		Panama	Herrera	07°38'N	80°40'W	310	1910	3
1854		Panama	Veraguas	08°10'N	81°05'W	100	1780	5
1885		Venezuela	Guárico	08°48'N	64°52'W	100	1200	5
1888		Venezuela	Anzoátegui	09°04'N	64°19'W	220	1020	5
1895		Venezuela	Anzoátegui	08°37'N	63°50'W	130	1080	5
1904		Venezuela	Bolívar	07°34'N	63°16'W	250	1290	4
1908		Venezuela	Bolívar	07°45'N	63°12'W	50	1150	3
1912		Venezuela	Monagas	08°31'N	62°44'W	40	980	4
1940	Ex CIAT 1547	Venezuela						
1960	Ex CIAT 1904	Venezuela						
1988	Ex CIAT 1908	Venezuela						
2001	BRA 007706	Brazil	Goiás	15°34'S	47°10'W	900	1590	5
2038	BRA 009024	Brazil	Bahia	12°14'S	45°02'W	530	1030	5
2045	BRA 007927	Brazil	Bahia	12°05'S	44°53'W	670	1010	5
2060	BRA 008991	Brazil	Bahia	12°18'S	42°54'W	490	850	6
2072*	BRA 008117	Brazil	Bahia	12°27'S	42°11'W	900	650	7
2073	BRA 008125	Brazil	Bahia	12°24'S	41°52'W	1150	780	7

(Continued)

Table 1. (Continuation).

CIAT no.	Other accession nos.	Country	Province, state	Latitude	Longitude	Altitude (m.a.s.l.)	Annual rainfall(mm)	Dry months <60 mm (no.)
2101	BRA 008931	Brazil	Bahia	12°28'S	41°17'W	490	1000	6
2110	BRA 008877	Brazil	Bahia	12°27'S	41°05'W	520	700	6
2117	BRA 008796	Brazil	Bahia	12°30'S	40°27'W	310	660	6
2118	BRA 008281	Brazil	Bahia	12°31'S	40°19'W	270	710	6
2120	BRA 008303	Brazil	Bahia	12°33'S	40°04'W	270	650	6
2123	BRA 008338	Brazil	Bahia	12°31'S	39°52'W	230	650	7
2158*	BRA 008613	Brazil	Bahia	12°23'S	38°21'W	150	1650	1
2171*	BRA 008737	Brazil	Bahia	12°35'S	38°55'W	190	1260	1
2230		Brazil	São Paulo					
2294	EPAMIG 963	Brazil	Minas Gerais	17°55'S	42°51'W	970	1160	5
2295	EPAMIG 1016	Brazil	Minas Gerais	14°33'S	44°17'W	500	870	7
2341		Colombia	Casanare	06°06'N	71°47'W	350	1530	4
2367	BRA 012599	Brasil	Bahia	14°51'S	39°04'W	40	2030	0
2368*	BRA 012611	Brazil	Bahia	14°54'S	39°05'W	80	1090	0
2371	BRA 012637	Brazil	Bahia	14°57'S	39°02'W	10	1960	0
2372	BRA 034762	Brazil	Bahia	14°57'S	39°02'W	10	1960	0
2374	BRA 012645	Brazil	Bahia	15°09'S	39°03'W	10	1900	0
2380	BRA 012718	Brazil	Bahia	14°36'S	39°23'W	60	1800	0
2384	BRA 012751	Brazil	Bahia	13°53'S	39°26'W	150	1100	7
2398	BRA 012858	Brazil	Bahia	12°25'S	38°54'W	200	1330	1
2405*	BRA 012939	Brazil	Bahia	12°14'S	38°28'W	180	1610	2
2418	BRA 013056	Brazil	Sergipe	10°44'S	37°05'W	60	1290	5
2434	BRA 013251	Brazil	Alagoas	09°18'S	35°49'W	120	1440	4
2443	BRA 013331	Brazil	Pernambuco	08°04'S	34°56'W	60	1610	3
2455	BRA 013447	Brazil	Paraîba	06°53'S	35°07'W	100	1510	3
2460	BRA 013510	Brazil	Paraîba	06°35'S	35°09'W	140	1190	4
2466	BRA 013552	Brazil	Rio Grande Do Norte	05°48'S	35°25'W	80	1200	5
2475	BRA 013650	Brazil	Rio Grande Do Norte	06°38'S	36°39'W	340	540	9
2486	BRA 013765	Brazil	Pernambuco	08°03'S	36°04'W	350	720	7
2498*	BRA 013889	Brazil	Sergipe	10°56'S	37°12'W	40	1440	3
2501	BRA 013919	Brazil	Sergipe	11°06'S	37°22'W	70	1400	3
2505	BRA 013951	Brazil	Sergipe	11°28'S	37°28'W	140	1120	4
2509	BRA 014028	Brazil	Bahia	11°43'S	37°52'W	150	1070	4
2516*	BRA 014079	Brazil	Bahia	12°57'S	39°15'W	200	1120	4
2524	BRA 014141	Brazil	Bahia	13°52'S	39°37'W	150	1000	2
2525	BRA 014150	Brazil	Bahia	14°38'S	39°22'W	100	1810	0
2562	BRA 017159	Brazil	Goiás	16°08'S	48°38'W	800	1630	5
2569	BRA 017221	Brazil	Goiás	15°51'S	49°14'W	700	1670	5
2573	BRA 016993	Brazil	Goiás	15°31'S	49°37'W	610	1640	5
2582	BRA 017078	Brazil	Goiás	14°45'S	49°18'W	540	1630	5
2592	BRA 016888	Brazil	Goiás	13°53'S	49°06'W	470	1560	5
2609	BRA 016837	Brazil	Goiás	11°47'S	49°07'W	330	1620	5
2621	BRA 016748	Brazil	Goiás	09°58'S	48°45'W	420	1750	5
2628	BRA 016543	Brazil	Goiás	09°15'S	48°35'W	280	1710	5
2629	BRA 016551	Brazil	Goiás	09°15'S	48°35'W	280	1710	5
2635	BRA 016624, CPI 92886	Brazil	Goiás	07°53'S	48°26'W	330	1640	4
2644	BRA 016454, CPI 92892	Brazil	Maranhão	05°53'S	47°22'W	270	1670	4
2651	BRA 016314	Brazil	Pará	03°14'S	47°30'W	160	2320	2
2685	BRA 022179, CPI 92907	Brazil	Goiás	12°07'S	46°29'W	550	1510	5
2729	BRA 017345, CPI 92921	Brazil	Distrito Federal	15°43'S	48°12'W	800	1610	5
2900	Ex CIAT 2118	Brazil						

* Included in the agronomic evaluation experiment.

Table 2. Origin of *Stylosanthes viscosa* accessions included in the preliminary evaluation (Experiment II).

CIAT no.	Other accession nos.	Country	Province, state	Latitude	Longitude	Altitude (m.a.s.l.)	Annual rainfall (mm)	Dry months <60 mm (no.)
10	CPI 38611	Mexico	Oaxaca	16°13'N	95°17'W	10	1060	7
1074A		Brazil	Bahia	12°26'S	38°57'W	280	1140	2
1094		Brazil	Bahia	13°10'S	39°26'W	260	970	2
1214	CF 63	Belize						
1431		Brazil	Mato Grosso Do Sul	20°30'S	52°42'W	310	1170	4
1514		Venezuela	Bolívar	08°15'N	63°40'W	100	1010	5
1688		Brazil	Mato Grosso	16°18'S	54°45'W	400	1570	5
1724		Brazil	Mato Grosso	15°31'S	55°09'W	625	1380	5
1783		Brazil	Mato Grosso	15°41'S	56°06'W	220	1390	5
1786		Brazil	Mato Grosso	15°41'S	56°06'W	220	1390	5
1787		Brazil	Mato Grosso	15°41'S	56°06'W	220	1390	5
1790		Brazil	Mato Grosso	15°41'S	56°06'W	220	1390	5
1791		Brazil	Mato Grosso	15°41'S	56°06'W	220	1390	5
1793		Venezuela	Zulia	10°10'N	72°27'W	200	1500	3
1818	CPI 40264B	Brazil	Pernambuco					
1954	CPI 33941	Mexico	Oaxaca	17°06'N	96°43'W	20	650	6
2009	BRA 007757	Brazil	Goiás	15°20'S	46°46'W	560	1580	5
2255	BRA 009326	Brazil	Bahia					
2371	BRA 012637	Brazil	Bahia	14°57'S	39°02'W	10	1960	0
2425*	BRA 013161	Brazil	Alagoas	09°48'S	36°09'W	120	1530	4
2430	BRA 013200	Brazil	Alagoas	09°37'S	35°44'W	20	1650	4
2448	BRA 013382	Brazil	Paraíba	07°24'S	34°57'W	80	1610	4
2462	BRA 013528	Brazil	Rio Grande Do Norte	06°21'S	35°10'W	80	1270	4
2472	BRA 013625	Brazil	Rio Grande Do Norte	06°13'S	35°59'W	300	490	9
2479	BRA 013692	Brazil	Paraíba	07°06'S	36°17'W	570	400	10
2528*	BRA 014184	Brazil	Bahia	14°43'S	39°19'W	100	1900	0
2761		Brazil	Mato Grosso	16°18'S	54°45'W	400	1570	[illegible]
2773		Venezuela	Lara	10°09'N	69°58'W	650	580	9
2786		Venezuela	Nueva Esparta	10°59'N	63°52'W	300	720	7
2869	CPI 33436B	French Guiana	Kourou	05°10'N	52°48'W	20	3100	2
2870	CPI 33831B	Mexico	Tamaulipas					
2871	CPI 40296	Brazil	São Paulo	23°26'S	47°24'W	630	1290	4
2872	CPI 40296B	Brazil	São Paulo	23°26'S	47°24'W	630	1290	4
2880	CPI 55859A	Brazil	Bahia	12°20'S	40°50'W	480	640	8
2881	CPI 55859B	Brazil	Bahia	12°20'S	40°50'W	480	640	8
2882	CPI 55862	Brazil	Bahia	13°16'S	39°38'W	310	1010	2
2883	CPI 55863B	Brazil	Bahia	12°27'S	40°10'W	270	620	7
2884	CPI 55863C	Brazil	Bahia					
2889	CPI 55873	Brazil	Bahia	13°44'S	40°04'W	200	710	7
2890	CPI 61675	Venezuela	Falcón					
2891	CPI 61999	Brazil	Bahia	17°50'S	40°08'W	10	1440	1
2892	CPI 84992	Mexico	Baja California	22°52'N	109°54'W	25	230	11
2894	Ex CIAT 2371	Brazil						

* Included in the agronomic evaluation experiment.

10 and 1150 m.a.s.l., with most germplasm coming from sites below 500 m.a.s.l.

The natural habitat of the *S. viscosa* germplasm was usually savannas (Cerrados, Caatinga, Llanos) or coastal scrub vegetation. Soils at collection sites ranged from sand to clay, being mostly light textured, of low to moderate fertility and acid.

Experiments I and II: Preliminary Evaluation

Both experiments were established by transplanting eight-week-old seedlings from jiffy-pots to unreplicated single-row plots with 13 spaced plants per plot. The rows were 150 cm apart (Experiment I) or 250 cm (Experiment II) with a distance of 50 cm between plants in the row. Accession CIAT 1094, which had been identified as an apparently superior line in a previous preliminary evaluation experiment, was included as a control in both groups of accessions; CIAT 2371 was also included in both experiments. The fertilizer applied was triple superphosphate (50 kg P_2O_5/ha) in a split dressing, 50% at planting and 50% three weeks later.

The attributes measured in the preliminary evaluation experiments are listed in Table 3. In addition to these, observations were made on size and shape of leaflets, stem diameter and leaf colour.

Statistical analysis consisted of the performance of a minimum variance hierarchical cluster analysis (Ward 1963) in order to classify the accessions in distinct plant-vigour groups. For this purpose, the monthly ratings of each accession in Experiment I and Experiment II were averaged into 5 and 4 trimestral (three-month) ratings, respectively, which were used as variables for the cluster analysis. This procedure had been successfully used to classify a collection of 133 accessions of 12 *Centrosema* species (Schultze-Kraft and Keller-Grein 1985). Results of other important plant characters studied are presented in the form of frequency distributions.

Experiment III: Dry-Matter Yield and Survival

Fourteen accessions from northeast and central Brazil and from eastern Venezuela were selected in August 1982 for agronomic evaluation in a small-plot cutting experiment (Tables 1 and 2), based on observations made in the preliminary evaluation experiments on plant vigour, resistance to anthracnose, palatability and according to seed availability.

In early November 1982, two-month-old seedlings in jiffy-pots were transplanted into plots, 2.5 m long x 2.0 m wide, with 20 spaced plants per plot. Distance between plants was 0.5 m, with 1.5 m between plots. The experimental design consisted of randomized complete blocks with four replications. Fertilizer was applied at the same rates and frequencies as in the preliminary evaluation experiments. After a standardization cut in early March 1983, six further cuts followed at 12-week intervals. Cuts were made with shears at a radial distance of 10 cm from the stem base, and yields of the six central plants were measured. Fresh weight (g/plant) was determined in the field. From the mix of the four replications, subsamples of 200 g were taken for determination of dry-

Table 3. Attributes measured in preliminary evaluation (Experiments I and II)

Attribute	Definition/Method
Plant height	Height in cm from soil surface to the highest point of the plant excluding inflorescences; mean of three random plants; six months after establishment
Lateral growth	Diameter in cm; mean of three random plants; six months after establishment
Days to plot cover	No. of days from establishment to plot cover (when at least 50% of plants of an accession were touching each other)
Plant vigour	Ratings from 0 (dead) to 5 (excellent) every four weeks; trimestral means of vigour ratings*
Vigour group	Cluster analysis group from trimestral means of vigour ratings
Flowering onset	No. of days from establishment to first flower (when 50% of plants of an accession had started flowering)
Inflorescence length	Length of inflorescence in cm from base of rhachis to apex; mean of 30 random samples of each accession
Seed production	Weight of all seed matured to 9 months after establishment; hand-harvesting once or twice a week
Anthracnose damage	Rating from 0 (no damage) to 5 (severe damage); results are presented as maximum damage observed during five evaluations at intervals of 2 to 3 months
Viscidity	Rating from 0 (not viscid) to 3 (extreme viscidity); mean of 2 assessments by eye and touch at 3 and 9 months after establishment
Animal acceptability	Ratio of grazing frequency of each accession : mean frequency of all accessions; presented as palatability indices (PI)**

* Plants were cut 9 months after establishment with shears at a radial distance from the plant crown of 10 cm and the regrowth was evaluated for another 6 months in Experiment I and 3 months in Experiment II, respectively.

** After having finished the agronomic evaluation, acceptability to cattle was evaluated in both experiments together. The area was fenced off with an electric fence and grazed by four young Zebu steers from 08:00 to 11:00 hours over four days. Between 11:00 and 17:00 hours, the test animals grazed on a pasture of *Andropogon gayanus*, *Brachiaria decumbens* and *Panicum maximum*, and spent from 17:00 to 08:00 hours of the next day in an enclosure without forage. At five-minute intervals, observers recorded the accessions eaten by the animals.

matter percentage for each accession after 48-hour oven-drying at 70° C and analysis of N, P and Ca concentrations. In cut 1, an additional subsample was taken to determine leaf-to-stem ratio. Severity of anthracnose was monitored during the experiment, and at its termination the surviving plants were counted.

RESULTS

Experiments I and II: Preliminary Evaluation

Attribute data for all accessions are presented in Tables 4 and 5. In addition, frequency distribution graphs are presented, showing in Figures 2-5 the number of days to plot cover and flowering onset, seed production, anthracnose severity, leaf and stem viscidity and palatability index. The accessions of the respective groups are listed in the Appendix, which also includes data for plant height and diameter, and inflorescence length. The results of the cluster analysis on the trimestral means of vigour ratings are shown in Tables 6 and 7.

Growth habit, leaf form and leaf colour. Plant height and lateral growth (diameter) evaluated six months after transplanting showed considerable variation. Plant height ranged in Experiment I from 6 to 72 cm and in Experiment II from 10 to 60 cm (Tables 4 and 5). Plant diameter varied between 26 and 145 cm for the accessions of Experiment I and between 15 and 147 cm for the materials included in Experiment II (Tables 4 and 5). Based on the ratio of both attributes (data not presented), 39 accessions of Experiment I and five accessions of Experiment II were classified erect; 15 accessions of Experiment I and five accessions of Experiment II were prostrate. Most accessions in both experiments, however, had a semi-erect growth form.

The collection also showed considerable variation for stem diameter, leaf size and form and leaf colour (data not presented). Shape of leaflets varied from elliptic to lanceolate, the tips being acute or obtuse. Leaf colour varied from light-green over emerald-green to grayish-green. Three accessions from Venezuela (CIAT 1538, 1547 and 1904) and two from Panama (CIAT 1851 and 1854) were quite different from the other accessions in having reddish leaflets and stems.

Date of plot cover and plant vigour. The number of days from transplanting to plot cover was highly variable, ranging in Experiment I from 40 to more than 111 days and in Experiment II from 40 to more than 124 days (Figure 2). Fifty-five percent and 40% of the collections, that is, 58 accessions in Experiment I and 17 accessions in Experiment II covered the plot within 40 to 70 days. The control accession CIAT 1094 needed 57 and 64 days in Experiments I and II, respectively. There were 9 accessions in Experiment I and 7 accessions in Experiment II which did not reach complete plot cover during the duration of the experiments. As expected, the number of days from transplanting to plot cover and plant diameter were negatively correlated ($r = -0.64$ ($P < 0.0001$) for Experiment I and $r = -0.36$ ($P < 0.03$) for Experiment II).

Table 4. Performance of *Stylosanthes viscosa* accessions in preliminary evaluation (Experiment I).

CIAT accession no.	Plant vigour: Accessions' means of ratings (0-5) in trimesters 1[a]	2	3	4	5[a]	Plant height (cm)	Plant diameter (cm)	No. of days to plot cover	No. of days to flowering onset	Length of inflorescence (cm)	Seed production (g/plot)	Anthracnose damage (0-5)	Viscidity (0-3)	Animal acceptability (PI)[c]
08	2.5	2.7	2.7	3.3	2.0	20	83	55	42	3.5	16.2	4	2.5	-[d]
09	3.0	4.3	4.7	2.0	1.5	48	127	50	42	1.0	4.9	4	1.5	-
1011	2.0	2.7	3.0	4.7	4.5	27	82	60	36	1.4	12.7	1	2.0	3.60
1051	2.5	2.0	2.7	2.3	3.0	37	85	98	78	1.4	2.7	1	2.0	1.37
1070	2.0	2.3	3.0	2.3	3.0	15	92	72	31	1.1	2.7	0	1.5	0.17
1094	2.5	3.3	4.7	2.0	4.0	35	124	57	61	1.0	0.1	1	2.5	1.71
1132	2.0	2.3	2.3	1.0	0.5	26	97	72	42	1.5	0.1	5	1.0	-
1216	2.0	2.7	2.3	2.0	1.0	20	112	65	69	1.3	8.2	4	1.5	0.86
1346	2.0	2.0	2.3	4.0	3.0	25	66	87	31	1.7	9.8	2	2.0	1.54
1348	1.0	2.0	2.7	4.3	3.0	28	78	70	36	1.8	2.7	1	1.0	1.20
1349	3.0	3.3	3.7	5.0	3.5	43	102	50	16	3.8	15.2	3	1.5	0.34
1353	3.5	4.7	4.0	2.3	4.5	62	125	50	31	1.3	15.7	2	1.5	3.42
1430	2.0	1.7	1.0	3.0	2.0	15	64	93	15	3.6	13.1	4	1.5	0.17
1435	2.0	3.0	3.0	4.3	3.0	32	90	65	17	2.2	12.1	3	1.5	0
1436	3.0	2.3	2.7	4.7	2.5	29	65	75	17	2.5	19.7	3	1.5	0
1439	3.0	2.7	2.3	4.7	3.0	24	77	65	17	4.4	27.0	2	1.5	1.20
1512	1.0	2.0	2.0	3.0	3.0	13	67	67	31	1.2	0.2	0	1.5	0.17
1524	2.0	1.0	1.0	4.3	3.0	15	60	99	30	1.6	2.0	1	1.0	2.91
1527	2.5	2.0	2.0	2.0	1.5	28	75	65	27	1.3	1.8	4	1.0	1.54
1538	1.5	3.0	3.0	5.0	3.0	29	83	50	17	2.8	6.2	4	2.5	1.37
1541	2.5	3.0	3.3	3.3	3.0	23	110	55	17	1.3	23.2	3	1.0	0
1544	1.5	2.0	2.7	4.0	2.5	16	83	67	17	1.2	32.7	3	1.5	0.34
1547	3.0	2.0	2.3	4.3	1.0	21	77	60	36	1.3	10.4	4	3.0	0.17
1593	3.0	3.3	3.0	1.0	0	31	113	50	27	1.0	0.3	5	1.0	-
1638	3.0	2.7	3.0	4.3	3.5	24	85	50	17	5.4	24.7	3	2.0	0.17
1661	3.0	2.7	2.7	3.7	3.0	21	83	50	16	3.5	16.4	2	2.0	0
1695	3.0	3.0	3.0	2.0	3.0	24	100	45	17	1.1	7.9	3	2.0	0.51
1697	2.5	3.0	3.0	5.0	4.0	22	92	55	36	1.2	21.2	2	2.0	0.51
1703	3.0	3.0	3.7	3.0	3.5	22	105	55	17	1.2	14.4	2	2.5	1.03
1716	3.0	3.0	3.0	4.0	3.0	19	78	53	14	4.0	32.6	1	2.0	0
1764	2.0	2.0	2.7	4.0	3.0	24	85	73	27	3.5	51.5	2	2.0	0.34
1785	2.5	2.7	3.3	3.7	4.0	29	102	65	31	1.4	11.2	1	2.5	0.86
1795	1.0	1.0	1.0	1.3	1.0	6	26	n.c.[b]	34	1.0	0.1	4	0	-
1807	3.0	2.7	2.0	1.0	0	24	98	50	27	1.6	1.1	5	2.0	0.17
1812	2.0	2.7	3.3	3.7	3.5	37	78	67	36	1.3	9.1	3	3.0	4.11
1817	1.5	1.0	1.0	2.0	1.0	9	63	n.c.	17	0.9	0	4	0.5	0.34
1841	1.0	1.0	1.0	2.0	2.0	7	49	n.c.	87	1.0	0	3	0.5	0
1851	1.0	1.0	1.0	1.7	1.0	7	58	n.c.	16	1.0	0	3	0.5	0
1854	1.0	1.0	1.0	2.0	2.0	9	85	n.c.	27	1.5	0.1	1	1.0	0.34
1885	1.0	1.0	1.0	3.0	2.0	14	34	n.c.	42	1.0	0.2	4	0	1.37
1888	2.5	2.0	1.7	2.0	2.0	35	54	n.c.	42	1.4	0.2	4	1.0	0.34
1895	2.0	3.0	3.3	3.7	1.5	29	97	73	100	1.4	6.4	4	0.5	0.86
1900	2.0	2.7	3.3	4.0	3.5	32	90	55	27	1.3	4.6	1	2.5	3.42
1904	3.0	3.3	4.0	4.3	3.0	33	110	50	17	1.1	4.2	2	1.5	0.34
1908	2.5	2.0	2.7	4.7	3.0	20	77	71	27	1.1	0.3	1	1.5	1.37
1912	3.0	3.0	3.0	3.7	3.5	25	110	50	36	1.5	0.5	3	2.0	1.03
1940	2.0	2.3	3.0	4.7	0.5	33	78	90	36	1.3	7.8	5	1.0	0.17
1960	2.0	2.7	3.0	4.0	3.0	16	113	50	69	1.0	4.0	2	1.0	1.54
1988	1.5	2.0	2.7	4.3	3.0	16	80	99	42	1.0	1.0	2	1.5	1.03
2001	2.5	3.0	2.7	1.0	1.0	15	108	50	17	1.6	34.5	5	1.0	0.17
2038	3.5	4.3	4.7	3.3	3.5	45	117	50	63	3.5	33.3	1	1.0	0.34
2045	3.5	4.3	4.7	1.3	2.0	45	113	50	78	1.9	8.2	4	1.0	1.37
2060	3.0	2.3	2.3	0.3	0	13	110	60	43	1.7	11.5	5	1.0	-
2072	3.5	4.7	5.0	3.0	4.5	60	110	50	17	1.3	3.6	2	3.0	1.54

(Continued)

Table 4. (continuation)

CIAT accession no.	Plant vigour: Accessions' means of ratings (0-5) in trimesters 1[a]	2	3	4	5[a]	Plant height (cm)	Plant diameter (cm)	No. of days to plot cover	No. of days to flowering onset	Length of inflorescence (cm)	Seed production (g/plot)	Anthracnose damage (0-5)	Viscidity (0-3)	Animal acceptability (PI)[c]
2073	3.0	3.3	4.0	2.7	3.0	45	110	85	17	1.4	5.9	2	2.5	1.20
2101	3.5	4.3	5.0	1.7	2.0	63	93	65	13	1.2	3.2	4	2.0	0.34
2110	2.5	3.3	3.7	2.3	2.5	42	85	55	15	1.5	2.9	2	2.5	2.05
2117	3.5	4.3	4.7	2.0	3.0	53	105	50	16	2.1	5.6	2	2.5	3.08
2118	2.0	1.3	1.0	2.3	2.0	7	70	90	16	1.4	5.3	0	1.0	2.05
2120	3.0	3.0	3.0	4.7	3.5	14	107	50	17	1.3	2.5	3	2.0	3.94
2123	2.0	2.0	1.7	4.3	2.5	14	87	72	16	1.4	0.4	3	1.0	1.37
2158	2.0	2.7	3.7	4.0	5.0	28	98	57	40	1.1	0.1	0	2.0	6.16
2171	2.0	3.7	4.7	2.7	5.0	55	95	60	40	1.1	0	1	3.0	3.60
2230	3.0	2.3	2.7	5.0	4.0	23	83	72	19	3.9	14.8	2	2.5	0.34
2294	3.0	3.0	2.7	1.0	1.0	16	115	50	17	1.7	4.8	4	1.0	0
2295	3.0	3.3	1.3	1.0	1.0	15	120	50	63	1.8	2.7	4	1.0	0.17
2341	3.0	2.7	2.0	3.0	1.5	25	92	50	17	1.7	18.4	4	2.0	0.86
2367	2.0	2.3	3.0	3.3	5.0	40	85	90	63	1.0	41.7	1	2.0	1.03
2368	2.5	3.7	4.0	3.7	4.5	35	99	57	78	1.3	15.3	0	2.5	0.17
2371	1.5	1.0	1.0	2.7	2.0	8	51	98	12	1.4	2.5	1	2.5	0.86
2372	2.5	2.0	2.3	3.7	2.0	15	72	70	16	1.2	5.6	1	1.5	0.68
2374	2.5	3.3	3.7	2.3	4.0	42	107	72	42	1.2	2.8	2	2.0	1.37
2380	2.0	1.0	1.3	3.7	3.0	11	76	83	14	1.3	9.4	1	2.0	0.34
2384	3.5	3.3	2.3	4.3	2.5	36	82	50	36	1.2	4.9	3	2.0	0.68
2398	1.5	1.0	1.0	2.7	2.0	7	68	111	14	1.2	0.3	2	1.5	0.51
2405	2.0	2.0	2.7	3.0	4.5	11	92	72	17	1.0	0.1	1	1.5	4.79
2418	2.5	2.0	2.0	3.3	3.0	12	89	80	31	0.9	6.2	2	1.0	1.03
2434	2.0	1.7	2.0	3.7	3.0	8	82	108	15	1.9	4.7	1	1.5	2.57
2443	1.5	1.0	1.0	2.7	1.0	15	40	n.c.[b]	12	1.4	13.4	4	1.0	0.51
2455	2.5	3.0	3.0	3.0	3.0	38	92	72	17	1.2	7.4	4	2.0	0.86
2460	2.0	1.0	1.0	2.7	1.5	28	56	n.c.	14	1.4	15.8	4	2.0	1.37
2466	2.0	2.0	2.7	3.3	3.0	18	90	90	20	1.1	3.0	2	2.0	0.34
2475	3.5	3.3	4.7	2.0	1.5	72	77	99	42	1.2	2.5	4	2.5	0.51
2486	1.0	2.3	4.3	2.3	4.0	62	90	93	42	1.2	1.5	3	1.5	1.71
2498	1.5	1.7	3.0	4.3	4.5	22	95	90	69	1.2	8.0	1	2.0	2.23
2501	1.5	1.3	2.0	3.0	3.0	31	63	108	80	1.3	5.8	1	1.0	0.51
2505	2.0	2.0	3.0	4.0	4.0	29	91	87	17	1.3	0	3	2.0	0.51
2509	2.0	2.3	3.3	3.3	4.0	30	100	85	31	1.3	0.2	3	1.5	2.23
2516	3.5	4.7	4.7	2.3	5.0	48	100	50	36	1.6	12.3	0	1.5	2.57
2524	2.0	2.3	2.7	3.0	3.5	37	82	83	50	1.1	18.6	3	2.0	0
2525	2.0	2.0	2.0	4.3	2.5	23	80	72	17	1.1	19.0	1	1.5	0.51
2562	3.0	3.3	1.7	1.7	1.0	19	113	50	69	1.3	4.9	4	1.0	0
2569	2.0	3.7	3.7	2.7	2.5	20	133	50	61	2.0	64.3	4	1.0	0.86
2573	2.5	3.7	3.3	1.7	1.5	23	133	52	69	1.4	59.0	4	1.5	0.51
2582	2.5	2.0	2.0	3.7	2.5	17	77	75	17	4.8	28.3	3	2.0	0.34
2592	2.0	2.7	3.0	1.7	1.5	26	107	55	75	2.0	31.3	4	1.0	0
2609	3.0	3.7	3.3	2.0	1.5	24	112	50	63	1.9	44.6	4	1.5	0
2621	2.5	2.0	2.3	3.7	2.0	24	72	72	17	2.2	6.4	4	1.0	0
2628	2.0	2.0	2.3	1.0	1.0	12	92	55	36	2.1	38.2	5	0.5	0
2629	2.5	2.0	2.3	3.7	2.5	23	87	72	14	2.4	31.4	3	1.5	0
2635	2.5	1.3	1.7	4.0	2.0	17	72	87	42	2.8	6.7	4	1.0	0.17
2644	2.0	3.0	4.0	3.7	3.5	19	145	55	105	2.6	22.8	3	2.0	0.51
2651	2.0	2.7	4.0	3.7	4.0	52	85	85	36	1.2	7.7	3	1.5	0.86
2685	3.0	3.7	4.0	3.0	2.5	43	117	50	42	2.4	54.7	4	2.0	0.17
2729	3.0	4.0	3.3	1.7	2.0	25	128	45	63	1.6	25.7	4	1.5	0.17
2900	2.0	2.7	3.7	2.7	3.0	14	123	55	19	1.3	2.1	1	1.5	0

a) Means of 2 ratings only; b) n.c. = plants did not cover the plot during the experimental period.
c) Palatability index (see Table 3); d) Plants had died before the acceptability assessment.

Table 5. Performance of *Stylosanthes viscosa* accessions in preliminary evaluation (Experiment II).

CIAT accession no.	Plant vigour: Accessions' means of ratings (0-5) in trimesters				Plant height (cm)	Plant diameter (cm)	No. of days to		Length of inflorescence (cm)	Seed production (g/plot)	Anthracnose damage (0-5)	Viscidity (0-3	Animal acceptability (PI)[c)]
	1	2	3	4[a)]			plot cover	flowering onset					
10	2.3	2.0	2.0	3.5	23	72	n.c.[b)]	7	2.0	1.1	4	1.0	1.20
1074A	3.3	5.0	4.0	1.5	45	128	47	46	1.3	1.7	4	2.0	0.17
1094	2.3	4.7	3.7	1.5	46	122	64	45	1.0	0.6	3	2.0	1.71
1214	2.3	1.7	0	0	28	50	68	23	-	0.1	5	3.0	-[d)]
1431	2.7	2.3	2.0	3.5	22	62	113	12	4.4	14.8	2	2.0	0.34
1514	1.0	1.0	1.0	0	23	38	n.c.	11	1.2	0.1	5	1.0	-
1688	3.0	3.3	2.0	2.0	30	72	98	7	3.5	11.5	4	1.5	0.34
1724	3.7	5.0	3.7	4.5	38	113	47	28	1.4	0.7	3	2.0	0.68
1783	3.0	4.7	2.3	1.0	37	108	47	32	1.1	4.2	4	2.0	0
1786	3.0	4.0	3.3	3.0	37	112	47	32	1.4	0.2	4	2.5	0.17
1787	3.0	4.3	2.3	2.5	38	107	54	34	1.2	3.5	4	3.0	0.17
1790	3.0	4.0	3.0	2.0	33	98	54	32	1.4	3.3	4	2.0	0.51
1791	3.3	3.7	1.7	1.0	32	102	54	32	1.2	8.6	4	2.0	0.68
1793	1.3	2.0	1.0	0	25	55	n.c.	46	-	0.1	5	1.0	-
1818	3.0	4.0	1.3	0	58	85	68	46	-	0.2	5	1.0	-
1954	2.3	1.3	1.7	3.0	25	25	n.c.	1	2.1	1.4	4	1.0	1.03
2009	2.7	3.3	1.3	2.5	37	92	63	39	1.5	0.1	4	2.0	0
2255	2.7	2.0	1.0	1.0	28	58	54	28	1.0	0.1	4	1.5	-
2371	1.3	2.0	1.7	2.5	10	65	104	1	1.5	7.8	2	2.5	0.86
2425	1.7	2.3	3.7	5.0	25	100	113	46	1.3	6.7	2	1.0	3.42
2430	2.0	2.7	2.3	5.0	18	78	113	12	1.2	1.6	2	1.5	0.34
2448	1.3	1.0	1.0	1.0	22	15	n.c.	46	0.9	0.1	3	1.0	0
2462	2.0	1.7	1.3	2.0	35	58	n.c.	39	1.4	2.5	4	1.5	0
2472	2.3	3.3	1.3	0	60	78	124	32	1.4	8.1	5	1.0	-
2479	3.0	4.0	2.0	0	38	83	83	32	1.6	9.8	5	1.5	-
2528	3.0	3.7	3.7	5.0	35	95	47	23	1.4	6.0	2	2.5	0.86
2761	3.0	2.3	1.3	1.5	38	60	83	12	3.3	7.5	4	1.5	0.17
2773	2.0	2.7	1.7	1.0	30	63	83	74	1.5	2.4	4	2.0	-
2786	2.0	2.0	2.0	2.5	30	65	124	23	1.7	2.6	4	1.5	0
2869	3.0	3.7	4.3	4.5	40	103	83	23	2.6	0.2	3	2.5	5.99
2870	2.3	2.0	2.0	2.0	18	70	115	0	2.3	0.3	4	1.5	0.51
2871	3.3	4.3	3.0	2.5	43	95	55	32	4.6	7.5	3	2.0	0.51
2872	3.0	4.0	2.7	1.5	40	102	55	31	4.5	5.3	4	1.5	0.17
2880	1.7	1.7	2.0	3.0	10	73	116	0	1.6	6.7	3	2.0	2.91
2881	1.7	2.0	3.0	3.0	18	107	98	1	1.6	5.6	3	2.0	2.91
2882	2.0	1.7	2.3	3.0	20	82	124	0	1.6	9.9	2	1.0	1.71
2883	2.7	4.0	3.3	3.0	52	123	105	1	2.4	2.8	3	1.0	1.71
2884	2.7	4.0	3.7	2.0	52	147	98	0	1.6	0.8	3	1.5	0
2889	2.7	3.7	1.7	2.0	42	70	68	32	1.4	5.8	4	2.0	0.34
2890	2.7	3.0	1.0	0	33	58	83	37	1.6	0.2	5	2.0	-
2891	3.0	3.3	2.3	3.5	37	93	54	31	4.3	8.2	4	2.0	0.86
2892	1.7	1.3	0	0	22	33	n.c.	1	-	0.1	5	1.0	-
2894	2.0	1.0	0	0	20	35	104	12	-	0.1	5	1.0	-

a) Means of 2 ratings only; b) n.c. = Plants did not cover the plot during the experimental period.
c) Palatability index (see Table 3); d) Plants had died before the acceptability assessment.

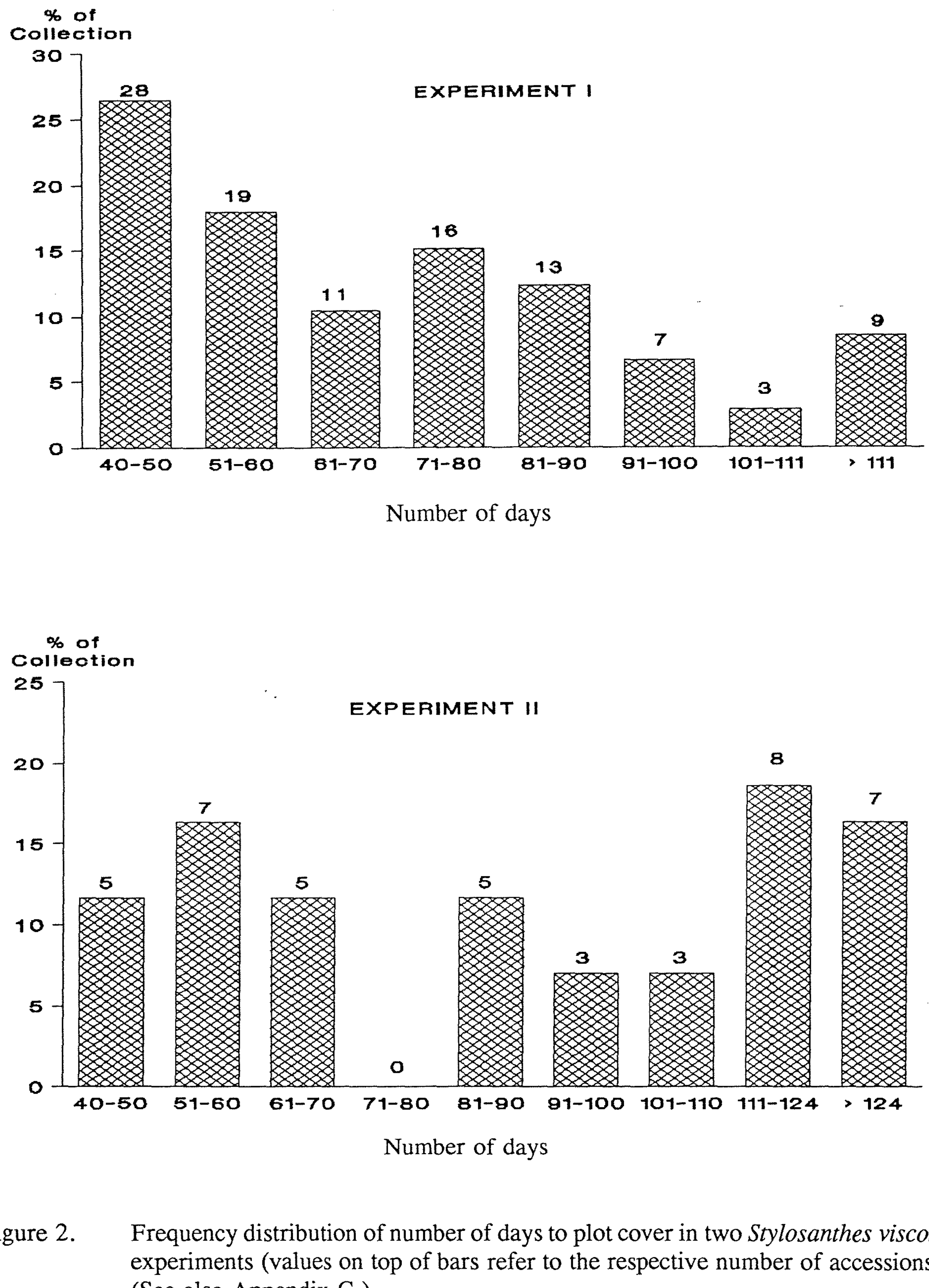

Figure 2. Frequency distribution of number of days to plot cover in two *Stylosanthes viscosa* experiments (values on top of bars refer to the respective number of accessions). (See also Appendix C.)

Plant vigour varied widely in both experiments (Tables 4 and 5). However, all accessions seemed to be adapted to the edaphic conditions since no symptoms of nutritional disorders were observed. Classifications of the accessions in cluster groups based on trimestral vigour ratings are presented in Tables 6 and 7.

In Experiment I (Table 6), the cluster analysis sorted the most vigorous accessions into cluster group VII. The decline in plant vigour during trimester 4 was due to a cut made at the end of trimester 3, which affected the regrowth of these vigorous plants; in trimester 5, however, they were completely recuperated. This group comprises accessions CIAT 1094, 1353, 2038, 2072, 2171, 2368, 2374 and 2516. Except for CIAT 2038 and 2374, these were selected for evaluation in Experiment III. Accessions in cluster V differ from those in cluster VII mainly with regard to their inferior performance in trimester 5. Cluster groups I and II are characterized by accessions of poor and very poor vigour, respectively. Contrary to the vigourous accessions in clusters VII and V, the cut made at the end of trimester 3 did not affect the regrowth of the short-growing materials in clusters I and II, which showed moderate to good vigour in trimester 4, but after that again had poor vigour. Cluster III accessions initially had poor vigour, but reached moderate to good vigour over time, whereas the materials included in cluster VI showed a considerable decline during the experimental period from moderate to very poor. Cluster IV material grew moderately, showing a good regrowth after the cut. In addition to the aforementioned 6 accessions selected for Experiment III, CIAT accessions 1538, 1785, 2158, 2405 and 2498 in cluster III as well as CIAT 1703 in cluster IV were also included in that experiment.

Plant vigour was negatively correlated with maximum incidence of anthracnose in the fourth trimester ($r = -0.39$, $P < 0.0001$) and fifth trimester ($r = -0.71$, $P < 0.0001$), respectively, while there was no relation between these attributes during the first three trimesters. As expected, mean plant vigour was positively correlated with plant height ($r = 0.64$, $P < 0.0001$) and diameter ($r = 0.51$, $P < 0.0001$).

In Experiment II (Table 7), the most vigorous accessions were located in cluster group V, which contains CIAT 1724, 2869 and 2528. The poorest vigour was registered for cluster IV material, which reflects the susceptibility of these accessions to anthracnose. Accessions in cluster I were characterized by moderate vigour until the cut carried out at the end of trimester 3; thereafter their vigour was poor. Vigour of the material in cluster group II was moderate during the first two trimesters and then decreased considerably because the plants were severely affected by anthracnose. Poor to moderate vigour was recorded for the accessions located in cluster III. CIAT 2528 and 2425 in clusters V and III, respectively, were selected for the agronomic evaluation experiment.

Table 6. Classification of 106 *Stylosanthes viscosa* accessions in seven cluster groups based on trimestral ratings of plant vigour (Experiment I). (See also Appendix D.)

Cluster group $R^2=0.74$	No. of accessions	Cluster group vigour ratings* in trimesters									
		1		2		3		4		5	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
I	16	2.3	(2.0-3.0)	2.1	(1.3-3.0)	2.3	(1.7-3.3)	3.8	(3.0-4.7)	2.2	(0.5-3.0)
II	14	1.5	(1.0-2.0)	1.1	(1.0-1.7)	1.0	(1.0-1.3)	2.6	(1.3-4.3)	1.8	(1.0-3.0)
III	26	1.8	(1.0-2.5)	2.3	(1.3-3.0)	3.1	(2.0-4.3)	3.6	(2.3-5.0)	3.6	(2.5-5.0)
IV	16	2.9	(2.5-3.5)	2.9	(2.0-3.3)	3.0	(2.3-4.0)	4.2	(3.0-5.0)	3.2	(2.5-4.0)
V	13	3.0	(2.0-3.5)	3.8	(3.0-4.3)	4.0	(3.0-5.0)	2.1	(1.3-3.0)	2.2	(1.5-3.0)
VI	13	2.6	(2.0-3.0)	2.7	(2.0-3.3)	2.3	(1.3-3.0)	1.3	(0.3-2.0)	0.9	(0-2.0)
VII	8	2.9	(2.0-3.5)	4.0	(3.3-4.7)	4.4	(3.7-5.0)	2.7	(2.0-3.7)	4.4	(3.5-5.0)

* Rating scale from 0 (dead plants) to 5 (excellent vigour).

Table 7. Classification of 43 *Stylosanthes viscosa* accessions in five cluster groups based on trimestral ratings of plant vigour Experiment II). (See also Appendix D.)

Cluster group $R^2=0.76$	No. of accessions	Cluster group vigour ratings* in trimesters							
		1		2		3		4	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range
I	11	2.9	(2.3-3.3)	4.2	(3.3-5.0)	3.1	(2.3-4.0)	2.2	(1.0-3.5)
II	11	2.8	(2.0-3.3)	3.2	(2.0-4.0)	1.5	(1.0-2.0)	1.0	(0-2.5)
III	12	2.0	(1.3-2.7)	2.0	(1.3-2.7)	2.2	(1.3-3.7)	3.2	(2.0-5.0)
IV	6	1.6	(1.0-2.3)	1.3	(1.0-2.0)	0.5	(0-1.0)	0.2	(0-1.0)
V	3	3.2	(3.0-3.7)	4.1	(3.7-5.0)	3.9	(3.7-4.3)	4.7	(4.5-5.0)

* Rating scale from 0 (dead plants) to 5 (excellent vigour).

Similar to Experiment I, a negative correlation was detected between maximum severity of anthracnose and plant vigour in the third and fourth trimesters of $r = -0.59$ ($P < 0.001$) and $r = -0.81$ ($P < 0.001$), respectively, while no correlation was found between these two variables in the first and second trimesters. This was because in both groups in general maximum severity of anthracnose was observed during the final two trimesters.

Mean plant vigour was positively correlated with plant diameter ($r = 0.85$, $P < 0.001$), but unlike Experiment I, there was no relationship between mean plant vigour and plant height.

Flowering and seed production. Flowering onset was highly variable, ranging in Experiment I between 12 and 105 days after transplanting and in Experiment II between 0 (plantlets were already flowering at transplanting) and 74 days (Figure 3). In both experiments, however, a majority of the accessions (69% and 84%, respectively) started blooming during the first 40 days after transplanting. Some variation existed in the colour of the standard, which ranged from deep yellow to cream-coloured (data not presented).

Seed production varied considerably in Experiment I, ranging from 0 to 64.3 g/plot (13 plants), while the accessions in Experiment II produced only between 0.1 and 14.8 g (Figure 3). Sixty percent of the accessions evaluated in Experiment I had relatively low seed yields (between 0.1 and 10.0 g/plot). In Experiment II, 47% of the collection produced less than 2.1 g. The most productive accessions were CIAT 2569, 2573, 2685, 1764, 2609 and 2367 for Experiment I, and CIAT 1431, 1688, 2882, 2479, 1791, 2891 and 2472 for Experiment II. There was a positive correlation between seed yield and inflorescence length of $r = 0.43$ ($P < 0.0001$) for Experiment I and $r = 0.49$ ($P < 0.002$) for Experiment II. Inflorescence length was highly variable, ranging in Experiment I from 0.9 to 5.4 cm and in Experiment II from 0.9 to 4.6 cm (Appendix G).

Anthracnose incidence. The principal disease observed was anthracnose caused by *Colletotrichum gloeosporioides*, which decreased plant vigour in both groups, resulting in a negative correlation between these two variables (see above). In Experiment II, there was also a correlation between anthracnose and seed production ($r = -0.35$, $P < 0.02$).

Considerable variation was detected in both experiments for severity of the disease (Figure 4). In Experiment I, six accessions did not show any symptoms (CIAT 1512, 1070, 2368, 2118, 2516 and 2158) and 39% of the collection was only slightly affected (ratings 1 and 2). Severe damage (ratings 4 and 5) was registered for 35% of the accessions. In Experiment II, all accessions were affected by the disease, which caused severe damage (ratings 4 and 5) in about 65% of the collection.

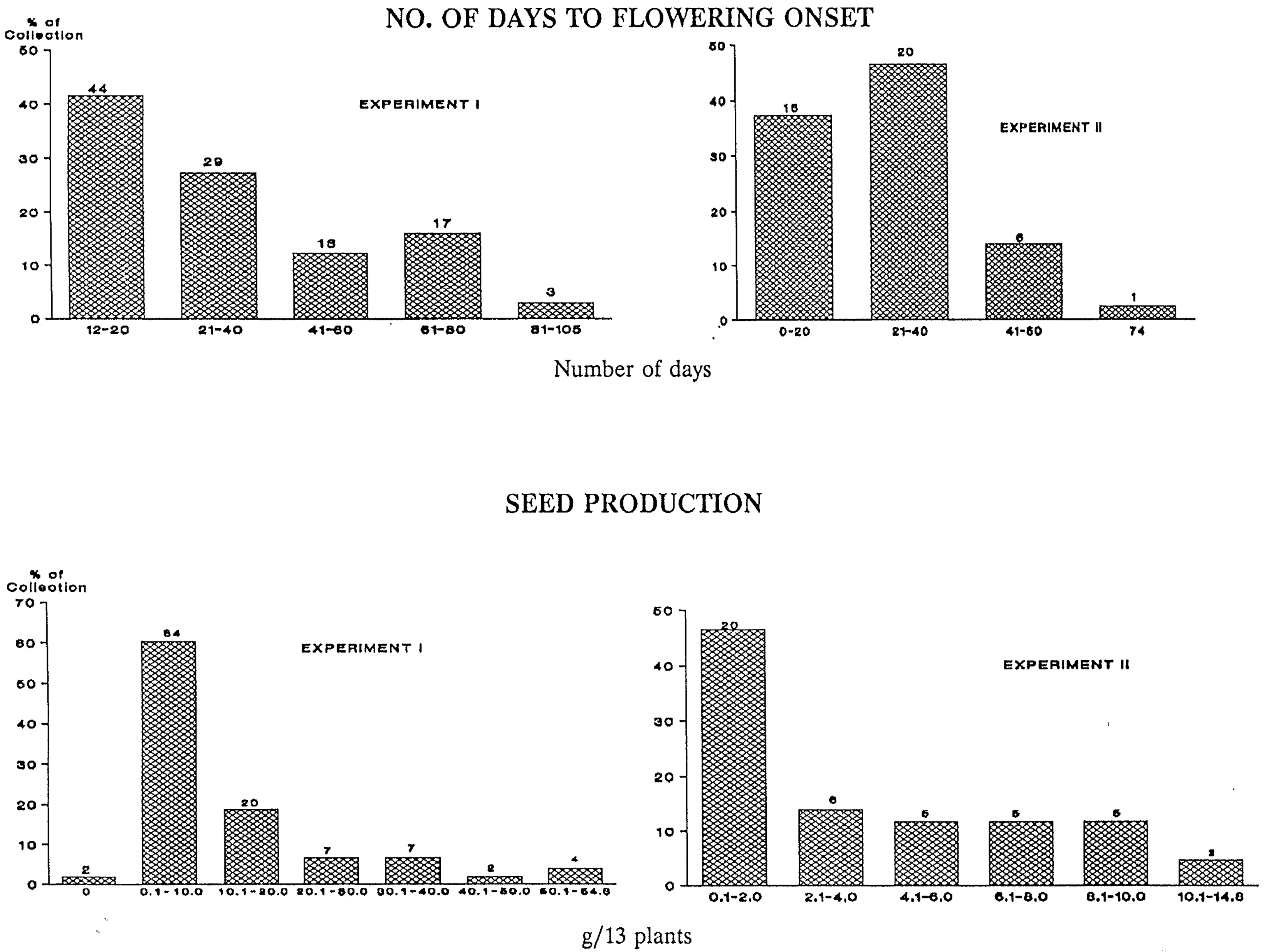

Figure 3. Frequency distribution of number of days to flowering onset and seed yield in two *Stylosanthes viscosa* experiments (values on top of bars refer to the respective number of accessions). (See also Appendix E and F.)

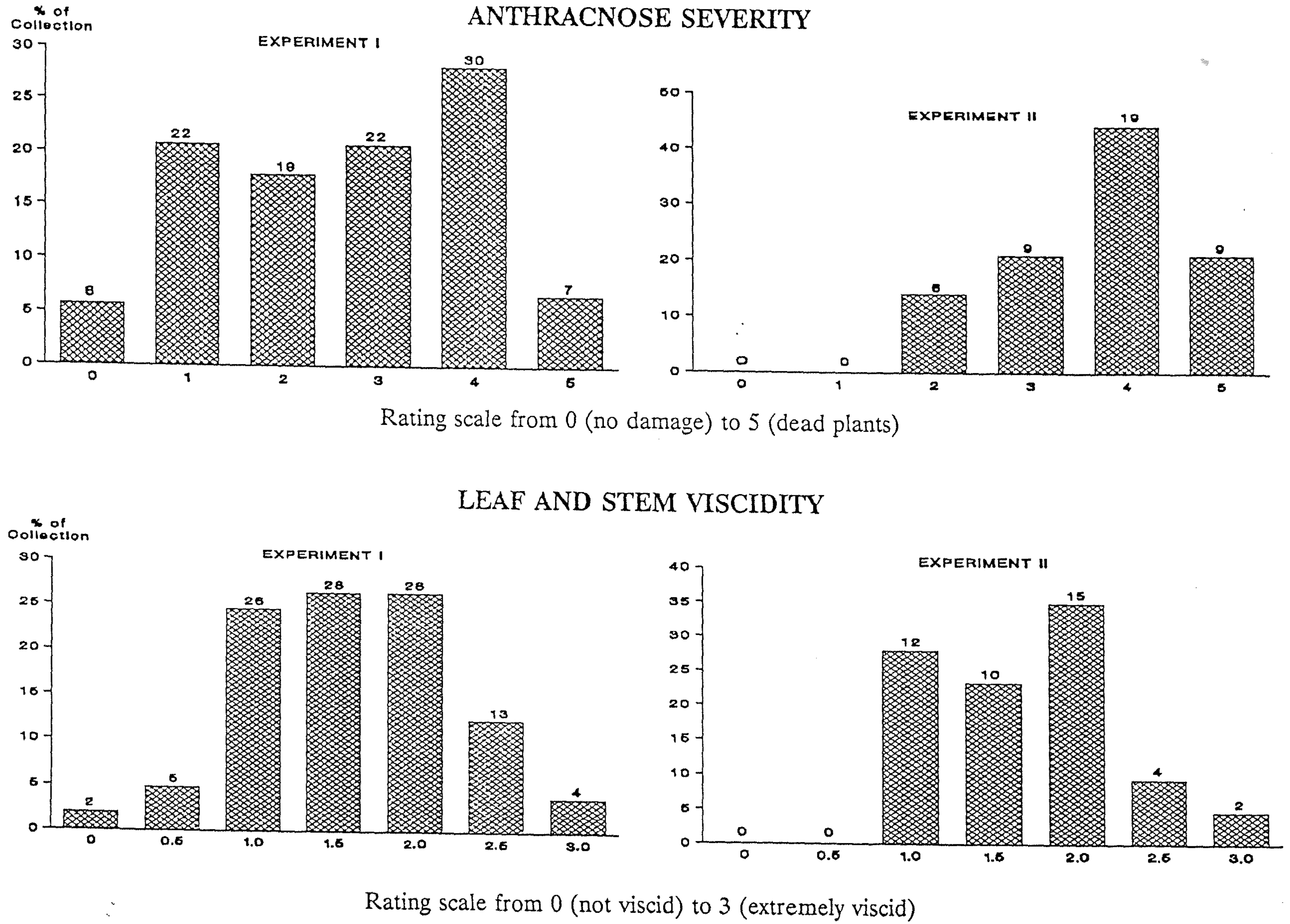

Figure 4. Frequency distribution of degree of anthracnose severity and leaf and stem viscidity in two *Stylosanthes viscosa* experiments (values on top of bars refer to the respective number of accessions). (See also Appendix H and I.)

Viscidity and acceptability to cattle. The germplasm evaluated showed considerable variation for degree of the viscous secretion on stems and leaves (Figure 4). In Experiment I, two accessions (CIAT 1795 and 1885) apparently did not produce the secretion. Most had a moderate stickiness, while 17 accessions were very sticky. In Experiment II, all accessions exhibited the viscous secretion. As for Experiment I, most of the accessions were moderately sticky and only on six accessions was a high degree of the sticky secretion observed.

Acceptability of the accessions to cattle expressed in the form of relative palatability indices (PI) varied widely, the extremes being 0 and 6.16 (Figure 5). Seventeen accessions were not included in the test since the plants had died. Twenty-two accessions were not eaten at all (PI = 0) and 62 accessions, that is, 48% of the collection, had a very low palatability index (PI between 0.17 and 1.00). The accession CIAT 1094 was of moderate palatability (PI = 1.71). The most palatable accessions were CIAT 2158 and 2869, followed by CIAT 2405 and 1812, and a group that comprised CIAT 1011, 1353, 1900, 2117, 2120, 2171 and 2425. Palatability appeared to be affected by anthracnose since a negative correlation between these two parameters of r = -0.39 (P < 0.001) was recorded. Because diseased plants were less vigorous than disease-free ones, the aforementioned relation seems to reflect a certain

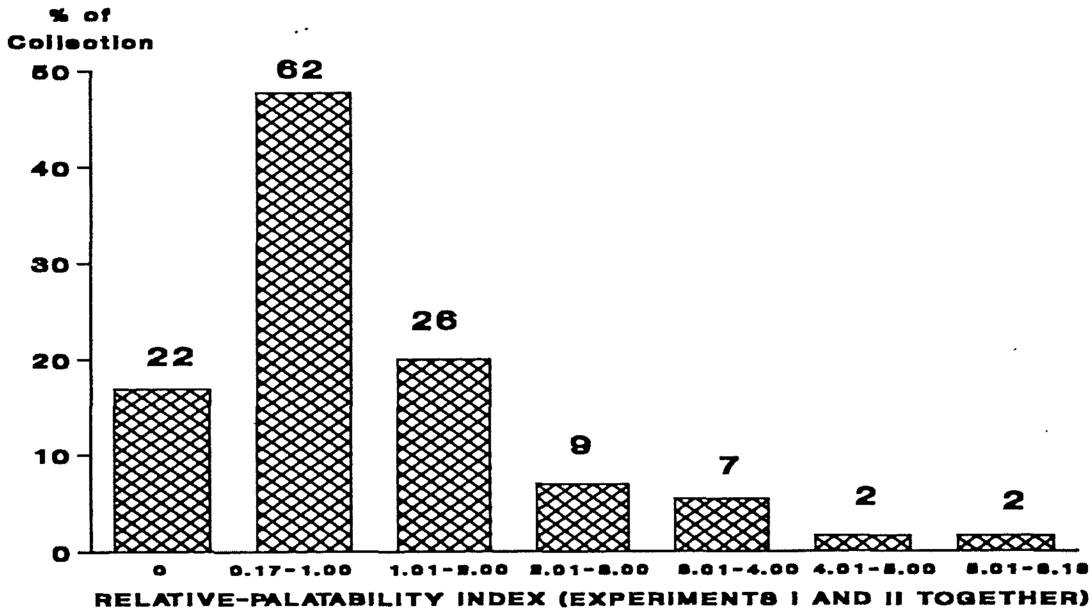

Figure 5. Frequency distribution of palatability index in a collection of *Stylosanthes viscosa* (values on top of bars refer to the respective number of accessions). (See also Appendix J.)

tendency of the animals to graze accessions which offered more forage, resulting in a positive, although not high, correlation between PI and plant vigour of r = 0.28 (P

< 0.001). Degree of plant stickiness apparently did not affect palatability.

Experiment III: Dry-Matter Yield and Survival

All accessions grew well and did not show any problems of soil adaptation. Dry-matter yields were quite variable, ranging in the mean of six cuts from 34.3 to 60.7 g/plant/12 weeks (Table 8), but did not differ significantly among most of the accessions. The most productive accessions were those from Mato Grosso, central Brazil (CIAT 1785 and 1703). Their rate of survival, however, was very low (25% and 4%, respectively), and was presumably influenced by a high degree of anthracnose susceptibility. Anthracnose ratings at the two final harvests were also variable, but none of the accessions proved to have a high level of resistance. Leaf percentage in total dry matter averaged 46%; CIAT 2171 was the leafiest (56%) and CIAT 2072 the stemmiest (38%) accession. The range of N and P concentrations was rather narrow (2.1-2.4% and 0.13-0.16%, respectively), but that of Ca concentration was somewhat wider (0.35-0.57%). *In vitro* dry-matter digestibility was not analyzed. However, data obtained in the preliminary evaluation experiments for leaves of the same 14 accessions ranged from 41.6% to 58.9% (Keller-Grein 1984).

During the experiment, considerable morphological variability was observed in accessions CIAT 2405 and 2425, each of which contained more than two plant types. As the seed for this experiment came from uniform plants grown under greenhouse conditions or from the aforementioned preliminary evaluation experiments, this finding suggests that outcrossing can occur in *S. viscosa*. Morphological variability had also been observed previously in introduction plots of three accessions from Venezuela (CIAT 1547, 1904 and 1908) and one accession from Brazil (CIAT 2118), leading to the separation of the distinct plant types and assignation of new accession numbers (CIAT 1940, 1960, 1988 and 2900, respectively). Observations made in the preliminary evaluation experiments on several accessions from Panama and Venezuela which flowered profusely but barely produced seeds might indicate self-incompatibility or the need for a pollinating insect.

DISCUSSION AND CONCLUSIONS

The morphological and agronomic attributes measured in the preliminary evaluation experiments proved to be highly variable among accessions. Thus, the *S. viscosa* collection seems to hold considerable potential for selection for further testing and eventual cultivar development or genetic enhancement.

Of particular interest is the variation observed for acceptability to cattle since extremely low acceptance is considered to be the main constraint on the potential use of *S. viscosa*. Gardener (1984) reported very low preference indices for two accessions of *S. viscosa* (CPI 34904 and CPI 40264B) evaluated in association with buffel grass and native pasture in Australia. Cattle preferred grass to the two accessions regardless of the season of the year, resulting in legume dominance over time. Unfortunately, the

Table 8. Dry-matter (DM) yield, plant survival, anthracnose tolerance, leaf percentage and nutrient concentrations of 14 selected *Stylosanthes viscosa* accessions.

CIAT accession no.	Growth habit	DM yield[1] (g/plant)	Surviving plants[2] (%)	Anthracnose rating[3]	% Leaf in total DM[4]	Concentration (%) in DM of whole plants[5]		
						N	P	Ca
1785	Semierect	60.7 a[6]	25 bc	4.0	47	2.1	0.14	0.39
1703	Semierect	54.3 ab	4 c	4.0	40	2.2	0.15	0.41
2158	Semierect	53.7 ab	49 ab	2.0	50	2.4	0.16	0.39
1538	Semierect	53.0 ab	65 a	3.0	44	2.3	0.14	0.50
2498	Semierect	49.6 abc	23 bc	3.5	49	2.2	0.13	0.45
1094	Semierect	47.0 abc	40 abc	3.5	40	2.2	0.14	0.38
2405	Semiprostrate	45.5 abc	50 ab	2.5	46	2.2	0.15	0.43
2368	Semierect	44.2 abc	51 ab	3.0	51	2.1	0.15	0.40
2171	Erect	42.2 bc	24 bc	3.0	56	2.2	0.13	0.40
1353	Erect	41.0 bc	31 abc	3.0	41	2.2	0.14	0.57
2528	Semierect	37.7 bc	60 ab	2.0	48	2.1	0.14	0.35
2516	Erect	37.5 bc	29 abc	2.0	48	2.4	0.16	0.48
2072	Erect	36.7 bc	29 abc	4.0	38	2.3	0.16	0.48
2425	Semiprostrate	34.3 c	51 ab	2.0	43	2.4	0.16	0.44
Mean		45.5	38	3.0	46	2.2	0.15	0.43

1/ Mean of 6 cuts 2/ At end of experiment (Nov. 1984) 3/ Mean of last two ratings (August and November 1984) where 0 = no infection and 5 = dead plants 4/ Only cut No. 1 5/ Means of 5 cuts 6/ a,b,c: significance at P = 0.05 (Duncan's Multiple Range Test).

acceptability of these two accessions, which are equivalent to accessions CIAT 08 and 1818, could not be determined in the present work, because they did not persist until the acceptability test was carried out, mainly due to susceptibility to anthracnose. Nevertheless, through this test it has been possible to identify a group of 11 accessions which cattle clearly preferred to the remaining part of the collection. However, it should be pointed out that, like *Stylosanthes* in general, particularly *S. viscosa* has a lower preference rating than some other legumes. In a subsequent cafeteria grazing experiment at Quilichao, for example, regardless of the season, two *S. viscosa* accessions (CIAT 1353 and 1538, of which the former accession was among the 11 preferred accessions in the preliminary evaluation experiments) exhibited a low palatability compared with *Centrosema acutifolium, Desmodium velutinum* and *Zornia glabra* (Schultze-Kraft *et al.* 1989).

The degree of plant stickiness caused by trichomes, which secrete a viscous fluid with a characteristic odor, reveals a considerable variability in the *S. viscosa* collection. Laboratory experiments have shown that accessions of *S. viscosa* and other *Stylosanthes* species which produce the sticky secretion are able to immobilize and kill cattle tick larvae (Sutherst *et al.* 1982, 1986). However, the effectiveness of *S. viscosa* in tick control under field conditions has not yet been determined. Research is also warranted to clarify to what extent plant stickiness affects acceptability. In the preliminary evaluation experiments, the degree of stickiness apparently did not affect acceptability to cattle. This may be because the dates on which the stickiness evaluations were carried out did not coincide with the date of the palatability test. Seasonal and local variations in plant stickiness can occur and seem to be related to climate, fungal diseases, fire and grazing (Sutherst *et al.* 1986).

The high variation in flowering onset could be expected since the accessions came from a wide range of geographical and climatic conditions. However, no relationships could be detected between this characteristic or other agronomically important attributes and environmental conditions at the original collection sites of the germplasm. Flowering onset also varied considerably among 11 accessions of *S. viscosa* evaluated at Lansdown, Australia, showing a range of 69 days with daylengths from 667 to 723 minutes (Edye *et al.* 1974, 1984). The early-flowering accessions may have a potential in regions with lower rainfall where early blooming and seed setting are essential characteristics to ensure self-regeneration. Similar to that of flowering onset, the variation in seed production was not surprising. Seed production of four accessions evaluated in south Florida was abundant and many new seedlings were produced each year (Brolmann 1980). *Stylosanthes viscosa* accessions studied in Australia had a free seeding habit (Edye *et al.* 1984).

The dry-matter yield of the selected accessions in the agronomic evaluation experiment was quite high. The proportion of surviving plants was, with some exceptions, rather low and seemed to be affected mainly by susceptibility to anthracnose, although these accessions in general were only slightly affected in the preliminary-evaluation experiments. It is possible that variations in disease pressure may have occurred or that the plants exhibited higher susceptibility under the more frequent cutting regime. Thus, development of improved field screening methods would appear to be warranted.

The proportion of leaves in the herbage is with few exceptions acceptable for three-month-old plants and compares well with data reported in the literature for *Stylosanthes* spp., which tend to have a quite high stem content (Anning 1979; McIvor 1979; Gardener 1980). The N and P concentrations reveal similar values for the 14 accessions tested; they are somewhat higher than those reported by Little *et al.* (1984) for mature *S. viscosa* herbage. Calcium content is relatively low in comparison with data reported in the literature for *S. gracilis* (Risopoulos 1966), *S. humilis* (Andrew and Robins 1969) or the closely related *S. scabra* (Maass 1989). Since no symptoms of Ca deficiency were observed, it appears that critical Ca concentrations for the *S. viscosa* accessions studied at Quilichao might be somewhat lower than those critical values reported by Salinas and Gualdrón (1989) for several other *Stylosanthes* species, ranging from 0.70% to 2.00%.

Due to the relatively high rainfall and its bimodal distribution, Quilichao is possibly not the most appropriate site to evaluate *S. viscosa* germplasm. However, the present study has revealed considerable morphological and agronomic variation among the large number of accessions tested. Thus, it is suggested to conduct further regional testing of *S. viscosa* in semiarid to subhumid savanna ecosystems, including (1) accessions that are representative of the wide natural distribution of the species and (2) accessions which were promising in the preliminary evaluation experiment in important attributes such as plant vigour, days to flowering (representatives of the principal groups), seed production, tolerance of anthracnose and relative palatability. A collection for such regional evaluation could comprise the following accessions: CIAT 10, 1011, 1094, 1353, 1431, 1439, 1524, 1703, 1716, 1764, 1785, 1812, 1854, 1900, 1908, 2038, 2117, 2120, 2158, 2171, 2368, 2374, 2405, 2425, 2434, 2498, 2516, 2528, 2644, 2869 and 2883.

The most foreseeable potential of *S. viscosa* is in low to intermediate rainfall areas with a pronounced dry season during which the preference of cattle grazing *S. viscosa*-grass pastures should switch from the then low-quality grass to the legume in spite of its relatively low acceptability. According to Burt *et al.* (1983) "it appears that some forms of *S. viscosa* are adapted to soil conditions intermediary to those of *S. scabra* and *S. capitata*", and have outyielded the closely related former species when studied under such conditions. This suggests situations between light textured, extremely acid and infertile soils on which *S. capitata* thrives and less acid, heavier and somewhat more fertile soils in the case of *S. scabra*.

It seems to be important to further broaden the genetic base by gathering germplasm from areas where *S. viscosa* is found but has not yet been collected. Areas which deserve collection because they are expected to host genetically diverse materials include Cuba, where indigenous *S. viscosa* is frequent; the Dominican Republic and Jamaica; as well as the Andean foothills of Bolivia; Sonora, Mexico; and Texas, USA, where the species has also been recorded (Williams *et al.* 1984).

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APPENDIX

A. *S. viscosa* accessions in groups according to plant height (cm)

1. Experiment I

6-10	:	CIAT 1795, 1817, 1841, 1851, 1854, 2118, 2371, 2398, 2434
11-20	:	CIAT 08, 1070, 1216, 1430, 1512, 1524, 1544, 1716, 1885, 1908, 1960, 1988, 2001, 2060, 2120, 2123, 2294, 2295, 2372, 2380, 2405, 2418, 2443,2466, 2562, 2569, 2582, 2628, 2635, 2644, 2900
21-30	:	CIAT 1011, 1132, 1346, 1348, 1436, 1439, 1527, 1538, 1541, 1547, 1638, 1661, 1695, 1697, 1703, 1764, 1785, 1807, 1895, 1912, 2158, 2230, 2341, 2460, 2498, 2505, 2509, 2525, 2573, 2592, 2609, 2621, 2629, 2729
31-40	:	CIAT 1051, 1094, 1435, 1593, 1812, 1888, 1900, 1904, 1940, 2367, 2368, 2384, 2455, 2501, 2524
41-50	:	CIAT 09, 1349, 2038, 2045, 2073, 2110, 2374, 2516, 2685
51-63	:	CIAT 1353, 2072, 2101, 2117, 2171, 2486, 2651
72	:	CIAT 2475

2. Experiment II

10-20	:	CIAT 2371, 2430, 2817, 2880, 2881, 2882, 2894
21-30	:	CIAT 10, 1214, 1431, 1514, 1688, 1793, 1954, 2255, 2425, 2448, 2773, 2786, 2892
31-40	:	CIAT 1724, 1783, 1786, 1787, 1790, 1791, 2009, 2462, 2479,2528, 2761, 2869, 2872, 2890, 2891
41-50	:	CIAT 1074A, 1094, 2871, 2889
51-60	:	CIAT 1818, 2472, 2883, 2884

B) *S. viscosa* accessions in groups according to plant diameter (cm)

1. Experiment I

26-40	:	CIAT 1795, 1885, 2443
41-60	:	CIAT 1524, 1841, 1851, 1888, 2371, 2460
61-80	:	CIAT 1346, 1348, 1430, 1436, 1439, 1512, 1527, 1547, 1716, 1812, 1817, 1908, 1940, 1988, 2118, 2372, 2380, 2398, 2475, 2501, 2525, 2582, 2621, 2635
81-100	:	CIAT 08, 1011, 1051, 1070, 1132, 1435, 1538, 1544, 1638, 1661, 1695, 1697, 1764, 1807, 1854, 1895, 1900, 2101, 2110, 2123, 2158, 2171, 2230, 2341, 2367, 2368, 2384, 2405, 2418, 2434, 2455, 2466, 2486, 2498, 2505, 2509, 2516, 2524, 2628, 2629, 2651
101-120	:	CIAT 1216, 1349, 1541, 1593, 1703, 1785, 1904, 1912, 1960, 2001, 2038, 2045, 2060, 2072, 2073, 2117, 2120, 2294, 2295,

		2374, 2562, 2592, 2609, 2685
121-145	:	CIAT 09, 1094, 1353, 2569, 2573, 2644, 2729, 2900

2. Experiment II

15	:	CIAT 2448
25-40	:	CIAT 1514, 1954, 2892, 2894
41-60	:	CIAT 1214, 1793, 2255, 2462, 2761, 2890
61-80	:	CIAT 10, 1431, 1688, 2371, 2430, 2472, 2773, 2786, 2870, 2880, 2889
81-100	:	CIAT 1790, 1818, 2009, 2425, 2479, 2528, 2871, 2882, 2891
101-128	:	CIAT 1074A, 1094, 1724, 2783, 1786, 1787, 1791, 2869, 2872, 2881, 2883
147	:	CIAT 2884

C. *S. viscosa* accessions in groups according to number of days to plot cover

1. Experiment I

40-50	:	CIAT 09, 1349, 1353, 1538, 1593, 1638, 1661, 1695, 1807, 1904, 1912, 1960, 2001, 2038, 2045, 2072, 2117, 2120, 2294, 2295, 2341, 2384, 2516, 2562, 2569, 2609, 2685, 2729
51-60	:	CIAT 08, 1011, 1094, 1541, 1547, 1697, 1703, 1716, 1900, 2060, 2110, 2158, 2171, 2368, 2573, 2592, 2628, 2644, 2900
61-70	:	CIAT 1216, 1348, 1435, 1439, 1512, 1527, 1544, 1785, 1812, 2101, 2372
71-80	:	CIAT 1070, 1132, 1436, 1764, 1895, 1908, 2123, 2230, 2374, 2405, 2418, 2455, 2525, 2582, 2621, 2629
81-90	:	CIAT 1346, 1940, 2073, 2118, 2367, 2380, 2466, 2498, 2505, 2509, 2524, 2635, 2651
91-100	:	CIAT 1051, 1430, 1524, 1988, 2371, 2475, 2486
101-111	:	CIAT 2434, 2501, 2398
>111	:	CIAT 1795, 1817, 1841, 1851, 1854, 1885, 1888, 2443, 2460

2. Experiment II

40-50	:	CIAT 1074A, 1724, 1783, 1786, 2528
51-60	:	CIAT 1787, 1790, 1791, 2255, 2871, 2872, 2891
61-70	:	CIAT 1094, 1214, 1818, 2009, 2889
71-80	:	-
81-90	:	CIAT 2479, 2751, 2773, 2869, 2890
91-100	:	CIAT 1688, 2881, 2884
101-110	:	CIAT 2371, 2883, 2894
111-124	:	CIAT 1431, 2425, 2430, 2472, 2786, 2870, 2880, 2882
>124	:	CIAT 10, 1514, 1793, 1954, 2448, 2462, 2892

D. *S. viscosa* accessions in plant vigour cluster groups

1. Experiment I
   - Cluster 1 : CIAT 08, 1346, 1547, 1764, 1895, 1940, 2123, 2341, 2372, 2418, 2434, 2525, 2582, 2621, 2629, 2635
   - Cluster 2 : CIAT 1430, 1524, 1795, 1817, 1841, 1851, 1854, 1885, 2118, 2371, 2380, 2398, 2443, 2460
   - Cluster 3 : CIAT 1011, 1051, 1070, 1348, 1435, 1512, 1538, 1544, 1785, 1812, 1900, 1960, 1988, 2158, 2367, 2405, 2466, 2486, 2498, 2501, 2505, 2509, 2524, 2644, 2651, 2900
   - Cluster 4 : CIAT 1349, 1436, 1439, 1541, 1638, 1661, 1697, 1703, 1716, 1904, 1908, 1912, 2120, 2230, 2384, 2455
   - Cluster 5 : CIAT 09, 1695, 2045, 2073, 2101, 2110, 2117, 2475, 2569, 2573, 2609, 2685, 2729
   - Cluster 6 : CIAT 1132, 1216, 1527, 1593, 1807, 1888, 2001, 2060, 2294, 2295, 2562, 2592, 2628
   - Cluster 7 : CIAT 1094, 1353, 2038, 2072, 2171, 2368, 2374, 2516

2. Experiment II
   - Cluster 1 : CIAT 1074A, 1094, 1783, 1786, 1787, 1790, 2871, 2872, 2883, 2884, 2891
   - Cluster 2 : CIAT 1688, 1791, 1818, 2009, 2255, 2472, 2479, 2761, 2773, 2889, 2890
   - Cluster 3 : CIAT 10, 1431, 1954, 2371, 2425; 2430, 2462, 2786, 2870, 2880, 2881, 2882
   - Cluster 4 : CIAT 1214, 1514, 1793, 2448, 2892, 2894
   - Cluster 5 : CIAT 1724, 2528, 2869

E. *S. viscosa* accessions in groups according to number of days to flowering onset

1. Experiment I
   - 12-20 : CIAT 1349, 1430, 1435, 1436, 1439, 1538, 1541, 1544, 1638, 1661, 1695, 1703, 1716, 1817, 1851, 1904, 2001, 2072, 2073, 2102, 2110, 2117, 2118, 2120, 2123, 2230, 2294, 2341, 2371, 2372, 2380, 2398, 2405, 2434, 2443, 2455, 2460, 2466, 2505, 2525, 2582, 2621, 2629, 2900
   - 21-40 : CIAT 1011, 1070, 1346, 1348, 1353, 1512, 1524, 1527, 1547, 1593, 1697, 1764, 1785, 1795, 1807, 1812, 1854, 1900, 1908, 1912, 1940, 2158, 2171, 2384, 2418, 2509, 2516, 2628, 2651
   - 41-60 : CIAT 08, 09, 1132, 1885, 1888, 1988, 2060, 2374, 2475, 2486, 2524, 2635, 2685
   - 61-80 : CIAT 1051, 1094, 1216, 1960, 2038, 2045, 2295, 2367, 2368, 2498, 2501, 2562, 2569, 2573, 2592, 2609, 2729
   - 81-105 : CIAT 1841, 1895, 2644

2. Experiment II
   - 0-20 : CIAT 10, 1431, 1514, 1688, 1954, 2371, 2430, 2761, 2870, 2880,

		2881, 2882, 2883, 2884, 2892, 2894
21-40	:	CIAT 1214, 1724, 1737, 1783, 1786, 1790, 1791, 2009, 2255, 2462, 2472, 2479, 2528, 2786, 2869, 2871, 2872, 2889, 2890, 2891
41-60	:	CIAT 1074A, 1094, 1793, 1818, 2425, 2448
74	:	CIAT 2773

F. *S. viscosa* accessions in groups according to seed production (g/plot)

1. Experiment I

0	:	CIAT 1817, 1841
0.1-10.0	:	CIAT 09, 1051, 1070, 1094, 1132, 1216, 1346, 1348, 1512, 1524, 1527, 1538, 1593, 1695, 1795, 1807, 1812, 1851, 1854, 1885, 1888, 1895, 1900, 1904, 1908, 1912, 1940, 1960, 1988, 2045, 2072, 2073, 2101, 2110, 2117, 2118, 2120, 2123, 2158, 2171, 2294, 2295, 2371, 2372, 2374, 2380, 2384, 2398, 2405, 2418, 2434, 2455, 2466, 2475, 2486, 2498, 2501, 2505, 2509, 2562, 2621, 2635, 2651, 2900
10.1-20.0	:	CIAT 08, 1011, 1349, 1353, 1430, 1435, 1436, 1547, 1661, 1703, 1785, 2060, 2230, 2341, 2368, 2443, 2460, 2516, 2524, 2525
20.1-30.0	:	CIAT 1439, 1541, 1638, 1697, 2582, 2644, 2729
30.1-40.0	:	CIAT 1544, 1716, 2001, 2038, 2592, 2628, 2629
40.1-50.0	:	CIAT 2367, 2609
50.1-64.3	:	CIAT 1764, 2569, 2573, 2685

2. Experiment II

0.1-2.0	:	CIAT 10, 1074A, 1094, 1214, 1514, 1724, 1786, 1793, 1818, 1954, 2009, 2255, 2430, 2448, 2869, 2870, 2884, 2890, 2892, 2894
2.1-4.0	:	CIAT 1787, 1790, 2462, 2773, 2785, 2883
4.1-6.0	:	CIAT 1783, 2528, 2872, 2881, 2889
6.1-8.0	:	CIAT 2371, 2425, 2761, 2871, 2880
8.1-10.0	:	CIAT 1791, 2472, 2479, 2882, 2891
10.1-14.8	:	CIAT 1431, 1688

G. *S. viscosa* accessions in groups according to inflorescence length (cm)

1. Experiment I

0.9-1.0	:	CIAT 09, 1094, 1593, 1795, 1817, 1841, 1851, 1885, 1960, 1988, 2367, 2405, 2418
1.1-2.0	:	CIAT 1011, 1051, 1070, 1132, 1216, 1346, 1348, 1353, 1512, 1524, 1527, 1541, 1544, 1547, 1695, 1697, 1703, 1785, 1807, 1812, 1854, 1888, 1895, 1900, 1904, 1908, 1912, 1940, 2001,

2045, 2060, 2072, 2073, 2101, 2110, 2118, 2120, 2123, 2158, 2171, 2294, 2295, 2341, 2368, 2371, 2372, 2374, 2380, 2384, 2398, 2434, 2443, 2455, 2460, 2466, 2475, 2486, 2498, 2501, 2505, 2509, 2516, 2524, 2525, 2562, 2569, 2573, 2592, 2609, 2651, 2729, 2900

2.1-3.0 : CIAT 1435, 1436, 1538, 2117, 2621, 2628, 2629, 2635, 2644, 2685
3.1-4.0 : CIAT 08, 1349, 1430, 1661, 1716, 1764, 2038, 2230
4.4-4.8 : CIAT 1439, 2582
5.4 : CIAT 1638

2. Experiment II
0.9-1.0 : CIAT 1094, 2255, 2448
1.1-2.0 : CIAT 10, 1074A, 1514, 1724, 1783, 1786, 1787, 1790, 1791, 2009, 2371, 2425, 2430, 2462, 2472, 2479, 2528, 2773, 2786, 2880, 2881, 2882, 2884, 2889, 2890
2.1-3.0 : CIAT 1954, 2869, 2870, 2883
3.3-3.5 : CIAT 1688, 2761
4.3-4.6 : CIAT 1431, 2871, 2872, 2891

Note: Missing values for CIAT 1214, 1793, 1818, 2892, 2894

H. *S. viscosa* accessions in groups according to anthracnose severity

1. Experiment I
0 : CIAT 1070, 1512, 2118, 2158, 2368, 2516
1 : CIAT 1011, 1051, 1094, 1348, 1524, 1716, 1785, 1854, 1900, 1908, 2038, 2171, 2367, 2371, 2372, 2380, 2405, 2434, 2498, 2501, 2525, 2900
2 : CIAT 1346, 1353, 1439, 1661, 1697, 1703, 1764, 1904, 1960, 1988, 2072, 2073, 2110, 2117, 2230, 2374, 2398, 2418, 2466
3 : CIAT 1349, 1435, 1436, 1541, 1544, 1638, 1695, 1812, 1841, 1851, 1912, 2120, 2123, 2384, 2486, 2505, 2509, 2524, 2582, 2629, 2644, 2651
4 : CIAT 08, 09, 1216, 1430, 1527, 1538, 1547, 1795, 1817, 1885, 1888, 1895, 2045, 2101, 2294, 2295, 2341, 2443, 2455, 2460, 2475, 2562, 2569, 2573, 2592, 2609, 2621, 2635, 2685, 2729
5 : CIAT 1132, 1593, 1807, 1940, 2001, 2060, 2628

2. Experiment II
0 : -
1 : -
2 : CIAT 1431, 2371, 2425, 2430, 2528, 2882
3 : CIAT 1094, 1724, 2448, 2869, 2871, 2880, 2881, 2883, 2884
4 : CIAT 10, 1074A, 1688, 1783, 1786, 1787, 1790, 1791, 1954, 1009,

2255, 2462, 2761, 2773, 2786, 2870, 2872, 2889, 2891
5 : CIAT 1214, 1514, 1793, 1818, 2472, 2479, 2890, 2892, 2894

I. *S. viscosa* accessions in groups according to leaf and stem viscidity

1. Experiment I
   - 0 : CIAT 1795, 1885
   - 0.5 : CIAT 1817, 1841, 1851, 1895, 2628
   - 1.0 : CIAT 1132, 1348, 1524, 1527, 1541, 1593, 1854, 1886, 1940, 1960, 2001, 2038, 2045, 2060, 2118, 2123, 2294, 2295, 2418, 2443, 2501, 2562, 2569, 2592, 2621, 2635
   - 1.5 : CIAT 09, 1070, 1216, 1349, 1353, 1430, 1435, 1436, 1439, 1512, 1544, 1904, 1908, 1988, 2372, 2398, 2405, 2434, 2486, 2509, 2516, 2525, 2573, 2609, 2629, 2651, 2729, 2900
   - 2.0 : CIAT 1011, 1051, 1346, 1638, 1661, 1695, 1697, 1716, 1764, 1807, 1912, 2101, 2120, 2158, 2341, 2367, 2374, 2380, 2384, 2455, 2460, 2466, 2498, 2505, 2524, 2582, 2644, 2685
   - 2.5 : CIAT 08, 1094, 1538, 1703, 1785, 1900, 2073, 2110, 2117, 2230, 2368, 2371, 2475
   - 3.0 : CIAT 1547, 1812, 2072, 2171

2. Experiment II
   - 0 : -
   - 0.5 : -
   - 1.0 : CIAT 10, 1514, 1793, 1818, 1954, 2425, 2448, 2472, 2882, 2883, 2892, 2894
   - 1.5 : CIAT 1688, 2255, 2430, 2462, 2479, 2761, 2786, 2870, 2872, 2884
   - 2.0 : CIAT 1074A, 1094, 1431, 1724, 1783, 1790, 1791, 2009, 2773, 2871, 2880, 2881, 2889, 2890, 2891
   - 2.5 : CIAT 1786, 2371, 2528, 2869
   - 3.0 : CIAT 1214, 1787

J. *S. viscosa* accessions in groups according to palatability index

- 0 : CIAT 1435, 1436, 1541, 1661, 1716, 1783, 1841, 1851, 2009, 2294, 2448, 2462, 2524, 2562, 2592, 2609, 2621, 2628, 2629, 2786, 2884, 2900
- 0.17-1.00 : CIAT 1070, 1074A, 1216, 1349, 1430, 1431, 1512, 1544, 1547, 1638, 1688, 1695, 1697, 1724, 1764, 1785, 1786, 1787, 1790, 1791, 1807, 1817, 1854, 1888, 1895, 1904, 1940, 2001, 2038,

	2101, 2230, 2295, 2341, 2368, 2371, 2372, 2380, 2384, 2398, 2430, 2443, 2455, 2466, 2475, 2501, 2505, 2525, 2528, 2569, 2573, 2582, 2635, 2644, 2651, 2685, 2729, 2761, 2870, 2871, 2872, 2889, 2891
1.01-2.00 :	CIAT 10, 1051, 1094, 1346, 1348, 1439, 1527, 1538, 1703, 1885, 1908, 1912, 1954, 1960, 1988, 2045, 2072, 2073, 2123, 2367, 2374, 2418, 2460, 2486, 2882, 2883
2.01-3.00 :	CIAT 1524, 2110, 2118, 2434, 2498, 2509, 2516, 2880, 2881
3.01-4.00 :	CIAT 1011, 1353, 1900, 2117, 2120, 2171, 2425
4.01-5.00 :	CIAT 1812, 2405
5.01-6.16 :	CIAT 2158, 2869