Marigold (*Tagetes* spp. L)

I. Subject

These test guidelines shall apply to all varieties, hybrids and parental lines of marigold (*Tagetes*spp.L.) of family *Asteraceae*.

II. Seed Material Required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA) shall decide when, where and in what quantity and quality of the planting material (seed or rooted cuttings) required for testing the variety is to be delivered. Applicants submitting seed material from a country other than India must make sure that all customs and formalities are complied with.
2. The minimum quantity of seed or rooted cuttings of varieties, hybrids and parental lines to be supplied by the applicant for open field cultivation should be:
    - For seed propagated varieties/hybrids/parental lines: 10g seeds (in one submission only).
    - For vegetatively propagated varieties /hybrids/ parental lines: 200 Nos. rooted cuttings (separately for independent growing seasons).
3. The seed should meet the minimum requirement for germination capacity (80%), moisture content should not be more than 8% and physical purity (98%) prescribed for certified seed in India. Especially for storage, which requires a higher standard, the applicant should state the actual germination capacity, which should be as high as possible. The planting material (seed or rooted cuttings) supplied should be visibly healthy, not lacking in vigour or affected by any important pest or disease.
4. The planting material must not have undergone any treatment unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.
5. Applicant has to indicate similarity of candidate variety with African (*Tagetes erecta*L.) or French marigold (*Tagetes patula*L.).

III. Conduct of Tests

1. The minimum duration of DUS test should normally be two independent but similar growing seasons.
2. The test should normally be conducted at two different locations. If any essential characteristic of the variety cannot be observed at these places, the variety may be tested at an additional place.

3. The field test shall be carried out under conditions ensuring normal growth and expression of all test characteristics. The size of the plot should be such that plants or parts of plant may be removed for measuring and counting without prejudice to the observations which must be made upto the end of the growing period. Each test shall include atleast60 plants, which should be divided among 3 replications. Separate plots for observations and for measuring can only be used if they have been subjected to similar environmental conditions.

4. Seed propagated material shall be transplanted between 25-30 days after seed sowing . In case of vegetatively propagated material transplanting shall be done after sufficient root formation in cuttings. Pinching/disbudding shall be followed upto 20 days after transplanting enabling the plant for clear expression of all the morphological traits.

5. Test plot design

Number of rows	:	2
Row to row distance	:	60 cm
Plant to plant distance	:	50 cm
Number of plants per row	:	10
Number of plants per replication	:	20
Number of replications	:	3

6. Additional test protocols for special purpose shall be established by the PPV&FR Authority.

IV. Methods and Observations

1. The characteristics described in the Table of Characteristics (Section VII) should be used for the testing of varieties /hybrids/ parental lines for DUS.

2. For the assessment of Distinctiveness and Stability, observations should be made on 18 plants or parts of plants selected randomly, which should be divided among 3 replications (6 plants in each replication).

3. For the assessment of Uniformity of characteristics in the plot as a whole (visual assessment by a single observation of a group of plants or parts of plants), a population standard of 1% with an acceptance probability of at least 95% should be applied. In case of a sample size of 60 plants, the number of off-types should not exceed 1.

4. All observation, assessment and measurement of the plant variety shall be taken at the time of full flowering stage except hypocotyl: anthocyanin colouration and hypocotyl: intensity of anthocyanin colouration which shall be taken after 10-20 days of seed sowing (at 2-4 leaf stage). However, time of beginning of flowering shall be recorded at first flowering stage.

5. Observation on all characters need to be recorded at all the stages as indicated in table of characteristics. Observation on flower characters should be recorded just after flowers are completely open.

6. For the assessment of colour characteristics, the Royal Horticultural Society (RHS) Colour Chart shall be used.

V. Grouping of Varieties

1. The candidate varieties for DUS testing shall be divided into groups to facilitate the assessment of Distinctiveness. Characteristics which are suitable for grouping purposes are those, which are known from experience not to vary, or to vary only slightly, within a variety /hybrids/ parental lines. Their various states of expression should be fairly evenly distributed throughout the collection.

2. The following characteristics are recommended for grouping of marigold varieties /hybrids/ parental lines.

Plant: height	characteristic : 5
Plant: growth habit	characteristic : 6
Flower head: floret type	characteristic : 17
Flower head: diameter	characteristic : 18
Only varieties with tubulate and ligulate floret type: flower head: number of ligulate floret whorls	characteristic : 19
Flower head: number of colours	characteristic : 25
Only varieties with one flower head colour: Flower head: colour with the following groups: Whitish Light yellow Yellow Light orange Orange Red Other	characteristic : 26
Tubulate and/or tubuligulate floret: main colour with the following groups: Whitish Light yellow Yellow Light orange Orange Red Other	characteristic : 28
Only varieties with two flower head colours: ligulate floret: main colourwith the following groups: Whitish Light yellow Yellow Light orange Orange Red Other	characteristic : 31

VI. Characteristics and Symbols

1. To assess Distinctiveness, Uniformity and Stability, the characteristics and their states as given in the Table of Characteristics should be used.
2. Notes (1-9) should be used for the purpose of recording and electronic processing of data. Each state of expression is allotted a corresponding numerical note (1-9) for the different characteristics.
3. Legend

   (*) Characteristics that should be used in every growing season on all varieties and shall always be included in the description of the variety /hybrid/ parental line., except when the states of expression of any of these characters is rendered impossible by a preceding characteristic or by the environmental conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided.

   (+) See explanation on the Table of the Characteristics in Section VIII.

4. Type of assessment of characteristics indicated in Table of Characteristics (Section VII)is as follows:

MG	**:**	Measurement by a single observation of a group of plants or parts of plants.
MS	**:**	Measurement of a number of individual plants or parts of plants.
VG	**:**	Visual assessment by a single observation of a group of plants or parts of plants.
VS	**:**	Visual assessment by observations of individual plants or parts of plants.

5. A code number in the fifth column of Table of characteristics(Section VII) indicates the optimum stage for the observation of each characteristic during the growth and development of plant. The relevant growth stages corresponding to these code numbers are described below:

   a. Observations forhypocotyl: anthocyanin colouration and hypocotyl: intensity of anthocyanin colouration of thecandidate variety shall be taken after 10-20 days of seed sowing (at 2-4 leaf stage).

   b. Observation for time of beginning of floweringof thecandidate varietyshall be recorded at first flowering stage.

   c. Observation for each characteristic of the candidate variety shall be taken at the time of full flowering stage.

VII-Table of characteristics

S.No.	Characteristic	States	Note	Stages of observation (days after sowing/ planting)	Example Varieties	Type of Assessment
1.	Hypocotyl: anthocyanin colouration	Absent	1	a	IIHRMy-4	VG
		Present	9		IIHRMO-2	
2.	Hypocotyl: intensity of	Weak	3	a	IIHRMy-5	VG

	anthocyanin colouration	Medium	5		Pusa BasantiGainda, Pusa NarangiGainda	
		Strong	7		Pusa Arpita, IIHRMO-2	
3.	Plant : fragrance (Vegetative parts)	Absent	1	b	-	VG
		Present	9		Pusa BasantiGainda,Pusa NarangiGainda	
4.	Flower : fragrance	Absent	1	c	-	VG
		Present	9		Pusa BasantiGainda, Pusa NarangiGainda	
5. (*) (+)	Plant: height (upto the tip of leaves from ground level measured in cm)	Very short (≤ 20)	1	c	-	MG
		Short (>20-≤ 40)	3		IIHRMO-2	
		Medium (>40-≤ 90)	5		Pusa NarangiGainda, Pusa BasantiGainda	
		Tall (>90-≤150)	7		Pusa Arpita	
		Very tall (>150)	9		-	
6. (*) (+)	Plant : growth habit	Upright	1	c	IIHRMy 5 IARI/Af/w-4	VG
		Semi upright	3		Pusa NarangiGainda, Pusa BasantiGainda	
		Spreading	5		Pusa Arpita	
7.	Stem: anthocyanin colouration	Absent	1	c	IIHRMy-4	VG
		Present	9		IIHRMO-2, Pusa NarangiGainda, Pusa Arpita	
8.	Stem: intensity of anthocyanin colouration	Weak	3	c	IIHRMy-5	VG
		Medium	5		Pusa BasantiGainda Pusa NarangiGainda	
		Strong	7		Pusa Arpita	
9. (+)	Leaf: type	Simple	1	c	-	VS
		Pinnate	9		Pusa NarangiGainda	
10. (+)	Leaf: length	Short	3	c	-	VG
		Medium	5		Pusa NarangiGainda, Pusa BasantiGainda	
		Long	7		Pusa Arpita	
11. (+)	Leaf: width	Narrow	3	c	IIHRMO-4	VG
		Medium	5		Pusa BasantiGainda, Pusa NarangiGainda	

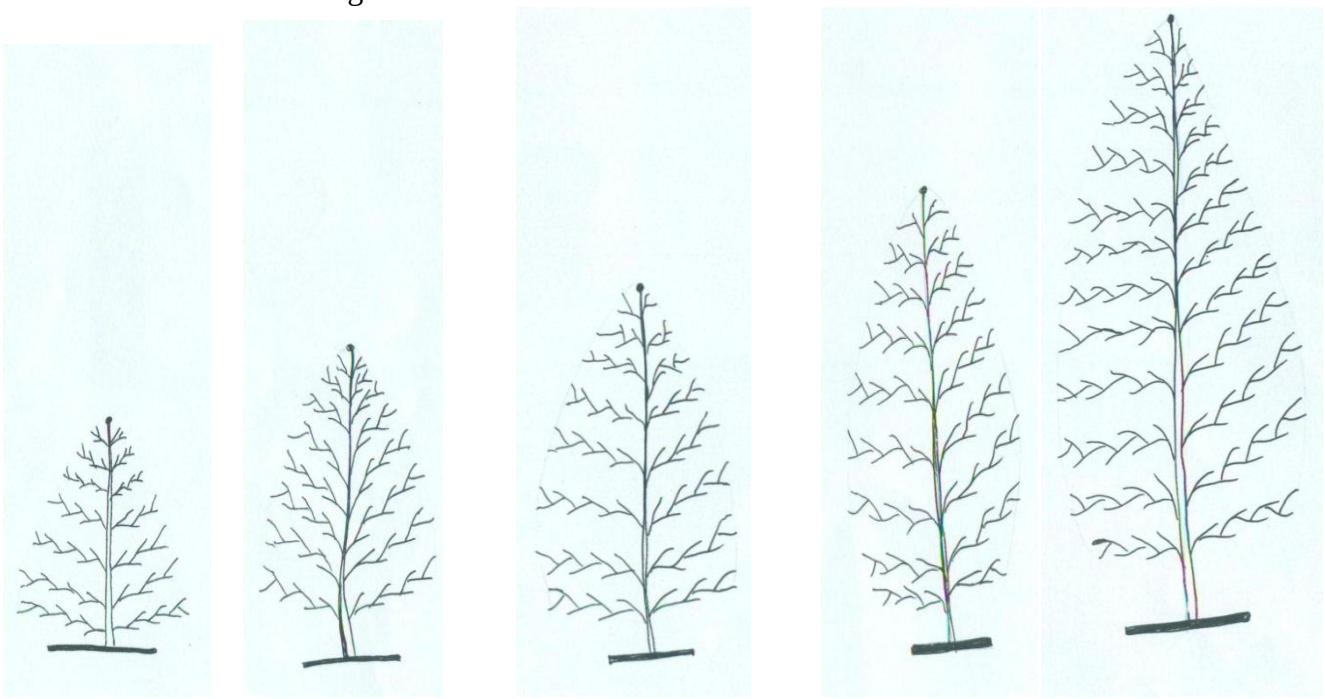
		Broad	7		Pusa Arpita	
12.	Leaf: intensity of green colour on upper side (at the time of first flowering)	Light	3	c	-	VG
		Medium	5		Pusa BasantiGainda, Pusa NarangiGainda	
		Dark	7		IIHRMO-2, Pusa Arpita	
13.	Only varieties with pinnate leaves: terminal leaflet: width	Narrow	3	c	-	VG
		Medium	5		Pusa BasantiGainda, Pusa NarangiGainda,	
		Broad	7		Arka Agni, ArkaAlankara	
14. (+)	Leaf margin: depth of indentation	Shallow	3	c	IARI/Af /w-4, Pusa NarangiGainda	VG
		Medium	5		Pusa BasantiGainda	
		Deep	7		IIHRFm-1	
15.	Flower head: length of peduncle of terminal flower head	Short	3	c	-	VG
		Medium	5		Pusa BasantiGainda, ArkaAlankara	
		Long	7		Pusa Arpita	
16.	Shape of flower head: view from above	Round	1	c	Arka Agni, ArkaAlankara	VG
		Irregular	9		Pusa NarangiGainda, Pusa BasantiGainda,	
17. (*) (+)	Flower head: floret type	All tubulate	1	c	-	VS
		Tubulate and ligulate	2		IIHRMys-3	
		Tubuligulate and ligulate	3		IIHRMO-4	
		All tubuligulate	4		-	
		All ligulate	5		ArkaAlankara, Arka Agni	
18. (*)	Flower head: diameter	Very small	1	c	-	VG
		Small	3		Pusa Arpita, IIHRMO-4	
		Medium	5		Pusa NarangiGainda, Pusa BasantiGainda	
		Large	7		Arka Agni, ArkaAlankara	
		Very large	9		-	
19. (*)	Only varieties with tubulate and ligulate floret type: flower head: number of ligulate floret whorls	Very few	1	c	-	VG
		Few	3		IIHRMys-3	
		Medium	5		-	
		Many	7		Pusa NarangiGainda	

20. (+)	Ligulate floret: shape	Flat	1	c	IIHRMO-4	VG
		Intermediate	2		Pusa BasantiGainda Pusa NarangiGainda	
		Trumpet	3		IARI/Af/w-8	
21. (+)	Ligulate floret: incision of margin	Absent	1	c	ArkaAlankara	VG
		Present	9		IIHRMO-3, Pusa NarangiGainda	
22.	Only varieties with incision of margin absent: ligulate floret: shape of apex	Rounded	1	c	-	VG
		Truncate	2		ArkaAlankara	
23.	Outer ligulate floret: length	Short	3	c	-	VG
		Medium	5		Pusa BasantiGainda Pusa NarangiGainda	
		Long	7		IIHRMy-5, IIHRMy-4, Arka Agni, ArkaAlankara,	
24.	Outer ligulate floret: width	Narrow	3	c	-	VG
		Medium	5		Pusa BasantiGainda Pusa NarangiGainda	
		Broad	7		IIHRMy-4, IIHRMy-5	
25. (*) (+)	Flower head: number of colours	One	1	c	Pusa NarangiGainda Pusa BasantiGainda, IIHRMO-4	VG
		Two	2		IIHRFm-1	
26. (*)	Only varieties with one flower head colour: flower head: colour	RHS Colour Chart (indicate reference number)		c	-	VS
27.	Only varieties with two flower head colours: tubulate and/or tubuligulate floret: number of colours	One	1	c	-	VG
		Two	2		-	
28. (*)	Tubulate and/or tubuligulate floret: main colour	RHS Colour Chart (indicate reference number)		c	-	VS
29.	Only varieties with tubulate and/or tubuligulate florets	RHS Colour Chart (indicate reference		c	-	VS

	with two colours: tubulate and/or tubuligulate floret: secondary colour	number)				
30.	Only varieties with two flower head colours: ligulate floret: number of colours	One	1	c	-	VG
		Two	2		IIHRFm-1	
31. (*)	Only varieties with two flower head colours: ligulate floret: main colour	RHS Colour Chart (indicate reference number)		c	-	VS
32.	Only varieties with two ligulate floret colours: ligulate floret: secondary colour	Whitish	1	c	-	VS
		Light yellow	2		-	
		Dark yellow	3		-	
		Light orange	4		-	
		Medium orange	5		IIHRFm-1	
		Red	6		-	
		Brown	7		-	
33. (+)	Only varieties with two ligulate floret colours: ligulate floret: distribution of colour	Type 1	1	c	IIHRFm-1	VG
		Type 2	2		-	
		Type 3	3		-	
34. (+)	Only varieties with type 1 ligulate floret colour distribution: ligulate floret: size of central colour zone	Very small	1	c	-	VG
		Small	3		-	
		Medium	5		-	
		Large	7		IIHRFm-1	
		Very large	9		-	
35.	Time of first floweringafter transplanting (in days)	Early (≤40)	3	b	IIHRFm-1	VG
		Medium (>40 -≤ 60)	5		Pusa NarangiGainda Pusa BasantiGainda	
		Late (>60)	7		Pusa Arpita	

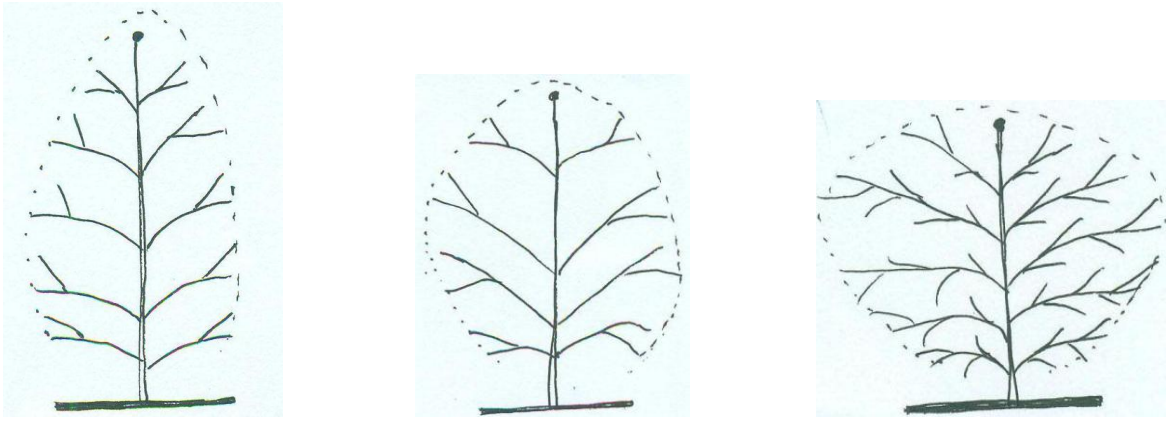
VIII. Explanations on the Table of Characteristics

Characteristic 5: Plant: height



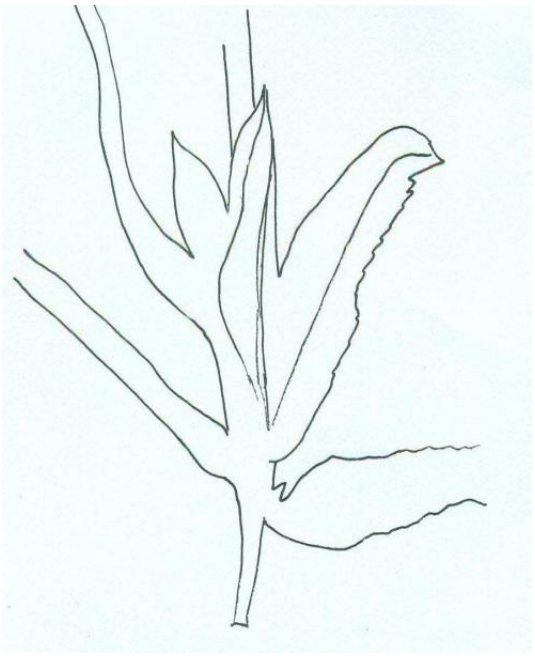
1	3	5	7	9
Very short	Short	Medium	Tall	Very tall

Characteristic 6: Plant: growth habit



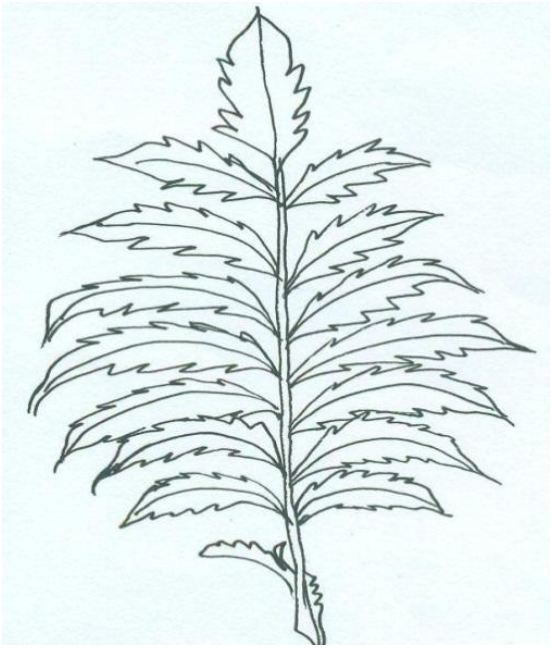
1	3	5
Upright	Semi upright	Spreading

Characteristic 9: Leaf: type



1

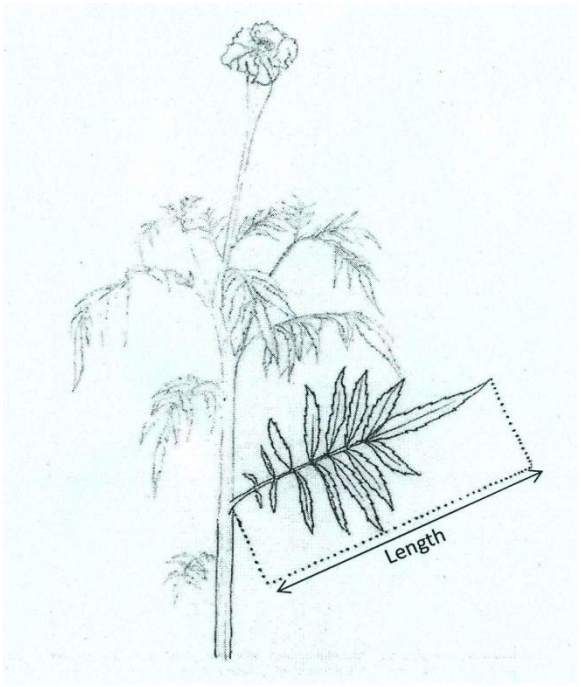
Simple

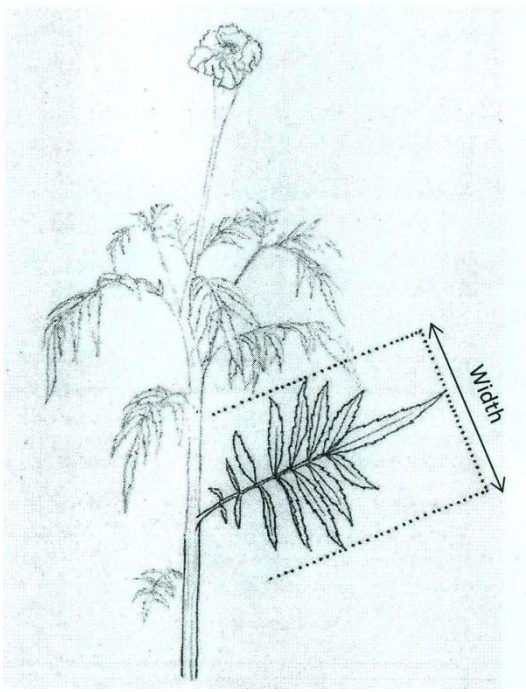


9

Pinnate

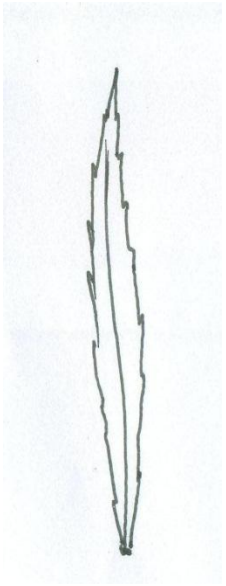
Characteristic10&11: Leaf: length and Leaf: width



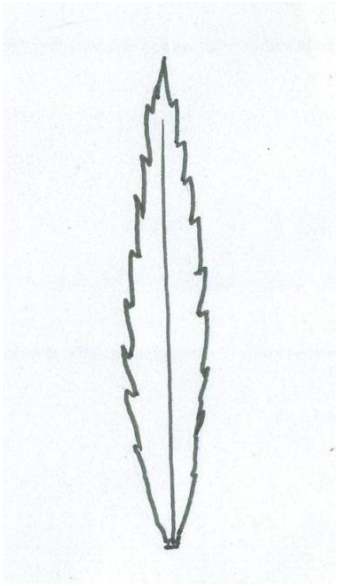


Observations should be made on a leaf in the middle zone of the main stem at the time of full flowering.

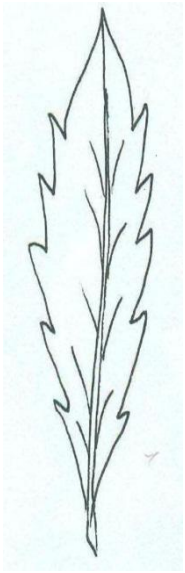
Characteristic14: Leaf margin: depth of indentations



3
Shallow



5
Medium

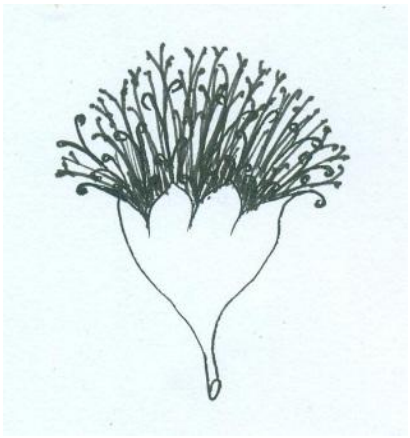


7
Deep

In the case of pinnate leaves, the observations should be made on a terminal leaflet.

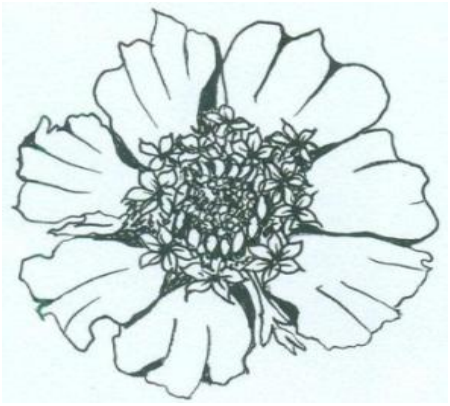
Characteristic 17: Flower head: floret type

The floret can be ligulate, tubuligulate or tubulate and can be inserted in the disc (central zone) or in the periphery (radial zone) of the flower head.



1

All tubulate

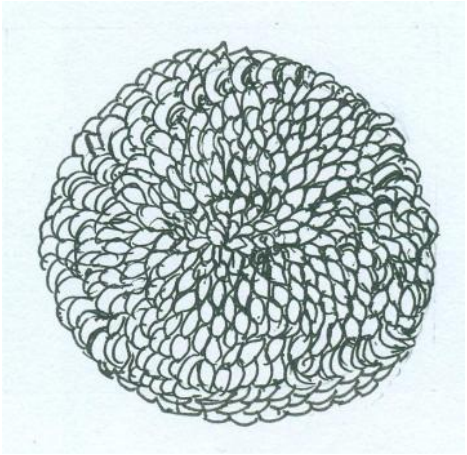


2

Tubulate and ligulate

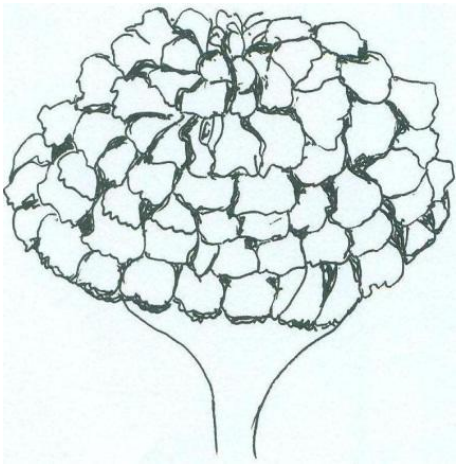
3

Tubuligulate and ligulate



4

All tubuligulate

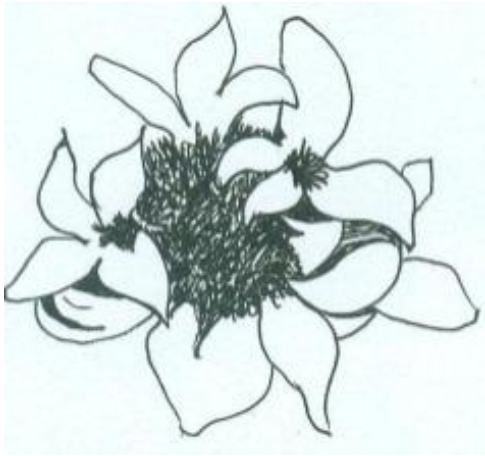


5

All ligulate

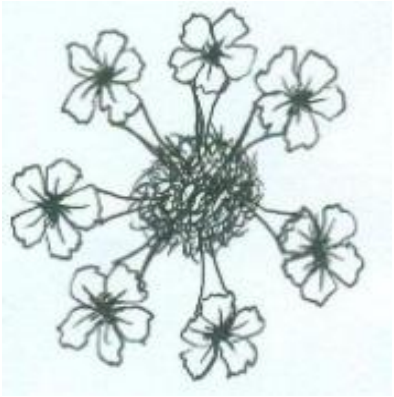
Characteristic 20: Ligulate floret: shape

1 flat



2

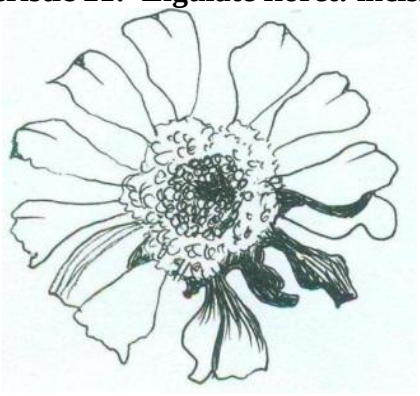
Intermediate



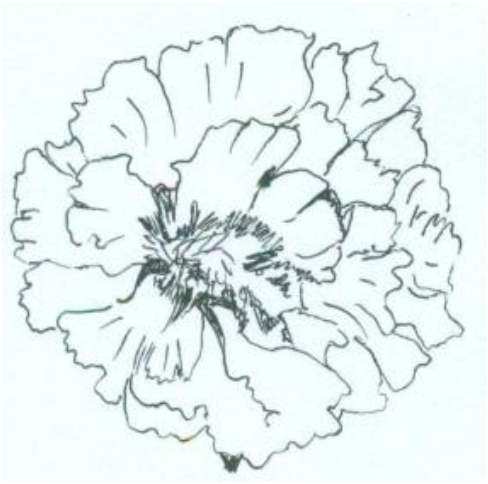
3

Trumpet

Characteristic 21: Ligulate floret: incision of margin



1
Absent



9
Present

Characteristics 25: Flower head: number of colours

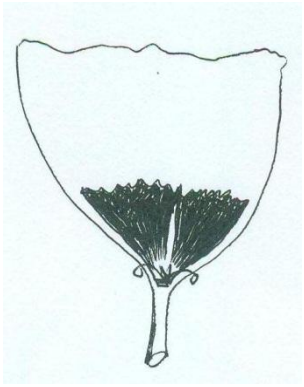
1

One

2

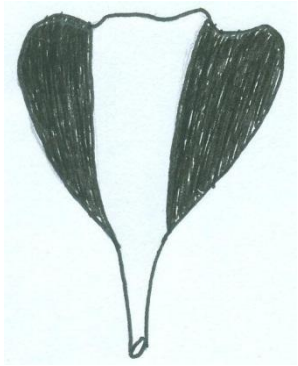
Two

Characteristic 33: Only varieties with two ligulate floret colours: ligulate floret: distribution of colour



1

Type 1



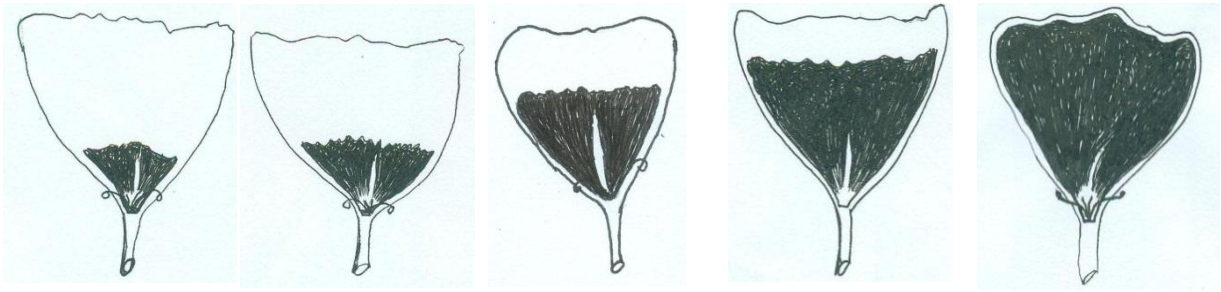
2

Type 2

3

Type 3

Characteristic 34: Only varieties with type 1 ligulate floret colour distribution: ligulate floret: size of central colour zone



1	3	5	7	9
Very small	Small	Medium	Large	Very large

IX. Working Group details

The test guidelines developed by the task force **(05/2014)**constituted by the PPV & FR Authority for **Marigold** with consultation by the National Core Committee in consultation with the Principal Investigators /Nodal Officers of the DUS Centres on marigold and Technical inputs also provided by the PPV & FR Authority and nodal officer.

Members of the Task Force

Dr. P. N. Mathur Coordinator South Asia Office**,** Bioversity International, NASC Complex, New Delhi	Chairman
Dr. N. K. Dadlani Ex- Director (Hort.) DAC, Ministry of Agriculture	Member
Dr. T. Janakiram Assistant Director General (Hort-1) KrishiAnusandhanBhawan-II ICAR, Pusa Campus, New Delhi	Member
Dr. MalavikaDadlani Consultant, Coordinator South Asia Office, Bioversity International, NASC Complex, New Delhi	Member
Dr. Kanwar Pal Singh Principal Scientist, Division of Floriculture and Landscaping, ICAR- IndianAgriculturalResearchInstitute, New Delhi	Member
Dr. Tejaswini Principal Scientist, Division of Ornamental Crops ICAR- IndianInstitute of Horticultural ResearchInstitute,	Member

Bangaluru, Karnataka	
Dr. K. V. Prasad Director, Directorate of Floriculture Research, College of Agriculture Campus, MPKV, Shivaji Nagar, Pune	Special Invitee
Dr. S. P. S. Raghava Rtd. Project Coordinator(Floriculture),ICAR, New Delhi & Marigold Breeder	Special Invitee
Dr. Ravi Prakash Registrar, PPV&FR Authority, New Delhi	Member Secretary

X. DUS Testing Centres

Nodal DUS Testing Centre	Other DUS Testing Centre
Division of Floriculture and Landscaping ICAR- IndianAgriculturalResearchInstitute, New Delhi	Division of Ornamental Crops ICAR- IndianInstitute of Horticultural Research, Bangalore, Karnataka