Forage Res., **48**(3) : pp. 354-358 (2022) **http://forageresearch.in**

STUDY OF MORPHOLOGICAL CHARACTERIZATION IN F_1 FORAGE OATS (*AVENA SATIVA* L.) GENOTYPES AS PER DUS GUIDELINE

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(Received : 16 December 2022; Accepted : 30 December 2022)

SUMMARY

The present research was conducted to study morphological characters in 40 F_1 crosses in oats as per DUS guideline. A total of nine morphological traits on forty oat crosses were observed during *Rabi* season 2022. All the F_1 crosses were grown in randomized complete block design with two replications. The different morphological traits observed are field grown plant *viz*., plant growth habit, leaf sheath hairiness, leaf blade hairiness, time of panicle emergence, stem hairiness of uppermost node, panicle orientation of branches, ligule shape, plant length (stem) (cm), panicle length (cm). The maximum plant growth was found in erect type for twenty five F_1plant genotypes. The strong leaves sheath hairiness was exhibited high for eighteen F_1 plant genotypes. The strong leaf blade hairiness was recorded in eighteen F_1 plant genotypes. Medium time of panicle emergence was observed in fourteen F_1 plant genotypes. Fifteen F_1 plant genotypes were showed for strong hairiness of uppermost node. The erect panicle orientation of branches was found to be in sixteen genotypes. Twenty seven broad edged ligule shapes were observed in F_1 plant genotypes. The maximum number of plant length was recorded in fifteen medium F_1 plant genotypes. The maximum number of panicle length was observed for medium type of F_1 plant genotypes.

Key words : Oats, morphological characterization, DUS guideline

Oats is an important winter cereals fodder crop, ranked sixth in the world cereal production maize, rice, wheat, barley and sorghum. Main cultivated oat is the *Avena sativa* L. with other variants as white oat and red oat. The process of milling mostly used a white oat, other important red oat (previously known as *A. byzantine* K. Koch) is preferred for hay (Stevens *et al.,* 2004). It is tolerant for abiotic and biotic stresses to a greater extent. Oat is better adapted to different soil types and its plant growth performs better on acid soils (pH-5.3-5.7) than other cereal grain crops. Oat has been shown to tolerate acid soils range a pH of 4.5 to 8.3 (Duda *et al*., 2021). Oats are well grown in cool moist climates and sensitive to hot, required dry weather from emergence of panicle through to maturity. Because of this reason, world oat production is generally ranged between latitudes 35-65°N (Ahmad *et al.,* 2010).

Oats contain 10 to 13 per cent of protein and about 30 to 35 per cent of dry matter produced by green fodder. Oat is rich in antioxidant α-tocotrienol, α-tocopherol, and avenanthramides, as well as total dietary fibre including the soluble fibre β-Glucan (Oliver *et al.,* 2010). Recently, with the advent of exaggerated dairy industry in our country, oat has fascinated the attention of breeders for its improvement due to its nutritious quality fodder for livestock and its grains as animal feed with high net energy gains (Ruwali *et al.,* 2013).

Genetic improvement of a crop depends upon the extent and magnitude of genetic variability present in the economic characters. Study of variation present in the characters of agronomic importance within large collection of materials is required to use the valuable genotypes for crop improvement programme (Jaipal and Shekhawat, 2016).

MATERIALS AND METHODS

Experimental site

The research was conducted under the All India Coordinated Research Project on Forage Crops, Department of Plant Breeding and Genetics at seed

breeding farm, College of Agriculture, Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur (M.P.).

Experimental materials

The F_1 materials were used for research to evaluate the morphological characterization. Crosses were made in the *Rabi* season 2020 collected from AICRP project, Jabalpur. The parental materials consisting of fourteen genotypes were collected from AICRP on forage crops, Jabalpur. Crosses were made among 14 genotypes by using Line x tester design in the livestock farm under AICRP on forage crops in *Rabi* season-2020.Crossed materials were harvested, stored in bags for next generation. The F_1 materials were grown in a randomized complete block design with two replications during *Rabi* season in 2021.

Observations recorded

The following observations were recorded at specific period of growth stage *viz*., plant growth habit, leaf sheath hairiness, leaf blade hairiness, time of panicle emergence, stem hairiness of uppermost node, panicle orientation of branches, ligule shape, plant length (stem) (cm), panicle length (cm).

RESULTS AND DISCUSSION

Plant growth habit

The plant growth is affected by the genetic factors as well as environmental conditions. Plant growth habit is extremely important morphological marker to discriminate different types of oats. The plant growth was classified into three parts as erect, semi prostrate, prostrate. The 25 genotypes were recorded as erect, 11 genotypes semi prostrate, 4 genotypes had prostrate type plant growth. Similar characterization and grouping based on plant growth habit characters were made by Gupta and Mehta (2018) and Arora (2013) evaluated 180 germplasm accessions of oat for different morphological and yield traits *viz*., growth habit (erect, semi-erect or semi prostrate), foliage colour (light green, green or dark green), plant stature (dwarf, semi-dwarf or tall type), panicle shape (equilateral, non-equilateral or flag type) and awn (presence or absence).

Leaf sheaths hairiness

The leaf sheath was found in the lower section leaves of the grass plant. It will enclose the inter node part. The lower part of leaf has grouped into four parts as presence absence of hairs on lowest leaf margin, weak, medium, strong. This trait was observed as hairiness on lowest leaves of plant at 50-% flowering stage. Among 40 genotypes studied 7genotypes has not lowest leaf sheath, 7 genotypes were weak and 8 genotypes have medium, 18 genotypes were grouped into strong lowest leaves. The earlier researcher was Gupta and Mehta (2018), Ravi *et al*., (2021).

Fig. 1. Erect type panicle branch.

Fig. 2. Hairiness of leaf blade margins.

Leaf blade hairiness

Leaf blade is below the flag leaf parts of leaves above the sheath. It is also called lamina. Leaf blade is classified into two parts as absence or presence of hairs on leaf blade, weak. This character was recorded during at the time of flowering stage. This character was found the margins of leaf blade hairiness below

TABLE 1
Morphological characterization of 40 hybrids of oats

Traits	Crosses									
	NDO 1 X KENT	NDO 1 X JO1	NDO 1 X JO5	NDO 1 X JHO 822	JMO 42 X KENT	JMO 42 X JO1	JMO 42 X JO5	JMO 42 X JHO 822	JMO 248 X KENT	JMO 248 X JO1
Plant Growth habit	Erect	prostrate	Erect	Erect	Erect	prostrate	Erect	Erect	Erect	Erect
Leaf Sheath hairiness	strong	Absent	Medium	strong	strong	strong	weak	Medium	weak	Medium
Leaf blade hairiness	Medium	absent	Medium	strong	weak	strong	weak	Medium	absent	absent
Time of panicle emergence	early	early	medium	early	medium	early	medium	early	medium	medium
Stem hairiness of uppermost node	absent	weak	medium	absent	absent	absent	absent	absent	absent	weak
Panicle orientation of branches	erect	unilateral	unilateral	erect	erect	unilateral	erect	erect	unilateral	erect
Ligule shape	Pointed	Broad pointed	pointed	Pointed	Pointed	Pointed	Pointed	Pointed	Broad Pointed	Pointed
Plant length(cm)	medium	medium	long	long	Very long	long	long	long	long	long
Panicle length(cm)	medium	short	medium	long	medium	medium	medium	medium	medium	short

*Stages of observation: 50% flowering

Traits	Crosses									
	JMO 248 X JO5	JMO 248 X JHO-822	JMO 259 X KENT	JMO 259 X JO1	JMO 259 X JO5	JMO 259 X JHO-822	JMO 271 X KENT	JMO 271 X JO1	JMO 271 X JO5	JMO 271 X JHO-822
Plant growth habit	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect	prostrate	prostrate
Leaf sheath hairiness	Absent	weak	Medium	strong	Absent	weak	Absent	Medium	strong	medium
Leaf blade hairiness	Absent	weak	Medium	strong	strong	strong	weak	strong	absent	strong
Time of panicle emergence	early	early	medium	late	medium	late	medium	late	medium	early
Stem hairiness of uppermost node	absent	weak	medium	absent	absent	absent	absent	absent	absent	weak
Panicle orientation of branches	erect	unilateral	unilateral	sub unilateral type	unilateral	erect	unilateral	sub unilateral type	erect	sub unilateral type
Ligule shape	Pointed	Pointed	Pointed	Pointed	Pointed	Pointed	Pointed	Pointed	Pointed	Broad pointed
Plant length(cm)	medium	medium	medium	long	Very long	long	Very long	medium	Very long	medium
Panicle length(cm)	long	long	medium	long	long	long	short	long	medium	long

*Stages of observation: 50% flowering.

Traits	Crosses									
	JMO 276 X KENT	JMO 276 X JO1	JMO 276 X JO5	JMO 276 X JHO-822	JMO 304 X KENT	JMO 304 X JO1	JMO 304 X JO5	JMO 304 X JHO-822	JMO 310 X KENT	JMO 310 X JO 1
Plant growth habit	prostrate	Semi prostrate	Erect	Erect	Erect	Semi prostrate	Erect	Erect	Erect	Erect
Leaf sheath hairiness	strong	weak	Absent	Absent	weak	strong	Absent	medium	strong	strong
Leaf blade hairiness	absent	weak	Medium	weak	medium	strong	Medium	weak	strong	medium
Time of panicle emergence	medium	early	medium	late	late	medium	late	late	late	late
Stem hairiness of uppermost node	absent	absent	weak	absent	absent	absent	absent	absent	weak	weak
Panicle orientation of branches	sub unilateral type	unilateral	sub unilateral type	erect	erect	erect	erect	sub unilateral type	erect	unilateral
Ligule shape	Pointed	Broad pointed	Pointed	Pointed	Broad pointed	Pointed	Pointed	Pointed	Pointed	Pointed
Plant length(cm)	Very short	short	medium	long	Very long	Very long	medium	long	Very long	medium
Panicle length(cm)	medium	short	medium	medium	Very long	Very long	Very long	medium	medium	medium

*Stages of observation: 50% flowering.

Traits	Crosses									
	JMO 310 X JO 5	JMO 310 X JHO-822	JMO 316 X KENT	JMO 316 X JO 1	JMO 316 X JO 5	JMO 316 X JHO-822	JMO 239 X KENT	JMO 239 X JO 1	JMO 239 X JO-5	JMO 239 X JHO-822
Plant growth habit	Erect	Semi prostrate	Semi prostrate	Semi prostrate	Semi prostrate	Semi prostrate	Semi prostrate	Semi prostrate	Semi prostrate	Semi prostrate
Leaf sheath hairiness	strong	strong	strong	strong	strong	strong	medium	strong	medium	strong
Leaf blade hairiness	strong	Medium	Medium	strong	strong	Medium	strong	strong	strong	medium
Time of panicle emergence	late	late	medium	late	Very late	Very late	Very late	Very late	medium	early
Stem hairiness of uppermost node	absent	weak	medium	absent	absent	absent	absent	absent	weak	absent
Panicle orientation of branches	erect	unilateral	unilateral	unilateral	sub unilateral type	sub unilateral type	sub unilateral type	unilateral	erect	unilateral
Ligule shape	Pointed	Broad pointed	Pointed	Pointed	Broad pointed	Pointed	Broad pointed	Pointed	Broad pointed	Pointed
Plant length(cm)	medium	Very long	medium	Very long	Very long	Very long	Very long	medium	medium	medium
Panicle length(cm)	long	Very long	Very long	long	Very long	Very long	Very long	Very long	long	long

*Stages of observation: 50% flowering.

Fig. 3. Pointed and edged type Ligula shape.

the flag leaf. Among 40 F_1 crosses classified into 6 F_1 crosses were belongs to absence of hairiness, 7F_1 crosses were classified as weak, 12 F_1 hybrids were medium 15 F_1 crosses were belongs to strong leaf blade hairiness. Correspondent results were found in leaf blade hairiness reported by Gupta and Mehta (2018), Ravi *et al*., (2021).

Time of panicle emergence

Panicle initiation is an important growth stage in oats. It is the reproductive phase in oats development. The flowering stage of oats classified into four types that is early flowering initiation, medium, late emergence of panicle, very late emergence of panicle. This attribute was recorded during 50% flower initiation stage. Observed the panicle emerged at the time of flower initiation. The 10 genotypes were early, 14 genotypes medium and 12 genotypes were late emergence of panicle and remaining 4 genotypes had very late time of panicle emergence. Similar results were exhibited by Gupta and Mehta (2018),Ravi *et al*. (2021).

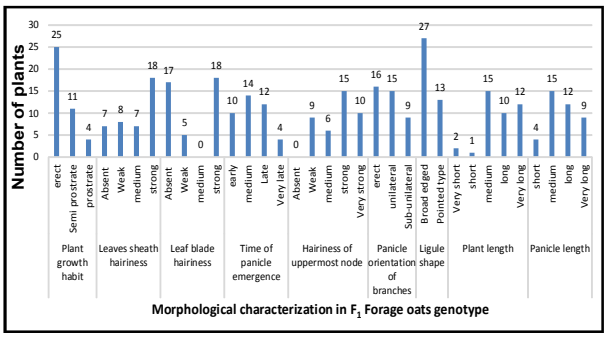

Fig. 4. Morophological characterization in F_1 Forage oats genotypes.

Stem hairiness of uppermost node

Oats plants of stem called as node. The region between nodes is defined as internode. Uppermost node may be hairy or smooth. Oats nodes are classified into four parts absence or presence of hairiness, weak, medium, strong. This trait was observed during 50% flowering time. Found the hairiness of node as absent, weak, medium, strong. Out of 40 hybrids, four genotypes were recorded as absence of stem. Twenty eight F_1 crosses were classified as weak, nine F_1 crosses classified as medium stem fallowed by two F_1 crosses classified as strong stem. Gupta and Mehta (2018),Ravi *et al.*(2021) were found correspondent results in stem hairiness of uppermost node.

Panicle orientation of branches

The panicle of oats is consisting of main stem with branches and sub-branches arising from a central axis. The panicles are classified according to their mode of branching as erect, unilateral, sub unilateral type of branches. Panicle orientation character was observed at the time of 50% flowering time stage. Found the different attitude branches of panicle. 16 F_1 crosses were grouped as erect panicle attitude type. 15 genotypes had unilateral type, 9 genotypes had sub unilateral type. Correspondent results were recorded in panicle orientation of branches in oat reported by Sumathi *et al.,* (2014), Arora (2013).

Ligule shape

Ligule is a variously modified extension of the sheath lying at the base of the blade, often a vertical membrane. The ligule shape was observed during at the time of 50% flowering time stage. The papery shape of membrane positioned between the leaf sheath and leaf blade. Out of 40 crosses 27 were found pointed type, only 13 crosses had broad edged type. Different

ligule shape was recorded by Gupta and Mehta (2018), Ravi *et al*., (2021).

Plant length (cm)

Plant length is the distance between the upper portion of the flag leaf and the ground level. Plant length was classified into very short, short, medium, long, very long. The plant height was measured during at the time of 50% flowering time stage. Among 40 F_1 crosses were classified into $1F_1$ crosses had very short, 2 F_1 crosses only short, 15 F_1 crosses found as medium, 10 F_1 crosses had long plant length and 12 crosses were divided as very long. Sumathi *et al.,* (2004), Gupta and Mehta (2018), Ravi *et al.,* (2021) reported the similar results. The same results were recorded in oats by Sumathi *et al.,* (2014), Gupta and Mehta (2018), Ravi *et al.,* (2021).

Panicle length (cm)

The oats inflorescence is defined as the panicle. It is the top part of the oats plant, it came from the last inter node. The panicle length was observed during at the time of harvesting stage. Observed panicle length measured with scale. Panicle length was classified into 4 F_1 crosses were short, $15F_1$ crosses had medium and 12 F_1 crosses have long, 9 F_1 crosses were divided as very long. Similar results were identified by Sumathi *et al*., (2004), Gupta and Mehta (2018).

REFERENCE

Ahmad A., F.M. Anjum, T. Zahoor, H. Nawaz, Z. Ahmed, 2010 : Extraction and characterization of β-glucan from oat for industrial utilization. *Int. J. Biol. Macromol.* **46** : 304-309.

Arora, R. N. 2013 : Characterization and evaluation of one and two-harvest of oats. *Forage Res.* **39** : 59-63.

Duda, M., N. Tritean, I. Rocz, R. Kadar, F. Russu, A. Fitiu, E. Muntean, A. vatca, 2021 : Yield Performance of Spring Oats Varieties as a Response to Fertilization and Sowing Distance, *Agronomy*, **11**(5): 815.

Oliver, R. E., D. E.Obert, and G. Hu, J. M. Bonman, E. W. Jackson, 2010 : Development of oat-based markers from barley and wheat microsatellites. Genome **6** : 458-471.

Gupta, K., and A. K. Mehta, 2018 : Morphological Characterization of Advanced Mutant Lines of Oat (*Avena sativa* L.). *Int. J. Curr. Microbiol. App. Sci.* **7**(11): 209-212.

Jaipal and S. S. Shekhawat, 2016 : Genetic variability and divergence studies in oats (*Avena sativa* L.) For green fodder and grain yield *Forage Res*. **42** : 51-55.

Nechu, R. K., S. K. Bilaiya, S. Ramakrishna, G. Mrunal, A. K. Mehta and S. Manmohan, 2021 : Characterization of Single Cut Oat (*Avena sativa* L.) Genotypes for Morphological Traits Frontiers in Crop Improvement.

Ruwali, Y., K. Singh, S. Kumar, and L. Kumar, 2013 : Molecular diversity analysis in selected fodder and dual purpose oat (Avena sativa L.) Genotypes by using random amplified polymorphic DNA (RAPD), *African Journal of Biotechnology*, **12** : 3425-3429.

Stevens, E. J., K. W. Armstrong, H. J. Bezar, W. B. Griffin, and J. G. Hampton, 2004 : "Fodder oats: an overview," in Fodder oats: A world overview, eds J. M. Suttie and S. G. Reynolds (Rome: FAO), 1-9.

Sumathi, S., and P. Balamurugan, 2014 : Usefulness of morphological characters for varietal identification in oats (*Avena sativa* L.). *Internat. J. Plant Sci*., **9**(1): 7-12.