DEVELOPMENT OF IDENTIFICATION KEYS ON THE BASIS OF PLANT MORPHOLOGICAL CHARACTER IN WHEAT

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ABSTRACT

An experiment was carried out at the Instructional Farm, Department of Agronomy, Junagadh Agricultural University, Junagadh, for the development of identification keys to characterize 28 wheat varieties of different species (17 of Triticum aestivum, 9 of Triticum durum and 2 of Triticum dicoccum) released for general cultivation in Gujarat at state level as well as at the National level in Central India based on the plant morphological characters. Plant morphological characters divided into five groups viz., plant growth habit, flag leaf characters, ear characters, awn characters and peduncle morphology. Based on the findings, it can be concluded that all the 28 tested varieties can be differentiated on the basis of all the plant morphological characters as a whole, as the tested varieties was differed with respect to one another for at least one plant morphological character. However, with respect to individual plant morphological group, the varieties can be differentiated on the basis of flag leaf characteristics and ear characteristics. The results showed that All the varieties tested noted difference for at least one flag leaf characteristics except DDK 1025 and DDK 1029 and for ear morphological characteristics except LOK 1, GW 496, HI 1500 and HI 1531.

KEY WORDS: Characterization, identification, key, T. aestivum, T. dicoccum, T. durum, wheat

INTRODUCTION

Wheat (*Triticum spp*. L.) is an annual plant that belongs to the grass family *Poaceae*, tribe *Triticeae* and subtribe *Triticineae*. It is the world's most widely cultivated food crop, followed by rice and maize (Gulbitti-Onarici *et al.,* 2009) and one of the oldest and most important of the cereal crops (Harlan, 1992), producing the highest global grain production of any crop (Lamoureux *et al.,* 2005). Three species of wheat *viz., Triticum aestivum* L. (bread wheat), *Triticum durum* Desf. (macaroni wheat) and *Triticum dicoccum* Schulb. (emmer wheat) are presently grown as commercial crop in India, covering 86, 12 and 2 per cent of the total area, respectively. The bread wheat (2n=42) is cultivated in all the wheat growing areas of the country, the macaroni or *durum* wheat (2n=28) is mostly grown in the Northern (Punjab) and Southern states, while the emmer wheat (2n=28) is confined to the Southern states (mainly Karnataka) and some parts of Gujarat (Anonymous, 2011). In India,

wheat is mainly grown in the states of Uttar Pradesh, Madhya Pradesh, Punjab, Rajasthan, Haryana, Bihar, Maharashtra, Karnataka and Gujarat. During 2013-14, India accounts an area, production and productivity of 31.34 million ha, 95.91 million metric tones and 3061 kg/ha, respectively (Anonymous, 2013). In Gujarat, wheat is grown during 2013-14 in about 13.51 lac ha with total production of 36.50 lac metric tones and productivity of 2074 kg/ha (Anonymous, 2013).

Maintenance of genetic purity of varieties is of primary importance for preventing varietal deterioration during successive regeneration cycles and for ensuring varietal performance at an expected level. The aspects of Distinctness, Uniformity and Stability (DUS) are fundamental for characterization of varieties. In countries having Plant Breeder's Right (PBR) in operation, a new variety is registered only, if it is distinct from other varieties, uniform in its characteristics and genetically stable. Grow Out-Test is conducted by growing the plants under field condition and growth features are observed in fixing genuineness. According to International Union for Protection of New Plant Varieties (UPOV), any new characteristics used in varietal characterization should be clearly defined, accepted and should have standard method of observation, least or not affected by environment, accessible to breeders, associated with reasonable costs and efforts. To identify wheat genotypes/varieties, International bodies like UPOV and IPGRI have published relevant descriptors. Such types of classical taxonomic approach is still being employed by certification agencies for the purpose of grow out test to determine the genetic purity of seed lots. These morphological descriptors have a traditional significance and are immediately accessible on the spot without need of equipment. Thus, a clear basis for distinctness testing procedure prior to varietal registration can draw out of this. However, the approach demands a field assessment, which depends on the degree of experience of the operator. In the light of the above facts, the present study on documentation of characters for wheat varieties was planned with the objective to identify stable diagnostic characteristics of plant morphology of wheat varieties.

MATERIALS AND METHODS

The experiment was conducted at the Infrastructural Farm, Department of Agronomy, Junagadh Agricultural University, Junagadh, during *rabi* 2014 for the development of identification keys for the varietal characterization in 28 wheat varieties *viz.*, MP 4010, HI 1500, HI 1531, HI 1544, GW 1, GW 503, DL 788-2, HD 2932, GW 11, GW 173, GW 190, GW 273, LOK 1, GW 322, MP 3288, GW 366, GW 496, HI 8381, HI 8498, HI 8627, HI 8713, A 28, A 206, GDW 1255, GW 1139, RAJ 1555, DDK 1025 and DDK 1029 of different species (17 of *Triticum aestivum*, 9 of *Triticum durum* and 2 of *Triticum dicoccum*) released for general cultivation in Gujarat at state level as well as at the National level in Central India based on the plant morphological characters. Plant morphological characters *viz.*, plant growth habit, plant foliage colour, plant waxiness, plant height excluding awns, flag leaf attitude, flag leaf anthocyanin colouration of auricle, flag leaf hairs on auricle, flag leaf length (cm), flag leaf width (cm), flag leaf waxiness of sheath, flag leaf waxiness of blade, days to ear emergence days, ear waxiness, ear colour, ear length excluding awns/scurs (cm), ear shape in profile, ear density, awns presence,

awns length (cm), awns colour, awns attitude, peduncle waxiness, peduncle length (cm) and peduncle attitude were studied as per the guidelines of DUS testing and based on the groups with respect to particular characters, the identification keys were prepared for the charzcterization of varieties.

RESULTS AND DISCUSSION

Plant growth characters

Use of plant growth characteristics to identify a variety has been classical approach for varietal purity testing. The varieties were grouped based on the plant growth habit, plant foliage colour, plant height excluding awns and plant waxiness. On the basis of plant growth characters, varietal identification keys were prepared (Figure 1). The varieties *viz.,* HI 1531 and GW 1 were having semi erect plant growth habit, light green foliage colour, short plant height excluding awns/scurs and presence of plant waxiness; DL 788-2, GW 173, HI 8713 and RAJ 1555 were having erect plant growth habit, green foliage colour, short plant height excluding awns/scurs and presence of plant waxiness; HD 2932, GW 190, GW 273, GW 322, MP 3288, HI 8498 and A 28 were having semi erect plant growth habit, green foliage colour, short plant height excluding awns/scurs and presence of plant waxiness; HI 8627 and A 206 were having semi erect plant growth habit, green foliage colour, medium plant height excluding awns/scurs and presence of plant waxiness; and HI 1500 and LOK 1 were having semi erect plant growth habit, green foliage colour, very short plant height excluding awns/scurs and presence of plant waxiness forming the different group and cannot be differentiated from each other in the respective group on the basis of plant morphological characters. However, the remaining varieties were different with respect to plant growth characters for at least one character and they can be easily identified in the seed production plot on the basis of plant growth characters. Similar results were reported by Mansing (2010), Sahari *et al.* (2012), Ahmad *et al.* (2013), Nawaz *et al.* (2013), Gergana (2014), Malik *et al.* (2014) and Semwal *et al*. (2014) in wheat.

Flag leaf morphological characters

On the basis of flag leaf morphological characteristics *viz*., plant flag leaf attitude, flag leaf antocyanin colouration of auricle, flaf leaf hairs on auricle, flag leaf length, flag leaf width and flag leaf waxiness of sheath and blade, the genotypes were categorized into different groups and varietal identification keys were prepared (Figure 2). All the varieties tested noted difference for at least one flag leaf characteristics except DDK 1025 and DDK 1029 (Figure 2). Two red seed varieties, DDK 1025 and DDK 1029 cannot be differentiated on the basis of flag leaf characteristics were having erect type plant flag leaf attitude, absence of flag leaf anthocyanin colouration of auricle, absence of flag leaf hair on auricle, long flag leaf length, medium flag leaf width, very weak flag leaf waxiness of sheath and very weak flag leaf waxiness of blade. Several workers characterized genotypes on the basis of flag leaf morphological characters such as Mansing (2010), Ahmad *et al.* (2013), Nawaz *et al.* (2013) and Gergana (2014) in wheat.

Ear morphological characters

The genotypic variation was observed in case of ear morphological characteristics which are helped to classify the genotypes into different groups. Wheat varieties were grouped on the basis of ear morphological traits *viz*., days to ear emergence. ear length,

ear waxiness, ear colour, ear shape in profile and ear density and the identification keys were prepared (Figure 3). All the varieties tested noted difference for at least one ear morphological characteristics except LOK 1, GW 496, HI 1500 and HI 1531 (Figure 2). The varieties, LOK 1 and GW 496 were having medium ear emergence, dull white ear colour, weak ear waxiness, medium ear length, tapering ear shape and medium ear density, whereas HI 1500 and HI 1531 were having medium ear emergence, dull white ear colour, very weak ear waxiness, medium ear length, parallel sided ear shape and medium ear density. Similar observations and grouping of genotypes based on ear morphological characteristics in wheat were made by Mansing (2010), Sahari *et al.* (2012) and Ahmad *et al.* (2013),

Awns morphological characters

Based on awns morphological characteristics *viz*., awns presence, awns colour, awns attitude and awn length, the genotypes were categorized into different groups. On the basis of awn morphology, varietal identification keys were prepared (Figure 4). The results revealed that all the varieties evaluated possessed awns. Out of 26 varieties, awns colour was dull white in twenty four varieties (MP 4010, HI 1500, HI 1531, HI 1544, GW 1, GW 503, DL 788-2, GW 11, GW 173, GW 190, GW 273, LOK 1, GW 322, MP 3288, GW 366, GW 496, HI 8498, HI 8627, HI 8713, A 28, GDW 1255, GW 1139, DDK 1025, DDK 1029), light brown in two varieties (HD 2932, A 206) and black in two varieties (HI 8381, RAJ 1555). As far as awns length and attitude, the varieties HI 8627, HI 8713, GDW 1255, DDK 1025, DDK 1029, A 206, GW 496, HI 8381, RAJ 1555 and HI 8498 were having very long awns, but differing in awn attitude with oppressed type (HI 8627, HI 8713, GDW 1255, DDK 1025 and DDK 1029), spreading type (A 206 and GW 496) and medium type (HI 8381, RAJ 1555 and HI 8498) attitude. The varieties, MP 4010, GW 1, MP 3288, GW 1139, HI 1531 and GW 366 were having long awns, but differing in awn attitude with spreading type (MP 4010, GW 1, MP 3288 and GW 1139) and medium type (HI 1531 and GW 366) attitude. The varieties, HI 1500, HI 1544, DL 788-2, GW 273, GW 322, A 28 and GW 190 were having medium length awns, but differing in awn attitude with oppressed type (HI 1500 and HI 1544), spreading type (DL 788-2, GW 273, GW 322 and A 28) and medium type (GW 190) attitude. The varieties, GW 503, GW 173, HD 2932, GW 11 and LOK 1 were having short awns, but differing in awn attitude with spreading type (HD 2932, GW 11 and LOK 1) and medium type (GW 503 and GW 173) attitude. Similar observations were made by Mansing (2010), Ahmad *et al.* (2013), Nawaz *et al.* (2013), Gergana (2014) and Semwal *et al*. (2014) in wheat.

Peduncle morphological characters

The varieties were classified on the basis of peduncle waxiness, peduncle attitude and peduncle length On the basis of peduncle morphology, varietal identification keys were prepared (Figure 5). The varieties, HI 1531 and A 206 were having very weak peduncle waxiness, medium peduncle length and straight peduncle attitude, while GW 366, A 28 and DDK 1025 were having very weak peduncle waxiness and short peduncle length, but were distinct with crooked, straight and bent peduncle attitude, respectively. The varieties, HI 8381 and HI 8713 were having weak peduncle waxiness, short peduncle length and straight peduncle attitude, while DL 788-2 was having weak

peduncle waxiness, short peduncle length and bent peduncle attitude. Varieties, MP 4010, HI 1500, LOK 1 and GW 496 were having medium peduncle waxiness, short peduncle length and straight type peduncle attitude, while HI 1544, DDK 1029 and GW 1 were having medium peduncle waxiness, short peduncle length and bent type peduncle attitude and GW 503 and HI 8627 having medium peduncle waxiness, medium peduncle length and straight type peduncle attitude. The varieties, GW 173, GW 322, GW 1139, GW 190, MP 3288 and RAJ 1555 were having strong peduncle waxiness and short peduncle length, but were differing in peduncle attitude, where GW 173, GW 322 and GW 1139 having straight type attitude and remaining having bent type attitude. The varieties, HD 2932, HI 8498, GW 11, GW 273 and GDW 1255 were having strong peduncle waxiness and medium peduncle length, but were differing in peduncle attitude with bent type (HD 2932, HI 8498), straight type (GW 11, GW 273) and crooked type (GDW 1255) attitude. Similar observations and grouping were made based on the peduncle morphological characteristics in wheat by Haljak *et al*. (2008), Naghavi *et al*. (2009), Mansing (2010) and Nawaz *et al.* (2013).

CONCLUSION

Based on the findings, it can be concluded that all the 28 tested varieties can be differentiated on the basis of all the plant morphological characters as a whole, as the tested varieties was differed with respect to one another for at least one plant morphological character. However, with respect to individual plant morphological group, the varieties can be differentiated on the basis of flag leaf characteristics and ear characteristics.

REFERENCES

Ahmad, A.; Mansoor, H. and Muhammad, M. K. 2013. Morphological characterization and structural features for high drought tolerance in some Omani wheat landraces. *International Conf. Food Agril. Sci., 55*: *IACSIT Press, Singapore. DOI: 10.7763/IPCBEE. 2013. V55. 5.*

Anonymous (2011). http://www.authorstream.com/.../arunugale-1055431-heterosis-and-combining.

Anonymous (2013). Wheat Scenario: A Snippet. *e-newsletter* 1 (2013), The Directorate of Wheat Research, Karnal, Haryana (India).

Gergana, G. (2014). Morphological and agronomical characterization of common wheat landraces (*Triticum aestivum* L.) from the National wheat collection of Bulgaria. *Emir. J. Food Agric*., **26(2)**: 164-169.

Gulbitti-Onarici, S.; Sancak, C.; Sumer, S. and Ozcan, S. (2009). Phylogenetic relationships of some wild wheat species based on the internal transcribed spacer sequences of nrDNA. *Curr. Sci*., **96**: 794-800.

Haljak, M.; Koppel, R.; Ingver, A. and Ruzgas, V. (2008). Variations in the morphological characteristics of winter wheat (*Triticum aestivum* L.). *Agronomijas Vestis. Latvian J. Agron.*, **11**: 54-59.

Harlan, J. R. (1992). Origin and Processes of Domestication. In: Grass Evolution and Domestication (Ed. GP

Chapman). Cambridge University Press, Cambridge.

Lamoureux, D.; Peterson, D. G.; Li, W.; Fellers, J. P. and Gill, B. S. (2005). The efficacy of cost-based gene enrichment in wheat (*Triticum aestivum* L.). *Genome*, **48**: 1120-1126.

Malik, Rekha; Sharma, Hemani; Sharma, Indu; Kundu, Sushila; Verma, A,; Sheoran, Sonia; Kumar, R. and Chatrath, R. 2014. Genetic diversity of agro-morphological characters in Indian wheat varieties using GT biplot. *AJCS*, **8(9)**: 1266-1271.

Mansing, J. S. (2010). Characterization of wheat (*Triticum* spp.) genotypes trough morphological, chemical and molecular markers. M.Sc. (Agri.) thesis (Unpublished) submitted to University of Agricultural Sciences, Dharwad.

Naghavi, M. R.; Monfared, S.R.; Ahkami, A. H. and Ombidbakhsh, M. A. (2009). Genetic variation of *durum* wheat landraces and cultivars using morphological and protein markers. *Proc. World Acad. Sci.: Engineer. Technol.,* **49**: 73-75.

Nawaz, R.; Inamullah; Ahmad, H.; Siraj Ud Din and Muhammad, S. I. (2013). Agro-morphological studies of local wheat varieties for variability and their association with yield related traits. *Pakistan J. Bot*., **45(5)**: 1701-1706.

Sahari, Khoufi; Khalil Khamassi; Jaime A. Teixeira da Silva; Ramzi Chaabane and M. Barek Ben Naceur. (2012). Morphological and molecular characterization of six of the most frequently cultivated hard wheat varieties in Tunisia. *J. Plant Breed. Crop Sci.,* **4(7)**: 106-114.

Semwal, D. P.; Pandey, Anjula; Bhandari, D. C.; Dhariwal, O. P. and Sharma, S. K. (2014). Variability study in seed morphology and uses of indigenous rice landraces (*Oryza sativa* L.) collected from West Bengal, India. *Australian J. Crop Sci.,* **8(3)**: 460-467.

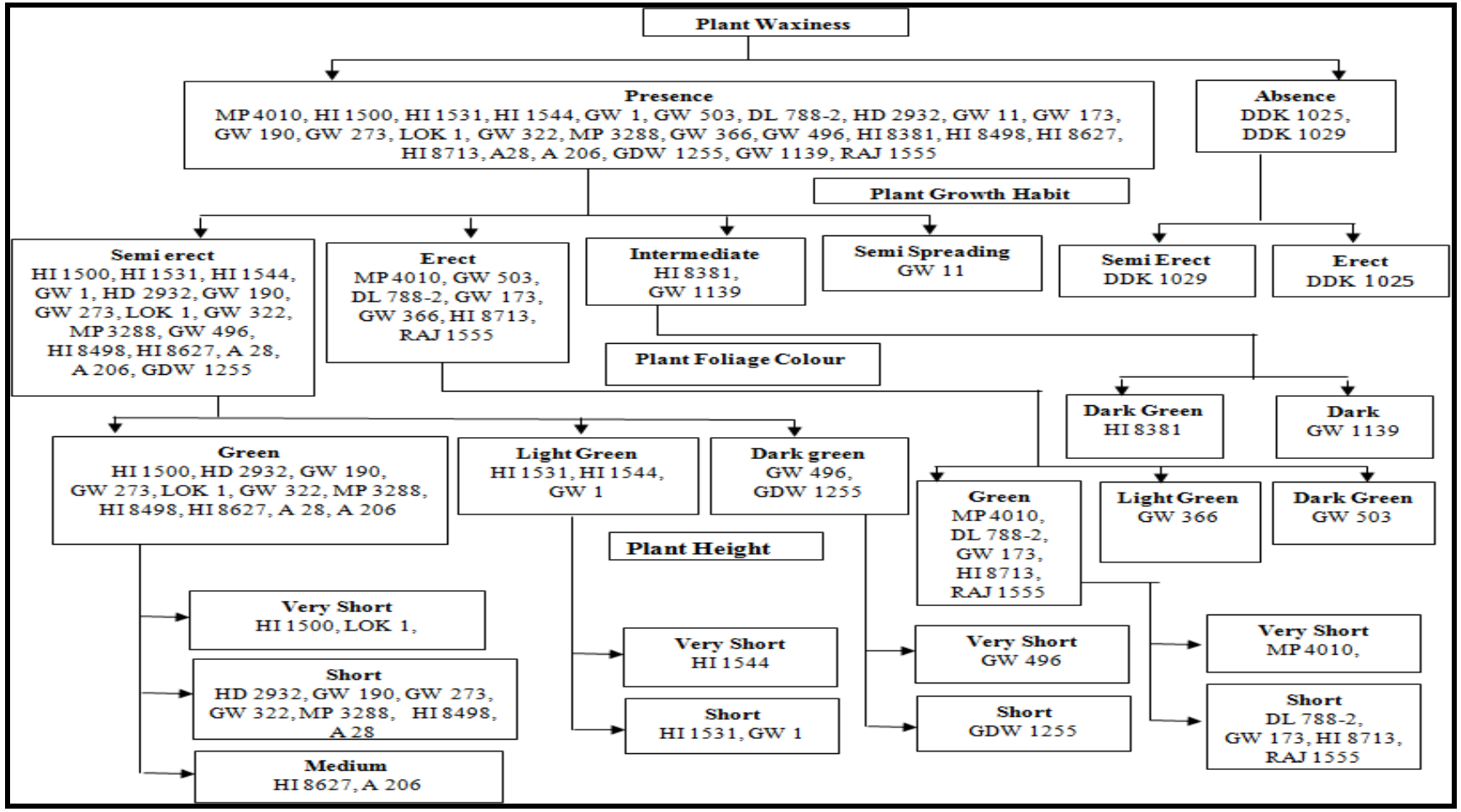

Figure 1: Wheat varieties identification keys on the basis of plant growth characters

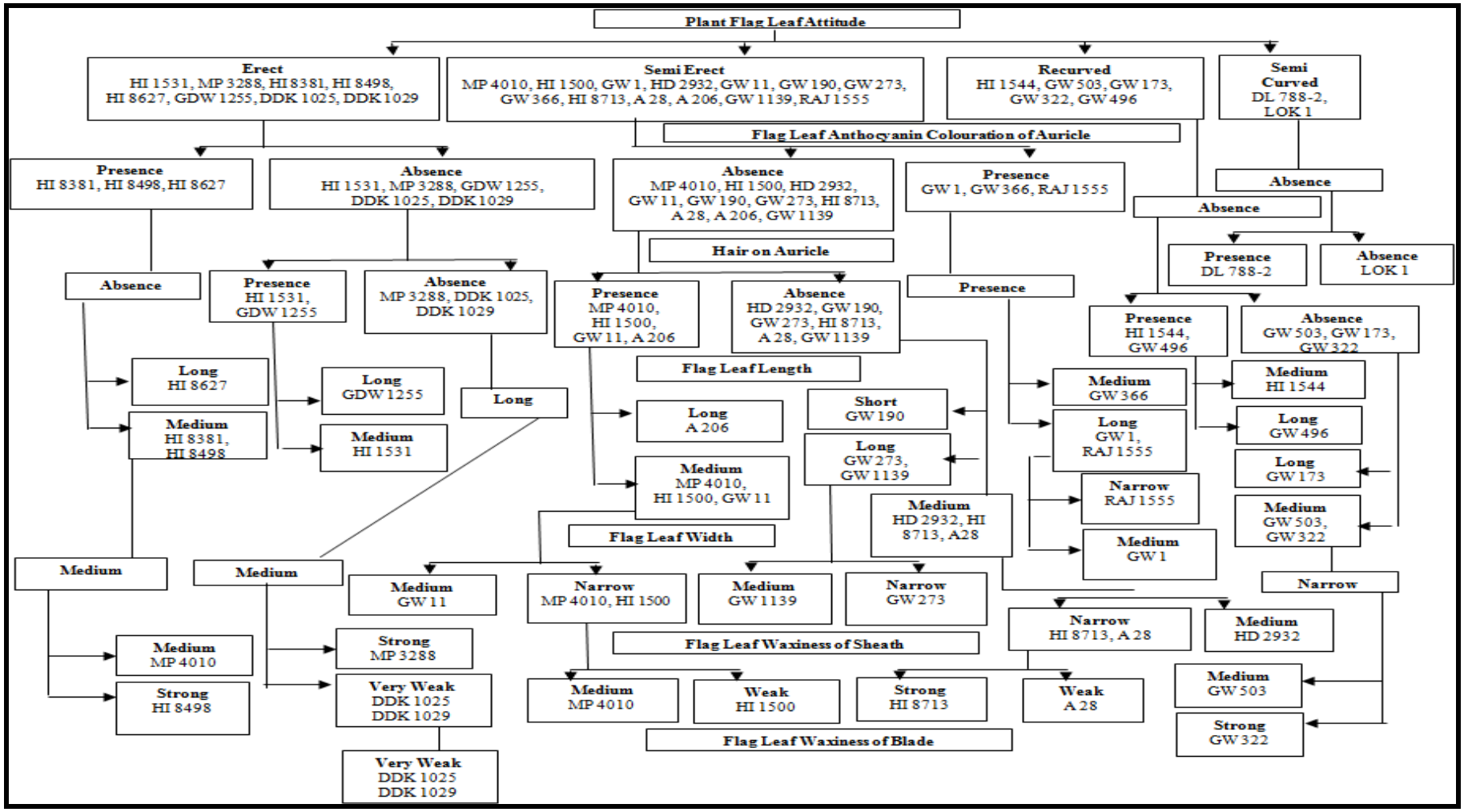

Figure 2: Wheat varieties identification keys on the basis of flag leaf morphological characters.

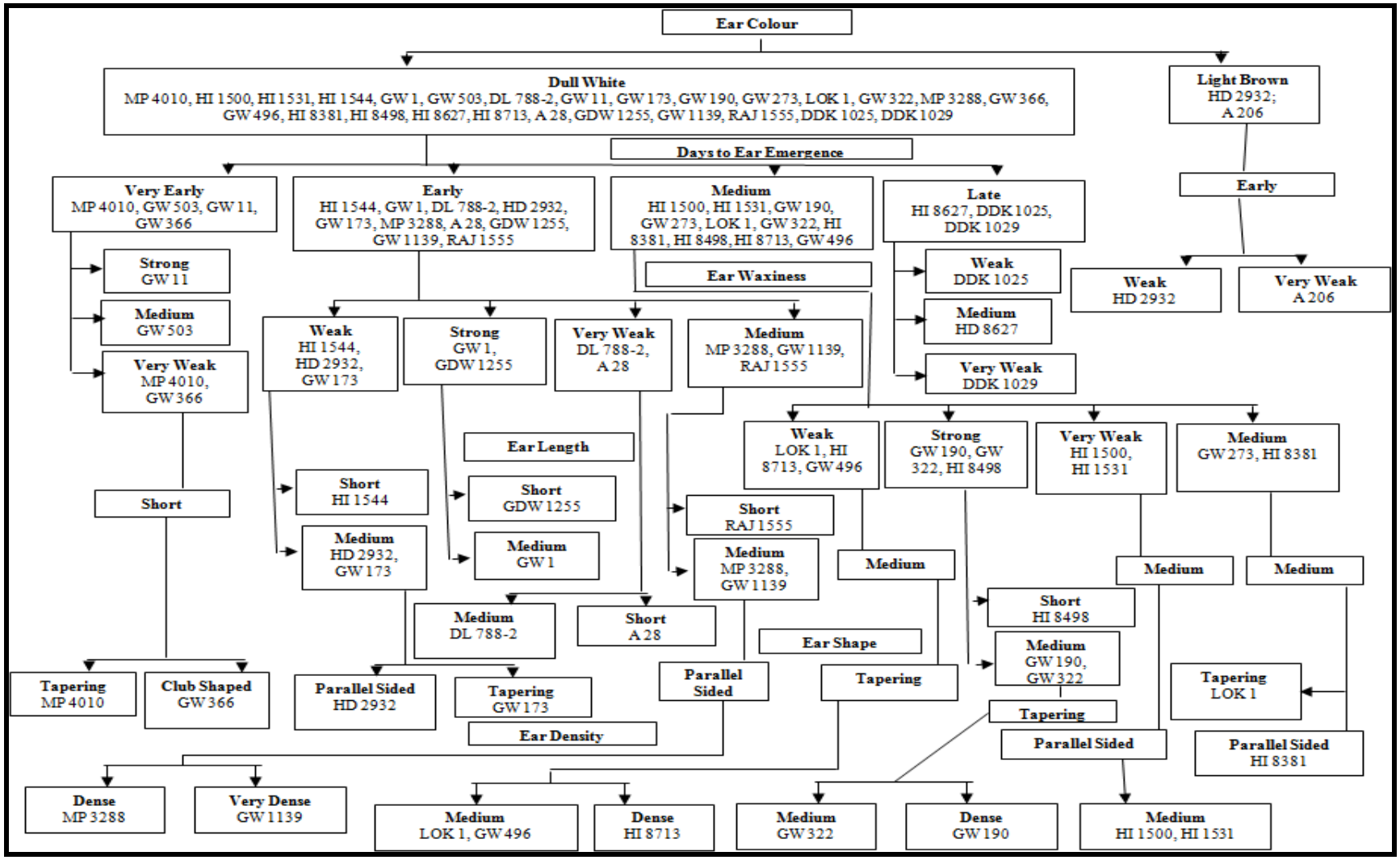

Figure 3: Wheat varieties identification keys on the basis of ear morphological characters

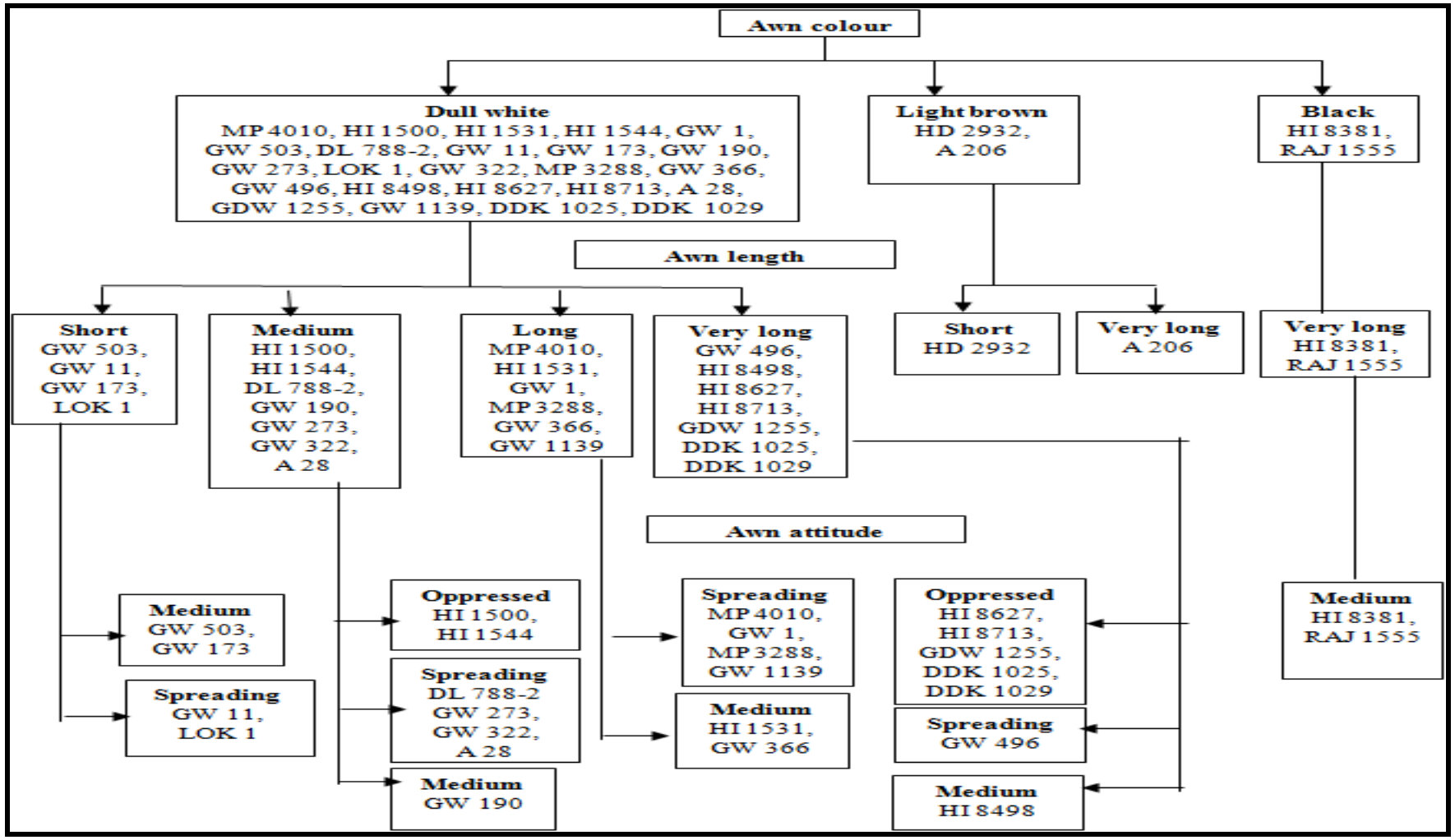

Figure 4: Wheat varieties identification keys on the basis of awn morphological characters

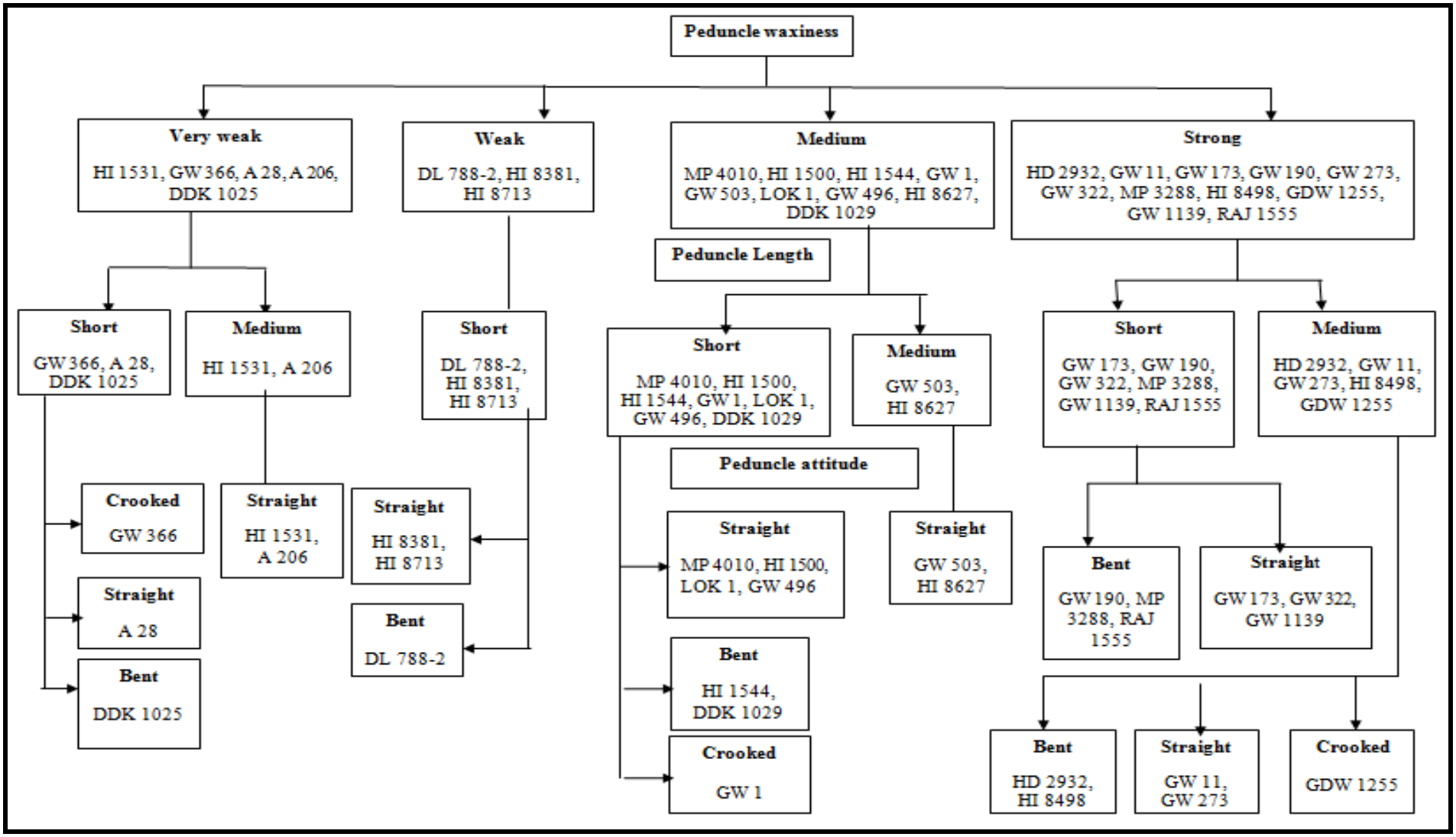

Figure 5: Wheat varieties identification keys on the basis of peduncle morphology.

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