Pak. J. Bot., 44(1): 255-259, 2012.

CORRELATION AND FREQUENCY DISTRIBUTION FOR DIFFERENT PARAMETERS AMONG BREAD WHEAT (*TRITICUM AESTIVUM* L.) ACCESSIONS

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Abstract

An experiment was conducted to evaluate the genetic variability and correlation of one hundred wheat (*Triticum aestivum* L.) accessions, during the growing season 2006 under the aegis of Plant Breeding and Genetics department, Faculty of Agriculture, Gomal University, Dera Ismail Khan, Khyber Pakhtoon Khwa, Pakistan. The accessions were characterized for the parameters, days to emergence, days to heading, days to maturity, plant height (cm) and number of tillers plant^{-1}. Results depict variation for all the traits. The entry [PARC/NIAR 002303(05)] took 5 days to emergence and the entry [PARC/NIAR 002450 (01)] emerged in 17 days with 24.35% coefficient of variation. The entry [PARC/NIAR 002303(05)] took minimum 82 days to heading and maximum 129 days were taken by the entry [PARC/NIAR 002450(01)] with 7.65 % coefficient of variation. Minimum days to maturity 130 were taken by [PARC/NIAR 002450(02)] and the entry [PARC/JICA 003852(02)] took 190 days to maturity. The accession [PARC/NIAR 002828(03)] was found with shortest plant height (32 cm) and [PARC/MAFF 004276(01)] was noted with maximum plant height (199 cm) with coefficient of variation 32.46%. The accession [PARC/MAFF 004267(02)] produced maximum number of tillers plant^{-1}. Days to emergence were found significant positive correlated with number of tillers plant^{-1} while significant negative correlation was noted for days to maturity with days to emergence. Days to heading were noted having significant positive correlation with plant height, while plant height was found positively significant correlated with number of tillers plant^{-1}.

Introduction

Wheat belongs to the grass family Poaceae (Gramineae), one of the largest families of Angiosperm (flowering plants) including 600-700 genera and approximately 10,000 species (levy and Feldman (2002) in which all major types of polyploids (autopolyploids, allopolyploids and segmental polyploids) are the members of this family. Common bread wheat (*Triticum aestivum* L.) belong to the tribe Triticeae. The main characteristics of Triticeae (a festucoid tribe) are;

1. Inflorescence is a compound spike (i.e., spike of spikelets).
2. Spikeletes are laterally compressed and each spikelet is surrounded by two bracts, the glumes.
3. The chromosome number is seven or its multiple.
4. The tribe has very wide adaptability and its members (both annual and perennial form) are found in a large range of habitats.

The genetic diversity is the key component of any agricultural production system. The history of gene pool assemblage on a systematic way goes back when Vavilov, in 1926 undertook first successful expedition to Northern Iran. The material from diverse geographical origin of the crop species can help to ensure genetically heterogeneous populations produce more and stable yield than genetically homogeneous lines (Simmonds, 1979).

The present study; undertaken to evaluate genetic variability and characterize different wheat germplasms for further wheat breeding program in Khyber Pakhtoon Khawa (KPK).

Materials and Methods

One hundred germplasms of wheat (*Triticum aestivum* L.) were obtained from the Institute of Agriculture Biotechnology & Genetic Resources (IABGR) at NARC, Islamabad. All the accessions were grown in a single row each in the year 2006 under the aegis of Department of Plant Breeding and Genetics, Faculty of Agriculture, Gomal University, Dera Ismail Khan following the augmented field design. Each accession was dibbled by hand in two meter long row with 45cm spacing, while plant to plant spacing was kept as 25cm within the rows. Recommended cultural practices and fertilizer were used during the growing season. The climate was hot and dry in summer and moderate during monsoon season indicating arid to semi-arid environment. The latitude is 31° 49' N to 70° 55' E with 397 feet to 689 feet from above sea level. In summer and winter the maximum temperature was 45°C and 8°C respectively. The annual precipitation ranges from 15 to 25 cm with maximum humidity ranges from 51% to 78% between June and October. All the accessions were evaluated and characterized for various traits i.e. days to emergence, days to heading, days to maturity, plant height (cm) and number of tillers plant^{-1}. The data recorded were statistically analyzed. Accession means were used to calculate the coefficient of variation, variance among accessions and frequency distribution of 100 accessions for various traits. Also simple correlation coefficients between all pairs of characters were calculated according to Steel & Torrie (1981) using plot mean values.

Results and Discussion

A high level of genetic variability was observed for 100 accessions of wheat (*Triticum aestivum* L.) among various parameters i.e., days to emergence, days to heading, days to maturity, plant height (cm) and number of tillers plant^{-1}. These parameters had the highest contribution to phenotypic stability.

Days to emergence: A frequent variation was observed for days to emergence, which varied from 5 to 17 days with mean value of 11±2.84 and coefficient of variation 24.35% (Table 1). The frequency distribution ranged from 5 to 18 days for emergence. Four accessions [PARC/NIAR 002303(05)], [PARC/NIAR 002450(02)], [PARC/JICA 003841(02)] and [PARC/MAFF 004295(04)] took minimum time of 5 to 6 days for emergence, while only one accession [PARC/NIAR 002450 (01)] emerged very late and took maximum 17 days to emergence (Fig.1).

Table. 1. Basic statistics of wheat accessions for genetic variability in various parameters.

Trait	Mean	Minimum	Maximum	Variance	SD	CV (%)	SE
Days to emergence	11	5	17	8.08	2.84	24.35	0.28
Days to heading	101	82	129	60.55	7.78	7.65	0.77
Days to maturity	152	130	190	125.05	11.18	7.35	1.10
Plant height	109	32	199	1261.99	35.52	32.46	3.50
No. of tillers plant^{-1}	10	4	20	7.98	2.82	27.59	0.28

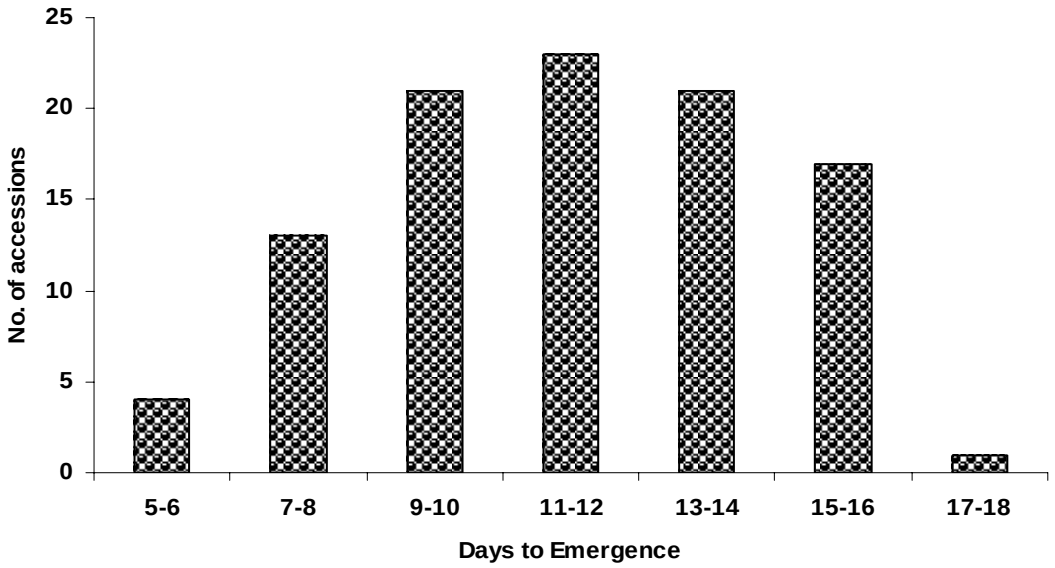

Fig .1. Frequency distribution of days to emergence.

Days to heading: The frequency distribution ranged from 82 to 109 days to heading. There are 35 maximum accessions, which took 100 to 105 days for heading. The entry [PARC/NIAR 002303(05)] and [PARC/MAFF 004267(02)] took minimum days for heading i.e. 82 days and the entry [PARC/NIAR 002450(01)] took maximum days for heading i.e., 109 days (Fig. 2). Maximum variations were observed among the accessions for days to heading. It varied from 82 to 129 days to heading with the mean value of 101±7.78 and coefficient of variation is 7.65% that indicated significant results for this trait (Table 1).

Days to maturity: Enormous variability was noted in days to maturity. It ranged from 130 to 190 days with the mean value of 152±11.18 and coefficient of variation is 7.65% which shows high significant results for this trait (Table 1). The frequency distribution ranged from 130 to 193 days. There are 39 maximum accessions that took 146 to 153 days for maturity. The entry [PARC/NIAR 002450(02)] and [PARC/MAFF 004276(01)] took minimum time for maturity (130 days) and the entry [PARC/JICA 003852(02)] took maximum time of 191 days to mature which was very late (Fig. 3).

Plant height (cm): The frequency distribution indicates that plant height ranged from 32 to 199 cm. There are 29 maximum accessions which were in the range of 95 to 115 cm. The accession [PARC/NIAR 002828(03)] was of short stature with 32cm length and the accession [PARC/MAFF 004276(01)] having maximum length i.e. 199cm (Fig. 4). Maximum variations were notified among the accessions for plant height (cm). It ranged from 32 to 199cm with the mean value of 109±35.52 (cm) and coefficient of variation is 32.46% that indicates significant results for this trait (Table 1).

Number of tillers plant^{-1}: A distant variability was observed which ranged from 4 to 20 numbers of tillers plant^{-1} with mean value of 10±2.82 and coefficient of variation was 27.59% (Table 1). The frequency distribution indicates that maximum number of accessions (48) have 9 to 12 numbers of tillers plant^{-1}. In which the accession [PARC/NIAR 002809(01)] have minimum numbers of 4 tillers plant^{-1} and the accession [PARC/MAFF 004267(02)] has 20 maximum numbers of tillers plant^{-1} (Fig. 5).

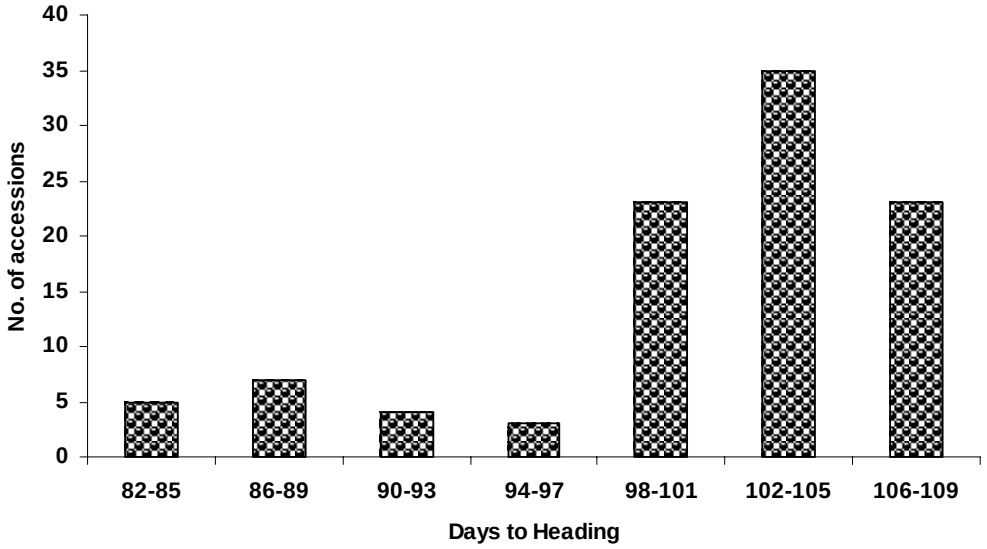

Fig. 2. Frequency distribution of days to heading.

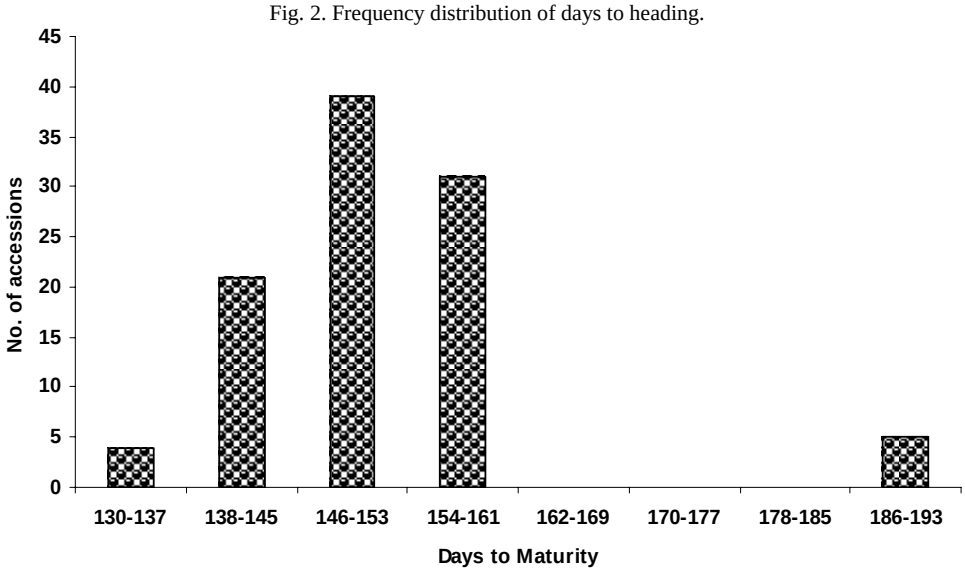

Fig. 3. Frequency distribution of days to maturity.

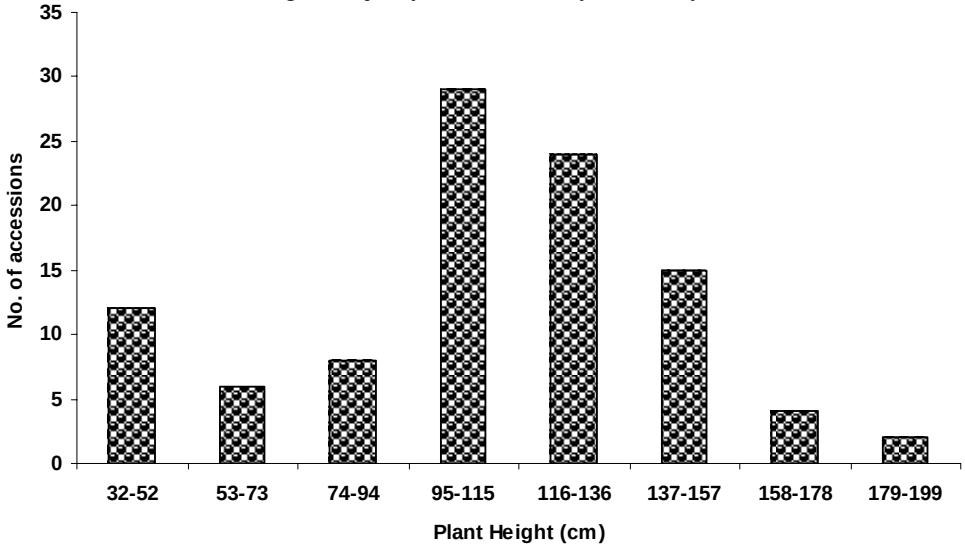

Fig. 4. Frequency distribution of plant height (cm).

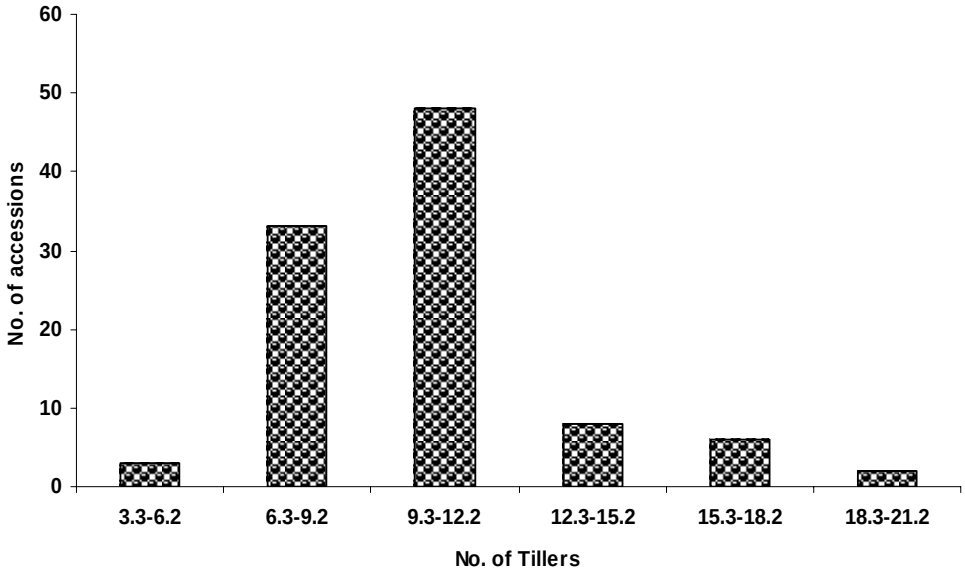

Fig. 5. Frequency distribution of number of tillers plant^{-1}.

These findings are according to the results of earlier Scientists i.e., Adary & Qualset (1978), Alptekin & Nusret (2005) and Bekele (1984) who observed the genetic variability among the accessions for these traits. A moderate level of genetic variability were noted for the said parameters and these observations also agree with the results reported by Bekele (1985); Pecetti *et al*., (1992), Khan *et al*., (2007 b); Ehdaie & Waines (1989) and Tariq *et al*., (2011).

Correlation coefficients: The correlation coefficient among various parameters i.e. days to emergence, days to heading, days to maturity, plant height (cm) and number of tillers plant^{-1} indicates (Table 2) positive significant correlation with each other. In this regards days to emergence had significant positive correlation with number of tillers plant^{-1} (r = 0.24). A strong positive correlation was observed among plant height (r = 0.02), while this parameter have significant negative correlation with days to maturity (r = -0.21) and days to heading (r = -0.05). Days to heading presents strong positive significant correlation only with plant height (r = 0.15), while this trait shows positive correlation with days to maturity (r = 0.14) and number of tillers plant^{-1} (r = 0.06). Days to maturity indicates positive correlation with plant height (r = 0.03) and negative correlation with number of tillers plant^{-1} (r = -0.08). While, positive correlation was observed for plant height with number of tillers plant^{-1} (r = 0.15). Correlation coefficients study also at par with the earlier scientists like Nevo *et al.*, (1982), Levy *et al.*, (1988), Sethi *et al.*, (1992), Faris *et al.*, (2006), Fufa *et al.*, (2005)., Khan *et al*., (2007 a), Fida *et al*., (2011) and Mohibullah *et al*., (2011) who also showed that significant positive correlation variation was observed for all the evaluated parameters.

Table. 2. Correlation coefficient of 100 accessions of wheat.

Traits	Days to emergence	Days to heading	Days to maturity	Plant height	No. of tillers plant^{-1}
Days to emergence	1.00				
Days to heading	-0.05	1.00			
Days to maturity	-0.21*	0.14	1.00		
Plant height	0.02	0.15*	0.03	1.00	
No. of tillers plant^{-1}	0.24*	0.06	-0.08	0.15*	1.00

The contribution of positive correlation of one hundred accessions of wheat (*Triticum aestivum* L.) among the desired traits, instead of high genetic variability indicates that it could effectively be utilized for further wheat breeding program. Hence wide selection stress could be applied on minimum days to heading, days to maturity, number of tillers plant^{-1} and plant height (cm) in landrace populations to enhance the desired grain yield. These accessions according to the traits indicating significant positive correlation and high genetic variability which can be used for future crop improvement program to introduce new wheat varieties according to the need of basic agro climatic condition of Dera Ismail Khan Zone, Khyber Pakhtoon Khwa, Pakistan.

According to analysis of one hundred accessions of wheat (*Triticum aestivum* L.), it was concluded that accession [PARC/NIAR 002303(05)], [PARC/MAFF 004276(01)], [PARC/MAFF 004267(02)] and [PARC/MAFF 004295(04)] have minimum period with only 5 days for emergence, 79 days to heading and 130 days to maturity which can be utilized for introducing short duration wheat accessions, while the entry [PARC/NIAR 002828(03)] has minimum plant height 32cm and the

accession [PARC/MAFF 004267(02)] has maximum number of 20 tillers plant^{-1}. Hence the entries [PARC/NIAR 002303 (05)], [PARC/MAFF 004295(04)], [PARC/NIAR 002828(03)] and [PARC/MAFF 004267(02)] have the desired characteristics by which we will be able to obtain greater grain yield and hence therefore recommended for general cultivation under different agro-climatic conditions in the area of Dera Ismail Khan.

Acknowledgements

I am greatly thankful to Higher Education Commission (HEC), Islamabad, Pakistan for providing financial support under the Indigenous Scholarship Program for Universities.

References

Adary, A.H. and C.O. Qualset. 1978. Genetic variability in landrace populations of durum wheat. *Dep. Pl. Sci.,* River Calif, USA Agro. Abs. 46.

Alptekin, K. and Z. Nusret. 2005. Variation in Wheat (*Triticum* spp.) Landraces from Different Altitudes of Three Regions of Turkey Genet. *Resour.Crop Evol*., 52, Num.6. 31: 68-73.

Bekele, E. 1984. Analysis of regional patterns of phenotypic diversity in Ethiopian tetraploid and hexaploid wheats. *Heriditas,* 100: 131-154.

Bekele, E. 1985. The biology of cereal landraces population. Problems of gene conservation plant breeding, selection schemes and sample size requirement. *Heriditas*, 103: 119-134.

Ehdaie, B. and J.G. Waines. 1989. Genetic variation, heritability and path-analysis in landraces of bread wheat from southwestern Iran. *Euphytica*, 41: 183-190.

Faris, H., M. Arnulf, S. Harjit, B. Getachew and J. Eva. 2006. Multivariate analysis of diversity of tetraploid wheat germplasm from ethiopia. *Genet. Resour.Crop Evol*., 53: 6.

Fida. M., A. Ijaz, K. Naqibullah, M. Khurram, N. Aysha, S. Salma and A. Khalid. 2011. Comparative study of morphological traits in wheat and triticale. *Pak. J. Bot*., 43(1): 165-170.

Fufa, H.P.S., B.S. Baenziger, I. Beecher, R.A. Dweikat, Graybosch and K.M. Eskridge. 2005. Comparison of phenotypic and molecular marker based classifications of hard red winter wheat cultivars. *Euphytica*, 145: 133-146.

Khan, M.M., M. Qasim, R.D. Khan and M.A. Rabani. 2007 a. Correlation and phenotypic variability studies for some agronomic traits among bread wheat (*Triticum aestivum* L.) accessions. *Gomal Uni. J. of Research Sci*., 23(2): 18-24.

Khan, M.M., R.D. Khan, M. Qasim and M.A. Rabani. 2007 b. Evaluation of some wheat (*Triticum aestivum* L.) germplasms for its variability for different traits. *Gomal Uni. J. of Research Sci*., 23(2): 32-38.

Levy, A.A. and M. Feldman. 2002. The impact of polyploidy on grass genome evalution. *Plant Physiol*., 130: 1587-1593.

Levy, A.A., G. Galili and M. Feldman. 1988. Polymorphism and Genetic control of high molecular weight glutenin subunits in wild tetraploid wheat (*Triticum turgidum* var. *dicoccoides*). *Weiz. Inst. Sci.,* Rehoo, Israel. Her. 61(1): 63-72; 35.

Mohibullah, M., M.A. Rabbani, S, Jehan, Zakiullah, A. Amin and Ghazanfarullah. 2011. Genetic Variability and Correlation analysis of bread Wheat (*Triticum aestivum* L.) Accessions. *Pak. J. Bot*., 43 (6): 2717-2720.

Nevo, E., E. Golenberg, A. Belies, A. Brown and D. Zohary. 1982. Genetic diversity and environmental associations of wild, Triticum dicoccoides, in Israel. *Theo. App. Gene*., 62(3): 241-254; 31.

Pecetti, L., P. Annicchiario and A.B. Damania. 1992. Biodiversity in a germplasm collection of durum wheat. *Euphytica,* 60: 395-407.

Sethi, S.K., Y.P. Sing and R.K. Sheoran. 1992. Genetic diversity in wheat. *Cro. Res. His*. 5: Supplement, 129-133; 4.

Simmonds, N.W. 1979. *Principles of crop improvement.* Longman, Newspaper.

Steel, R.G.D. and Torrie. 1981. *Principles and Procedures of Statistics*. 2nd Edition, McGraw-Hill Book Co., Inc., New York, USA, pp. 633.

Tariq. M., S. Ayesha, R. Awais and N. Nazia. 2011. Evaluation of genetic diversity in different Pakistani wheat land races. *Pak. J. Bot*., 43(2): 1233-1239.

Vavilov, N.I. 1926. Studies on the origin of cultivated plants. *Bulletin of Applied Botany, Genetic and Plant Breeding*, 16: 1-248.

(Received for publication 27 January 2010)