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Wheat - in the Light of Evolution

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Introduction

Wheat is the cereal grain, having C_3 mechanism and leading source of vegetable protein. Wheat is the most important worldwide staple food. Botanically, the wheat kernel is a type of fruit called a caryopsis.The wheat family *Poaceae* includes 12,000 grass species in about 771 genera that are classified into 12 subfamilies. *Triticum* comprises six biological species at the diploid, tetraploid, and hexaploidy levels. These earliest cultivated forms were diploid (genome AA) (einkorn) and tetraploid (genome AABB) (emmer) wheat.The central to wheat domestication is wild emmer wheat has contributed two genomes to bread wheat (*T. aestivum*). The tetraploid species, *T. turgidum* (genomes AABB) and *T. timopheevii* (genomes AAGG)are polyphyletic.The genus *Aegilops* plays an important role in wheat evolution because, wild emmer(*T. dicoccoides and T. araraticum*) resulted from the hybridization of wild wheat, *T. urartu* and *Ae. SearsiiT. aestivum* originated some 6000-7000 years ago by the hybridization of tetraploid wheat. The early domesticated forms of einkorn, emmer, and spelt are all hulled, whereas modern forms of tetraploid and hexaploid wheat are free-threshing.

Birth of the genus *Triticum*

According to the simplified scheme of origin of *Triticum*genus, the ancient form of diploid prototype gave birth to two basic genus- *Triticum* and *Aegilops*, through natural variation and selection and those are further divided in to three main lineages, as the first lineage is einkorn or diploid lineage that includes *T. monococcum* and *T. urartu*, from which *T. urartu* helps to form emmer or tetraploid lineage and creates *T. turgidum* by hybridizing with ancient *sitopsis* species and that *T. turgidum* again involve in allopolyploidization with *Ae. tauschii* to create third spelt lineage of hexaploid hulled *T. aestivum* and that hulled *T. aestivum* is further converted in to the free- threshing type by domenstication. Same way other hexaploid which is *T. zhokovskyi* formed through the hybridization between *T.*

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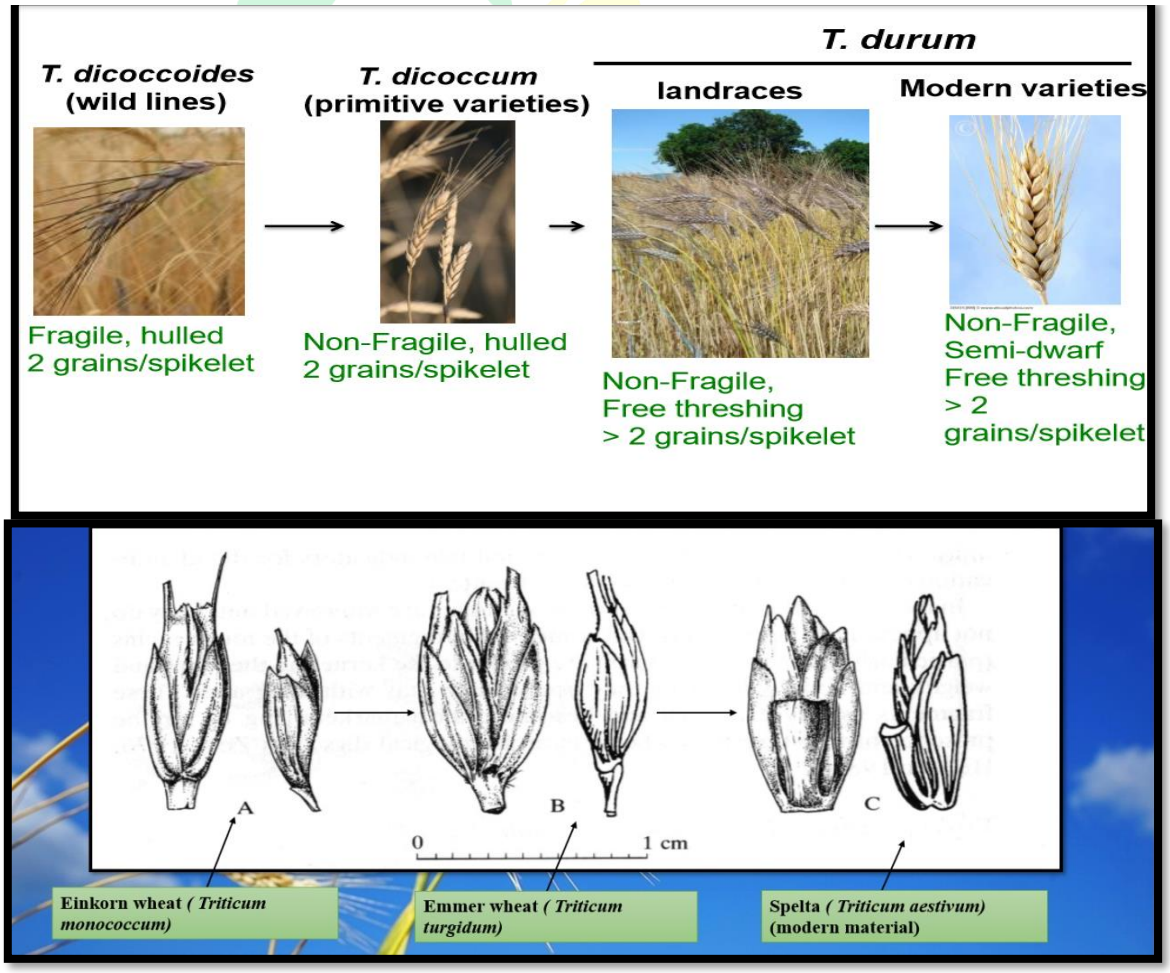
monococcum and *T. timopheevii* which itself created through the hybridization between *T. urartu* and *Ae. Speltoides.* All the progenitors are mainly divided into two classes as wild and cultivated, from which wild form includes species like *Aegilops Speltoides, Triticum urartu, Triticum dicoccoides, Aegilops tauchii*. Whereas, cultivated form includes species like, *Triticum durum, Triticum aestivum, Triticum spelta, Triticumdicoccum*. Phylogenetic trees showing a single origin for domesticated varieties of einkorn.

❖ **External morphology**

Peng *et al.,* 2011 grouped various species of *tritucum* under various sections on the basis of morphological characters like, Fragileness, hulled/free-threshing, no. of grains per spikelet, spikelet- Fragile and non- brittle spikes, glume forklets, Rachis segment, Dehiscence, seed shape, Selection criteria. Various characters are as under



The wild einkorn wheat had long, loose spikelet, whereas spelta have short and compact spikelet which provide strength to the spikelet.The other character is glume forkelets

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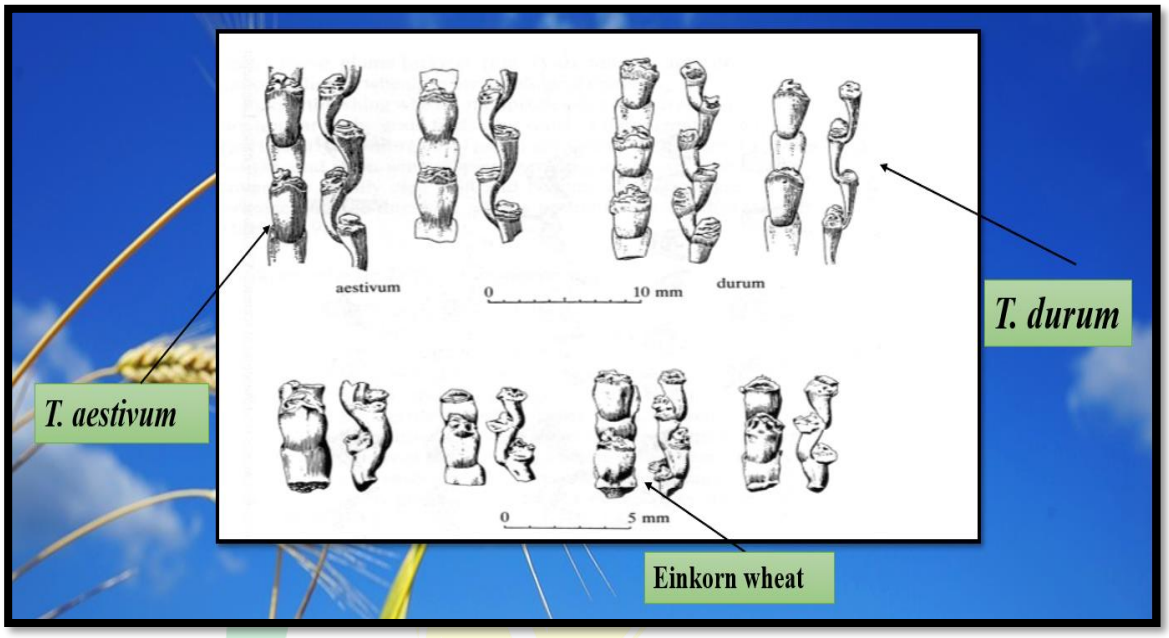
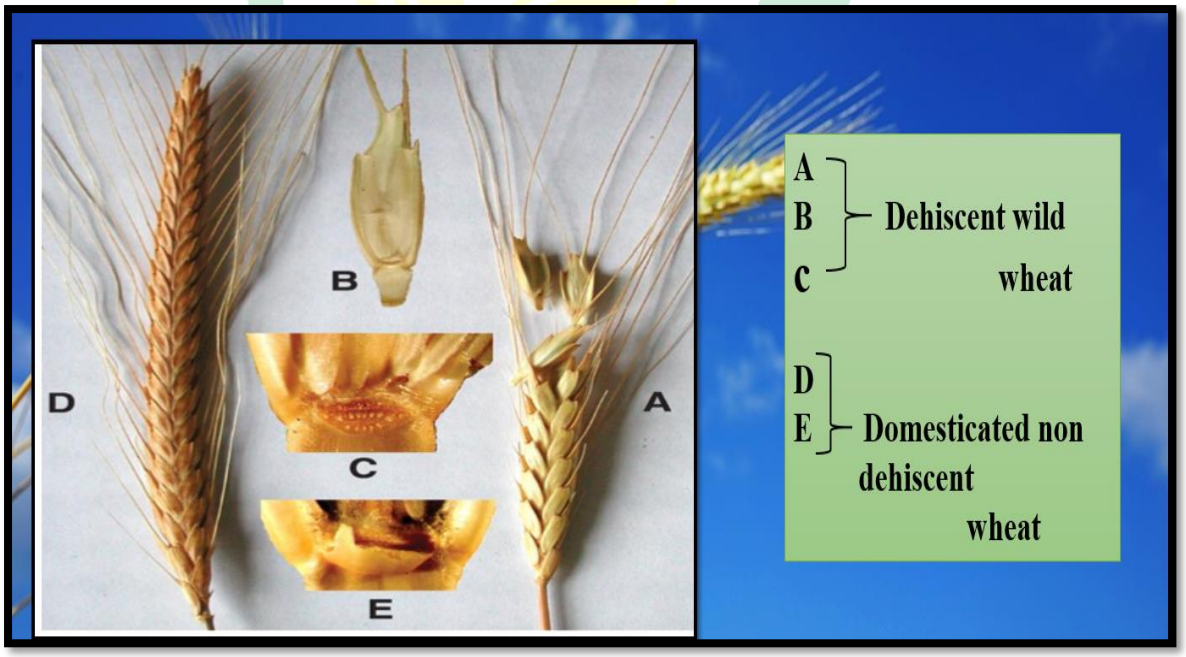
in which the einkorn species wheat are awnless and modern cultivated wheat have well developed awns and that awns are responsible for 12% of the total photosynthesis of plant.



The modern wheat *T. aestivum* have long and thin rachis segment which can bear more spikelet per plant and wild wheat have short and thick rachis segment which bears less spikelets per plant.



The wild wheat spikelet has the character of easily dehiscent whereas the modern domesticated wheat does not easily break or dehiscent at the time of maturity.

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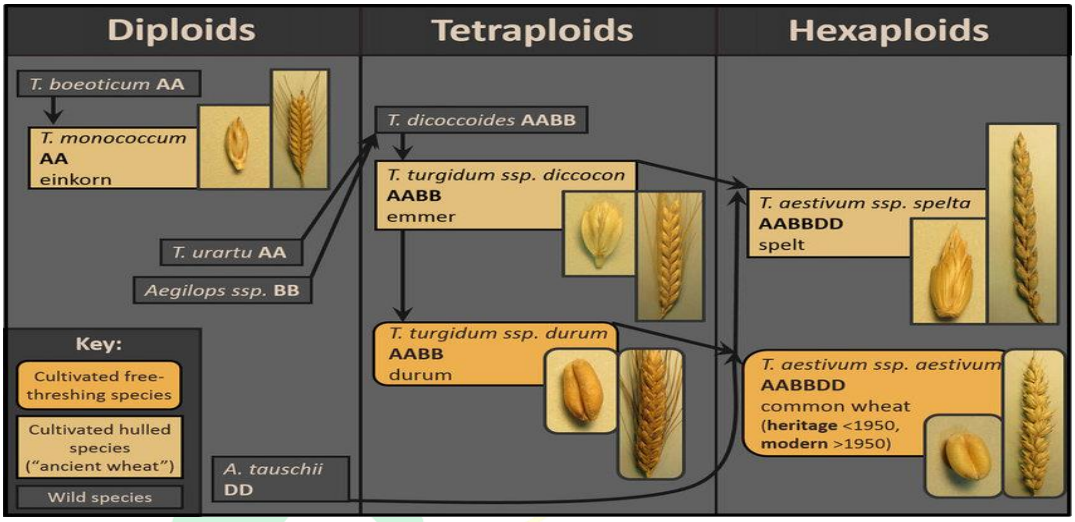
Evolution of *Triticum aestivum*

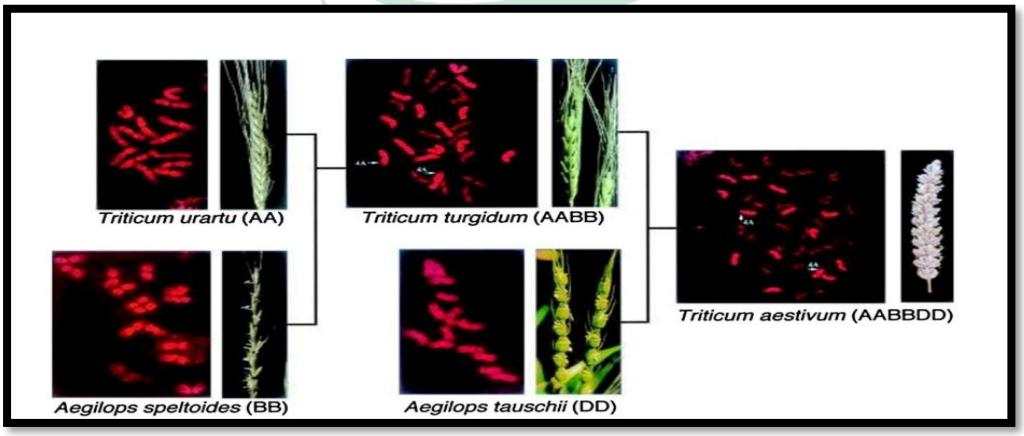


In this figure, we can clearly see that the *T. tugidum* is hybridization between the *T. urartu* and Aegilops species and the *T. aestivum* is derived from the *A. tauschii* and *T. turgidum*

Cytological and cytogenetical evidence for evolution

The cytological evidence suggests that in wheat the haploid numbers of chromosome is 2n= 7, 14, and 21 in diploid, tetraploid and hexaploidy species respectively. Cytological studies, mitotic behavior of chromosome and RFLP analysis has showed that donor of genome A is *T. urartu* whereas, B genome is donated by *Ae. speltoides* and genome D is derived from *Ae. tauschii*.The karyotype representation shows there is presence of seven haploid number of chromosomes in diploid, 14 numbers of chromosome in tetraploid and 21 numbers of chromosome in hexaploid species.

Karyotypic representation of the evolution of *Triticum aestivum*



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Origin of Triticale

The origin of triticale dates back to 1873 when the Scottish botanist A. S. Wilson made the first cross between wheat and rye. The first 'true' allopolyploid triticale according to today's definition was bred in 1888 by the famous German plant breeder W. Rimpau who managed to create a cross between wheat and rye that was partially fertile. Triticale is an artificial intergeneric hybrid between a female wheat parent (*Triticum* spp.) and a male rye parent (*Secale* spp.). The first triticales were made using bread wheats, the offprings are called octoploids (AABBDDRR; 2n = 8x = 56), and they combine the A-, B-, D- genomes from *Triticum aestivum* with the R-genomes from rye.

References

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