Late Palaeolithic Barley Farming

(Continued from page 3)

novation of barley cultivation occurred in the life of this palaeolithic community and yet it made no noticeable difference in their cultural development. Wendorf *et al* write: "Barley appears to have been no more than simply another resource used as part of a broad-based economy. If our interpretations of the Wadi Kubbaniya evidence are correct, then it would seem, in this case at least, that the development of food production was one of the great nonevents of prehistory."

The role of radiocarbon dating in archaeological studies of this kind can hardly be underestimated, and it is the antiquity of the evidences for barley production that makes this case so interesting. However, it has been pointed out[2] that if the C-14 dates are reinterpreted according to a non-equilibrium model, conclusions which are radically different will follow. It has been argued that conventional C-14 dating tends to stretch out real time in the neolithic and palaeolithic periods, making them far longer than they really are. If these 10,000 years of radiocarbon time represent, in real time, a few generations, then the discoveries cease to be anomalous and controversial.

Wendorf's article raises other questions which are merely noted here. Whilst the authors refer to multiple occupation levels, they also describe them as deflated. By this they mean that expected layers of sand and silt between occupation layers are absent. "Most of these sites are now heavily deflated and appear as large, dense concentrations of artifacts on the surface, palimpsests of several occupations brought together by erosion." Is erosion responsible for bringing the occupation layers close together? Or is this another indication that C-14 dates inflate time-spans in prehistory?

From a Biblical perspective, it is expected that the principles of farming were known from the earliest times. Wendorf *et al* may not be so far from the mark when, in this particular case, they refer to the innovation of food production as a nonevent. It is suggested, therefore, that a more profitable line of enquiry is to consider why aspects of farming practice are *absent* from a society, rather than speculate on how farming was initiated.

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BIOGEOGRAPHY FROM A CREATIONIST PERSPECTIVE: II. THE ORIGIN AND DISTRIBUTION OF CULTIVATED PLANTS

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A model is developed for the origin and distribution of cultivated plants from the standpoint of rapid creation, the fall, the flood, and a post-flood dispersal from the area of Asia Minor. It is assumed that each type of plant was created separately but that crop plants vary as to the length of time they have been under human cultivation.

Certain plants appear to have been domesticated very early and it is proposed that these represent forms which were cultivated before the flood and then propagated by Noah and his descendents. Data from archaeology fit such a view in that many crop plants are found to have been cultivated first in mountain highlands in the mideast and only later elsewhere. Vavilov's "centers" of crop plant origin are reevaluated as centers of post-flood agriculture.

Other cultivated plants seem to have been domesticated more recently. It is assumed that these were unknown to Noah as crop plants but were later brought under culture. Ancestors for most cultivated plants are completely lacking, a fact that supports creation rather than evolution.

The processes of mutation, selection, cultivation, hybridization and polyploidy are analyzed in relation to the history and development of corn, wheat, apple, rose, orchid, and strawberry varieties. While many very interesting modifications have been achieved, there has not been any evolution of new species that would persist under natural conditions.

Cultivated Plants Have No Ancestors

All plants were formed by the Creator as separate "kinds" which have not varied beyond rather narrow limits since the time of creation. In Genesis 1:11 it was reported that God made the "fruit trees," the "grass," and the "herb yielding seed after his kind." Certainly numbered among the created plant species were those which man was later to cultivate for food, fabric, and other products. The commentators Keil and Delitsch understood the scope of this creation act as they wrote. "These three classes embrace all the productions of the vegetable kingdom."[1] If the Bible record is accurate, we should find no evolutionary forerunners of the cultivated plants.

The geneticist Darlington rejected the scriptural view, writing that once upon a time people used to think that horticultural plant types were the ". . . gift of the gods . . ." but that such belief was shaken about 150 years ago when it was found that there were ". . . new and equally valuable crop plants existing exclusively in America."[2] What Darlington did not understand is that

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the limitation of some domesticated plants to America does not in itself strike down the idea that God created the original species which man has used in horticulture. In order to discredit the creationist position, whole series of fossil and living "links" would be required, showing that cultivated taxa indeed arose as offshoots from an ancestral evolutionary tree. Such evidence is completely lacking. Not only are the broad lines of familial ancestry for flowering plants nonexistent, but also there is a paucity of transitional forms needed to show the descent of most genera and species,[3] and this is admitted by evolution-minded workers, as evidenced in the following quotations:

> "With most domesticated plants the wild ancestral species are unknown or doubtfully known."[4]
>
> The geneticist Vavilov ". . . was convinced that most cultivated plants are quite dissimilar to their nearest relatives . . ."[5]

This matter of missing ancestors for crop plants loomed as such a problem to C. D. Darlington that he entitled one whole section of his book covering pages 161-163 "Loss of Ancestors". Since the ancestors of cultivated plants do not exist, Darlington countered by suggesting that they had necessarily been lost:

> "Yet another consequence of the natural process of cultivation which is to be expected on our view is that the cultivated forms of a species should sometimes have extinguished their wild ancestors."[6]

He attributed this routine loss of ancestors to such factors as rapid evolution, recent ecological changes, and genetic crossing. Darlington implied on page 161 that loss of ancestors was actually inevitable:

> "The extinction of wild ancestors is, however, another way of saying the occurrence of complete domestication."

Thus when one seeks steps to show how cultivated plants might tie back into the roots of angiosperm ancestry at the species, genus, and family level, he is told that the process of domestication by its very nature obliterates the developmental steps! This is a peculiar argument, but somewhat reminiscent of how evolutionists attempt to deal with scarcity of fossil links and supposedly "helpful mutations". And furthermore the main fact still stands that ancestries are in each case lacking; and this is direct support for the belief that no such ancestries ever existed.

(The Domestication of Animals)

While there are many features of animal domestication which are very similar to the cultivation of plants, the former subject is a broad one which deserves separate coverage. Although very little has been written by creationists on this subject, the creation scientist C. E. Turner recently reviewed certain key literature sources from the vantage of scripture.[7]

Although he brought up many points, Turner's major conclusions were as follows:

1. Domesticated animals did not arise gradually from wild ancestors.
2. The Creator marked out from the beginning certain creatures which were intended to be most useful to man.
3. Domesticated animals appeared quite recently (within 10,000 years or less from the present.)
4. Domestication of animals has yielded some changes (as with the dog) but all of this has been "Strictly within the domestic species" and is a matter of man's having been ". . . allowed by God to improve breeds and yields by selective breeding."
5. Domestication of animals is an attempt on man's part to recover the loss which he has experienced in this regard since the fall; ". . . domestic animals descended from those described as 'good' in the beginning, deteriorating in the hands of fallen man, until scientific enlightenment produced improved Western stocks from the time of the Reformation and the consequent progress of the Seventeenth Century."

Creation View Fosters Cultivation of New Plant Types

In Genesis 1:29 it was recorded that every green herb on the face of the earth was given to man for seed and every tree for fruit. Darlington quoted Charles Darwin as believing that in ancient times man was ". . . compelled by severe want to try as food almost everything which he could chew or swallow", which Darlington himself then described as ". . . a view with much biblical corroboration."[8] Here is a tacit admission that the biblical view fosters research and experimentation into plants as a source of human food.

We must not conclude from this passage, however, that man in some way will find great food value in every plant. This biblical statement describes the plant world before the fall brought thorns, thistles, and perhaps numerous biochemical changes. But the passage still applies in the sense that every species of plants must serve as a food for at least one species of animal. Furthermore, the biblical emphasis surely does encourage additional experimentation and research in quest of new crop plants. The sunflower, for example, was undiscovered as a source of oil and food until the last century. Perhaps as the mindset of Genesis 1:29 penetrates crop plant research more fully, man will discover other species which could help satisfy his growing needs for food, fuel, and forage.

The Impact of the Fall on Plant Cultivation

In Genesis 2:9 it is apparent that God caused every fruit tree to grow out of the ground in the Garden of Eden, where they were assembled for the convenience of Adam and Eve, although it is assumed that these plants likewise grew elsewhere. After his disobedience (Genesis 3:24), man was driven from the garden but the fruit trees (with the exception of the tree of life and the tree of the knowledge of good and evil) must have been growing outside the Garden. Nothing is told of what happened to the tree of knowledge of good and evil but the tree of life appears in Revelation 22:2 where it was shown to thrive in the New Jerusalem—a city which is to descend from heaven where it is to rest on a new earth to be formed after the present earth has been destroyed.

At the time of the fall, Genesis 3:17-19, the soil began to yield thorn- and thistle-laden plants. L. H. Fisk has pointed out that this advent of thorns must be "pre-Devonian" in terms of historical ecology,[9] which simply means that thorns came to plants before the flood. Also, the soil became more resistant to man's agricultural efforts so that he could secure its benefits only by the sweat of his face. Thus we may assume there were no plants with thorns or thistles before the fall nor were there any obnoxious weeds. God transformed the biotic world to such an extent that the apostle Paul wrote "... the whole creation groaneth and travaileth in pain together until now (Romans 8:22). This curse doubtlessly entailed much biological intervention with the Creator producing comprehensive revisions in the digestive tracts and dental apparati of carnivorous animals. Plants from various botanical families produced thorns. The true thistle, for example, is a member of the sunflower family. One plant in the mint family, however, (*Salvia carduacea* or thistle sage) has thistles and resembles the true thistle so closely that the non-botanist might mistake it for the real item.[10] Since all of this genetic intervention at the time of the fall was implied but not mentioned, the Bible does not rule out the possibility that the Creator worked rapidly after the flood to modify existing species for their new habitats, as Lammerts has suggested elsewhere.[11]

Effect of Cultivation on Plant Species

The Creator endowed many plants with a high potential for variation. This has allowed the formation of many varieties within various species of cultivated plants, as evidenced in the cabbage group which includes cabbage, cauliflower, kohlrabi, brussel sprouts, broccoli and kale in the same species. Some of our presently useful species may have been cultivated since the time of creation, like wheat and possibly apples. Others like the sunflower and the strawberry have been brought into domestication in very recent times. In his very helpful article on domesticated plants and animals, Harlan makes the point that "Domestication involves genetic changes that make the plants better suited to the conditions of man-made environments and less well adapted to the conditions of natural environments."[12] He added that, "... the domesticated races of maize, wheat, rice, potato, sweet potato, and most other crops would all die out without human intervention." Thus the stringless bean may be preferred for eating, as the geneticist Tinkle pointed out;[13] but this may have little or nothing to do with the success such a plant can have in nature, outside of man's care.

Human cultivation of plants involves selection for types that have greater yield to man or greater ease of handling. It is likely that genetic irregularities such as gene mutations, chromosomal breaks and changes in chromosome number (polyploidy) began to occur after the fall. Although such changes are largely negative, in some cases they play a stellar role in formulating new varieties of crop plants under man's auspices. Thus even genetic irregularities have helped man achieve specific goals in plant breeding. However, as W. J. Tinkle indicated, this selection within crop plants such as sugar beet and corn has absolute limits and does not produce new species.[14,15]

Polyploidy, Plant Breeding, and Agriculture

A plant breeder may put pollen of one species onto stigmas of another species, leading to hybridization. Subsequently the chemical "colchicine" can be applied to cause doubling of chromosome number in the hybrid zygote, producing an "allopolyploid" (also called an "amphidiploid" because of its regularity in chromosome pairing during meiosis.) Allopolyploids may be fertile and manifest some very useful properties. Then too, colchicine may be used on the stem tips of non-hybrid plants and thereby induce autopolyploids which may yield larger fruit or flowers than the diploids while generally being less fertile. It is possible that early plant breeders knew about polyploidy. But even if ancient people did not understand chromosome doubling and the use of colchisine, some allopolyploids and autopolyploids may have arisen by chance in populations of plants under their cultivation. Such novelties surely would have come to the attention of the plant breeders and would have been preserved.

Apparently polyploidy occurs at a regular low rate in natural populations. The cytogeneticist Swanson has discussed this at great length concluding that things a botanist would call a "species" may at times be formed from one or more preexisting species by a process of natural allopolyploidy.[16] Lammerts, however, attributes nearly all of this polyploidy to a period of intense activity by the Creator after the flood, when existing species were modified rapidly with resulting hybridization and segregation into derivative species. Although Howe sees this post-flood activity as a distinct possibility, he likewise believes that the Creator may have carried out some of the polyploid speciation gradually and he feels that a certain amount of this may still be bringing changes in both cultivated and natural populations—although much more slowly in the latter since man is not involved as the agent in controlling selection.[17]

Whatever may be said about variation at the species level as regards polyploidy and selection, Swanson arrived at a negative conclusion concerning polyploidy in the origin of genera and higher taxa:

> "The above enumeration of various aspects of polyploidy leaves one evolutionary question to be answered. Can polyploidy lead to the formation of categories higher in the taxonomic scale than species? The direct evidence presently available seems to provide a negative answer, for the species derived through hybridization and polyploidy do not depart radically from their diploid ancestors either morphologically or ecologically. The general belief is that most of the hereditary changes leading to generic and familial differentiation originate at the diploid level, and that polyploidy is actually a conservative and, indeed, a deterrent factor in preventing the segregation necessary for the establishment of divergent lines. Gene variation and aneuploidy offer greater possibilities for such divergence, while polyploidy offers continued stability and survival to already established gene combinations."[18]

Thus, however polyploidy arose, Swanson makes it exceedingly plain that the real evolutionary steps did not transpire at the polyploid level but had to occur among the diploid ancestors of the polyploid species—polyploidy itself being a "conservative device" and a "deterrent factor" in the development of major categories!

Creationist writers have likewise criticized the efficacy of polyploidy as a means of macroevolutionary change. Thus the geneticist Klotz while recognizing the existence of chromosomal aberrations and changes in chromosome number, concluded that they really contribute nothing that is new.[19] Lammerts has argued cogently that some of the "species" that are supposed to have arisen by natural allopolyploidy may have originated by several other means such as diploid merogeny in which an unreduced pollen grain asexually forms an embryo.[20,21]

Mutations, Selection, and Horticulture

A particular gene mutation, variant allele, chromosomal aberration, or polyploid change has a much greater chance of being incorporated into the genetics of a species if that species is under human cultivation. One hardly needs to mention the well-known fact that mutations are largely harmful! Even among the mutations that show one "helpful" facet, the multiple aspect of gene expression (known as "pleiotrophy") regularly dictates that other manifestations of the same mutation will be "harmful" to the species in its natural environment. Thus in man himself the mutation for synthesis of hemoglobin-S in the red blood cells instead of hemoglobin-A is "helpful" only if the population is severely subject to malaria. Although the hemoglobin-S does confer slightly greater resistance to malaria on the heterozygotes or hybrids, it is frequently lethal, causing sickle cell anemia in the homozygotes! The mutation for albino in mammals (e.g. squirrels) is harmful and is weeded out of wild populations by the effect of what is called "natural selection." Only when man intervenes (as at Olney, Illinois) do white squirrels become prevalent![22]

Likewise in roses that are subjected to neutron irradiation, some mutations occur which are of certain interest to rose breeders. However these mutations are routinely inferior to the original stock as regards vigor and viability[23] and would be eliminated if the species were not under domestication, as Lammerts has shown.

In observing populations of California poppy and other flowering herbs,[24] we found that generally the deviant phenotypes prevalent in a moist year are almost totally lacking when the population faces a regular crisis of drought in other years. Although the gene pool contains alternative alleles for various loci and although other modifications such as aberrations and polyploids may be present, these deviant types are routinely reduced in number as the population faces environmental vicissitudes. If man begins to domesticate such a plant, on the other hand, he may for reasons of his own select such deviants, caring for them and providing the special environment which they now require. By this means generous changes can come within sections of a species in a very short time.

One should not use the term "evolution" as Harlan did (". . . domestication is an evolutionary process . . .") to refer to these changes because in most cases the forms produced are unable to persist in nature without man's intervention and most have not undergone enough change to be classified as distinct "species." Harlan wrote that:

> ". . . the domesticated races of maize, wheat, rice, potato, sweet potato, and most other crops would all die out without human intervention."[25]

Usually these horticultural forms are merely strains or varieties within a given species and the word "evolution" is inapplicable unless by "evolution" one simply means a change of any magnitude!

As more became known about the processes involved, the pace of selection would have quickened. The rate at which man improves crop plants has also increased recently because the population pressure has made it pay off. Little was done with the beet for over 1800 years and then the development of five types occurred rapidly—garden beets, chard, mangels, sugar beets, and foliage beets. The pea was used since before the Christian era but experienced more improvement in the last 100 years than in the previous 2000.

Darlington attributed changes arising in plants cultivated by early people to what Charles Darwin had called "unconscious selection" and had described as ". . . the mere act of preserving the most favored and neglecting or destroying those less valued."[26] But there is no reason to refer to such selection as "unconscious" because human purposes were being fulfilled. There is likewise no reason to refer to the results as "evolution" because the boundaries of the "kinds" were not transgressed. In fact, it is likely that the mere act of tilling the soil and raising plants under field conditions will eventuate in horticultural varieties. Under field culture larger forms, some of which are polyploids, ". . . can compete favorably with earlier forms on arable land with higher nutrition."[27] Harlan noticed that these developments were not new species but simply, ". . . morphological monsters that are completely dependent on man for survival: these plants are fully domesticated."[28] Mendel viewed changes in all plants as simply variations *within* the species. He understood the huge impact that agriculture itself had on plant forms:

> ". . . our cultivated plants are members of various hybrid series, whose further development in conformity with law is varied and interpreted by frequent crossings *inter se.* The circumstances must not be overlooked that cultivated plants are mostly grown in great numbers and close together, affording the most favourable conditions for reciprocal fertilization between the varieties present and the species itself."[29]

Was Ancient Man Really "Primitive"?

Cain was a "tiller of the ground" so that agriculture began immediately after creation and the fall. In the scriptural perspective, man did not start as a primitive creature but originally had a level of intelligence at least as great as that which he presently possesses. These early people were probably very busy working with plants; and with the long lives people had, they may have developed many lovely flowers and luscious fruits. They most certainly practiced plant breeding, selection, and agriculture from the very beginning.

It is difficult for the creationists to distinguish clearly between pre-flood and post-flood remains. It is possible, of course, that the pre-flood habitations of man were largely obliterated in the deluge and that the only artifacts we may correctly assign to the pre-flood period are such things as the historian Van Fange has reviewed: the baked clay figures, mortars, beads, nails, an iron pot, and other obviously human products buried at great depths, sometimes even in coal seams.[31] Thus there may be no way to examine this very interesting period of pre-flood agriculture other than to analyze the oldest deposits, generally studied by archeologists, which presumably correspond to the early post-flood remains. The Jarmo discoveries of the mideast, the Ocampo Cave, the Tehuacán remains in Mexico, and the Ayacucho deposits for example are dated at 6000 to 7000 B.C. We suspect that these are early post-flood remains and should be given a much more recent date. Nevertheless they are certainly very old; and still they contain the following crops—einkorn wheat, emmer wheat, barley, lentils, peas, scarlet runner beans, maize, squash, gourds, lima beans, and others.[32] These data fit with the belief that certain crops were under cultivation as far back as human archaeological deposits can be studied, which shows that man has always been agriculturally oriented. Thus the "hunting" and "gathering" stages which are supposed to have preceded agriculture by many centuries were simply non-agricultural human societies that existed contemporaneously with agricultural societies at various localities after the flood. Actually A. C. Custance has demonstrated that most of the diverse fossil human skulls and archaeological remains fit squarely with a post-flood dispersion model and require no recourse to evolution theory.[33]

The Post-flood Dispersal of Cultivated Plants

In Genesis 6:21 Noah was commanded to take food onto the ark. Very likely seeds, cuttings, buds, and scions of all the finest existing varieties of fruits, ornamental trees, and shrubs were saved. Noah had over 120 years to plan such a venture. Furthermore in Genesis 8:11 an olive leaf is mentioned, having been brought back by a bird after the flood. This indicates that there was survival of certain previously cultivated plants outside the ark through such possible means as seed sprouting, floating mats of vegetation, or even regrowth of pre-flood stems after the waters subsided. And some species presently cultivated may have been as yet unnoticed by agriculturalists and would have survived like other wild forms during the flood.[34]

Genesis 8:13 contains the statement that "Noah removed the covering of the ark and looked and behold, the face of the ground was dry." Although it is sometimes assumed that the entire earth was dry at this specific time, and alternative view is probably closer to the truth. Noah could not see the whole earth so these comments most likely had reference to the local situation—a dry mountain valley where he could get started once again with his farming enterprise.

Authorities agree that the most ancient remains of cultivation come from areas of moderately high altitude in Kurdistan! This most significant fact ties in closely with the flood model for dispersal of cultivated plants by Noah and his descendants. Darlington wrote, "The earliest settlements in Kurdistan are dated at about 7000 B.C. and lie at altitudes between 2000 and 4000 feet."[35] Continuing, Darlington pointed out that the deposits contained emmer wheat and two-rowed barley. Harlan produced a map showing ancient agricultural centers as dots, most of which surround the very region where the ark landed—Jarmo, Ali Kosh, Palegawra Cave, Cayonu, and Catal Huyuk. From these various archaeological sites remains of barley, einkorn wheat, emmer wheat, lentils, peas, goats, sheep, cattle, pigs, and dogs are reported.[36] The dates like 7000 B.C. given by Harlan and others for this near-eastern outburst of agriculture probably collapse down to something like 3400 B.C. when the vagaries of the C^{14} dating method are taken into account.

Below the 4000 foot level at this time the earth was probably still covered with water or was in such a moist condition that it was altogether uninhabitable. Only later were people able to move to Kurdistan and cultivation eventually reached the lower plains. A progression of C^{14} dates shows that agriculture gradually appeared on the plains and at lower altitudes as time elapsed. By way of analogy, we should remember that as recently as 150 years ago it was necessary to insert lines of drainage tile into the swamp prairies in such areas of the middle-western United States as northern Illinois to convert this very moist land into suitable terrain for raising crops. Lake Tulare was the largest lake west of the Rockies in 1870. It was fed by the Kern and Kings Rivers, and was described in 1862 as extending for 60 miles north and south, being 36 miles across at its widest and covering 800 square miles. The sidewheel steamer, Marie Androsa, was used to carry hogs and cattle across this lake. In the 1800's people could go almost halfway to Bakersfield by steamer through an area which is now virtually dry, as Lammerts has reported.

For several thousands of years while man was cultivating plants in mountain highlands and valleys, undoubtedly sedimentary strata were still being deposited in vast oceanic areas from which the water was gradually receding. Noah probably grew these particular plants from the reserve of grape and other cuttings he had on the ark. Authorities are amazed by the fact that agriculture started around the world at about the same time. Thus Harlan wrote on page 95:

> "For reasons we can only speculate about, people in various parts of the world all seem to have begun the process of domestication at about the same time."

In the creation-flood view this seemingly spontaneous onset of agriculture at various points simultaneously would stem from a migration of Noah's descendants.

A creation-flood view also affords an explanation for the fact that crop plants appear to emanate from one "center" of ancient agriculture or another, as Howe indicated earlier, "It is at least possible that valuable plants stored on the ark were preserved by the children of Noah. If certain economic plants were cherished by different races, one would expect to find important crop plants coming from several centers of post-flood civilization."[38]

Probably propagules of many cultivated plants were carried and used by post-flood peoples as they traveled and repopulated the earth. Accordingly, early man started migrating from the mid-eastern highlands to other places, carrying various propagules such as seeds and cuttings. Darlington assumed much the same series of events from the evolutionary standpoint in that agricultural use of plants followed a pattern of expansion from early centers.[39] The key difference between Darlington's concept and a creation model is that he believed this spread of agriculture was an evolutionary phenomenon and we assert instead that the geographical spread of plant cultivation was the natural result of man's post-flood migration.

> "The timing of the development of cultivation in different regions is what one would expect on the assumption that the earliest cultivators, supported by their regular food supplies, had gradually multiplied and under pressure and crowding had moved into new regions in search of new land."[40]

This statement of an evolutionist supports a post-flood dispersion model so well that no comment is needed!

People moving to a certain locality may have lost some crops that thrived quite well in other areas of migration. Undoubtedly Noah's descendants discovered that each particular crop plant grew best in certain specific post-flood habitats. At each "center" of civilization man specialized in some crops rather than others for reasons such as difference in climate, soil, and human preference.

It is likely that some of these post-flood centers actually lost particular cultivated crops by losing propagules in transit or as a result of repeated failure to raise the plant under the prevailing weather conditions. Ultimately one set of crop plants would have been thriving well in one particular locality while a very different set was being grown at other centers, although the plants were for the most part all derived from the ark supplies.

No apologies need be made for assumptions involved in the foregoing argument. Any historical analysis of plant geography must be in some measure speculative and this is especially true of the evolution theory. A model is either strong or weak in so far as it is able to encompass the existing data of science and in terms of the number of assumptions which it requires on its behalf.

Returning to the creationists' problem of why corn is found in ancient deposits from Central America but not from Asia Minor, it seems that chance likewise may have played a role. Presumably settlers in the near-east had both wheat and maize. But maize is temperamental in varying environments, as Dobzhansky has pointed out. A type suited to Iowa may be worthless in Peru and vice versa. Tropical varieties of corn are adapted to short days while corn from temperate zones requires long summer days for successful yield.

Probably pre-flood corn was adapted to the tropical climate and uniform length of days throughout the year. If settlers in Asia Minor started with the same corn as those who happened to end up in Central America, it would fail to develop in Asia Minor because the days would be too long (not to mention other aspects in which this corn would be unsuitable in that habitat.) By the same token, the settlers ending up in Central America would have had resounding success with such corn. Evidently the long day types of corn were developed much later.

One might intelligently turn this whole question around to the evolutionist and ask why was wheat found only in Asia Minor and related areas. We believe the creation view has the best answer to both questions.

Vavilov's "Centers" of Crop Plant Origins

Schery and Darlington discussed centers of plant origin, referring frequently to the works of Vavilov and the botanist, De Candolle.[41,42] Vavilov had assumed that the place where a particular crop plant showed its greatest diversity must have been the place from which it originated. This idea, coupled with archaeological studies, led to the popular belief that there were certain key areas of plant evolution.

It is possible, however, that these "centers" of origin proposed by Vavilov were simply centers of crop culture after the flood. The fact that many of them are in the heartlands where the ark rested is at least suggestive. Even Darlington assumed that we must take Vavilov's centers of origin as ". . . centers of development".[43] Darlington also asserted that Vavilov's view was too simple in the face of current facts. He felt that it was too general and that different ". . . species in cultivation . . . develop by utterly diverse processes . . ." A flood creationist would agree with Darlington on these points and would add that centers of diversity and development for crop plants surely correspond to centers of human habitation after a post-flood migration.

Likewise Harlan has objected to Vavilov's evolutionary oversimplification and wrote that: ". . . what once seemed to be well-defined centers tend to fade or to become vague or indistinct. My own viewpoint has changed with the evidence, and what I thought and wrote 20 years ago bears little resemblance to my present assessment of the situation."[44] Harlan found that, ". . . the domestication of pigs is found all the way from Europe to the Far East. Cattle of various kinds were tamed over most of the same range. With respect to plants, much the same is true of rice in Asia, of sorghum in Africa and of beans in the Americas . . ." Thus Harlan was impressed by the fact that the same crop plant or animal showed up independently from various points that Vavilov would have classified as separate centers of evolution. Harlan suggested that this happened because ". . . these food plants were widely distributed and were manipulated by various peoples over their entire range." But it is equally possible that these crops show up in many centers simultaneously because they were carried there by Noah's descendents. Harlan concludes one section of his article with this amazing summary:

> "Each may have been repeatedly domesticated at different places or may have been brought into the domestic fold in several regions simultaneously. At least we cannot point with any confidence or precision to a single center of origin for these particular plants and animals."[45]

Some Crops First Domesticated After the Flood

It is possible that some of our horticultural plants are those which were first brought under cultivation after the flood. This may account for the so-called "appearance" of particular new crops at more recent levels in agricultural sites. Writing of ancient humans, Darlington put it this way:

"But in doing so they had changed the character of some of their crops, they had lost others, and they had picked up many new ones. They had certainly begun with peas and lentils already in Kurdistan; and early they had also had flax which under irrigation became cultivated for its oil-seed as linseed.

But in crossing Asia they had picked up new grains, millets and buckwheats, and in entering China they had acquired soya bean and much later, rice."[46]

The origin of each of these crops may not be exactly as Darlington has postulated but the germ of his idea is that ancient man in early migrations may have begun cultivating wild plants that showed promise.

Like his ancestors, post-flood man may have experimented with plants, cultivating previously wild forms and thus introducing them as new crops. This in itself may explain why some of our agricultural plants seem to arise at various later dates in archaeological and recorded history.

Darlington sensed an apparent conflict in all of this, however:

> "On the one hand it is supposed that the movement of men spread cultivation over the whole of the Old World. On the other hand it is assumed that the movement ceased and was followed by a separation and isolation of great regions."[47]

Yet there is no conflict here if we take the Babel experience and possible continental rifting into account. Early man's post-flood migration would have caused the movement and spreading of agriculture.

Then the tower of Babel and possibly continental rifting would have separated and isolated peoples. Thus an apparent conflict in Darlington's view (migration followed by isolation) is erased in the biblical perspective.

A Bible based explanation for these archaeological events is both profound and simple. It accounts for the plants which seem to have been cultivated since time immemorial as those which were domesticated by Adam's descendants *before* the flood. Yet it allows that the other species were not brought into cultivation until post-flood times and this explains the cultivated plants which manifest a more recent origin. It likewise provides an explanation for the seemingly contradictory facts that agriculture at first spread from an ancient center but then underwent isolation.

The History of Corn

Pollen attributed to corn was discovered by Baarghorn in a core taken from what is presently the site of Mexico City and assigned a date of 80,000 years (see Mangelsdorf p. 539, Baker p. 78). While creationists are not impressed by this interglacial date based on uniformitarian evolutionary assumptions, they are most interested in the fact that corn was evidently present even before its archaeological remains were deposited in various caves. Mangelsdorf *et al.* concluded that, ". . . this fossil pollen settles two important questions. It shows that corn is an American plant and that the ancestor of cultivated corn is corn and not one of corn's relatives, teosinte or *Tripsacum*."[48] But G. W. Beadle maintained recently that these 5 pollen grains were too large to have been the pollen grains of the small ancient corn which must have had very short silks. Beadle concluded that these grains were contaminants in the drilling core.[49]

Figure 1. Artist's reconstruction of wild corn—adapted from Mangelsdorf. Although Mangelsdorf labeled this material "wild corn," such cobs may have been produced by another variety of cultivated corn available to ancient people. Evidently this reconstruction rests on three different fragments found at two or more levels in the San Marcos Cave. Beadle has suggested that these plants represent an ancient cross between teosinte and corn itself. Sketches by John Schilling.

Archaeological deposits of corn which have been given the oldest date are those of the Tehuacán Caves in Mexico (5200 B.C.) Mangelsdorf and colleagues made a thorough study of these deposits and reported that at the lowest levels corn had very small ears and male flowers (tassels) attached to the cob (see Figure 1).

At other levels, continuing on up to that which is assigned a date of 240 A.D., this smaller type of corn was intermingled with various types of cobs that more closely resembled modern corn. See Figure 2.

Mangelsdorf *et al.* reconstructed what they called "wild corn" from fragments found at different cave levels:

> "A well preserved cob, an intact husk system consisting of an inner and outer husk of the Abejas phase in the San Marcos Cave, and a piece of staminate spike from the Ajalpan phase of the same cave provide materials for a reconstruction of Tehuacán wild corn."[50]

Evidently the "wild corn" reconstruction, like so many in the realm of human anthropology, is a composite product of several different fragments and may not

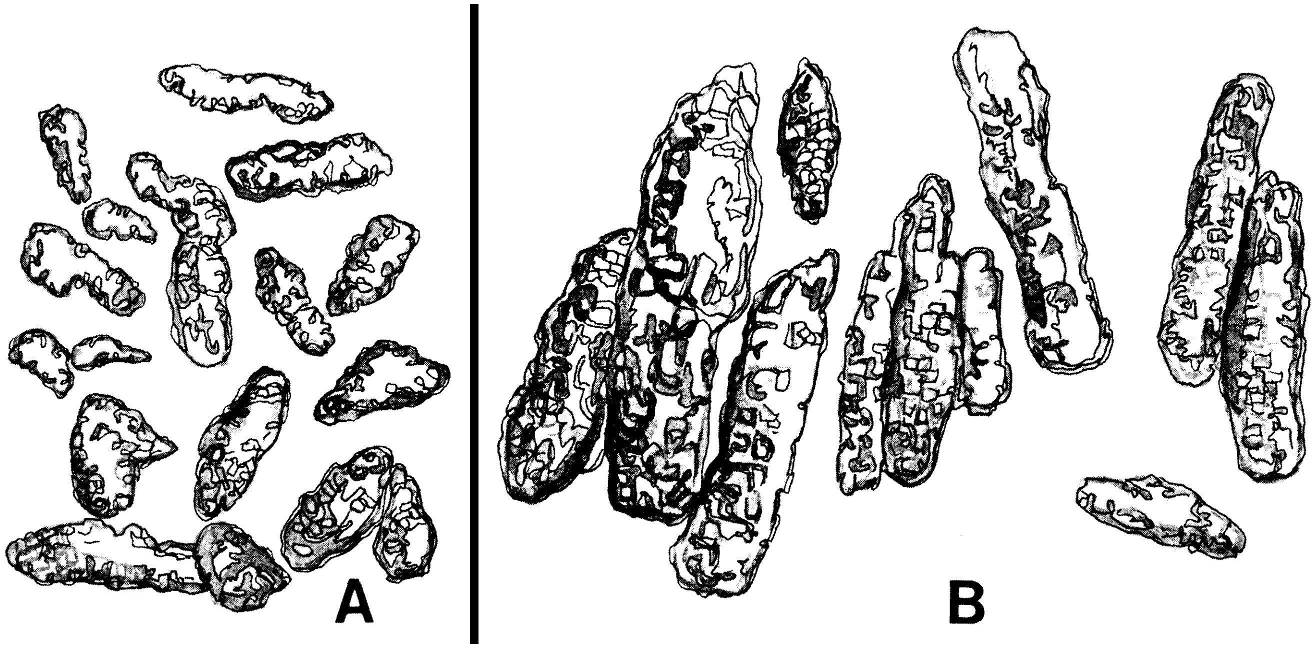

Figure 2. A drawing of cobs from the San Marcos Cave based on a photograph by Mangelsdorf (actual size). Mangelsdorf designated the cobs on the left (A) "wild corn" and those on the right (B) as "early cultivated corn." Some of the cobs from the cultivated corn are just as small as those attributed to wild corn. Perhaps these were all produced by various forms of corn raised by early man—none of them being truly "wild" or ancestral. Or they may have resulted from ancient hybridization between teosinte and corn as Beadle suggested. Sketches by John Schilling.

represent anything that ever existed in its own right. In the face of all this it is not surprising that Dobzhansky[51] concluded that the "how" and the "where" of corn's origin are still unknown.

Mangelsdorf *et al.* assumed that the "wild corn" went extinct because man took over its best areas of cultivation and because it interbred with the cultivated corn types—thus being genetically swamped out of existence. But after considerable discussion of this so-called "wild corn" and other cobs, Mangelsdorf and his collaborators came to the surprising conclusion that:

> "There has been no change in the basic botanical characteristics of the corn plant during domestication. Then, as now, corn was a monoecious annual bearing its male and female spikelets separately, the former predominating in the terminal inflorescences and the latter in the lateral inflorescences, which, as in modern corn, were enclosed in husks. Then, as now, the spikelets were borne in pairs; in the staminate spikelets one member of the pair was sessile, the other pediceled. The only real changes in more than 5000 years of evolution under domestication have been changes in the size of the parts and in productiveness."
>
> ". . . Despite a spectacular increase in size, productiveness under domestication, which helped make corn the basic food plant of the pre-Columbian cultures and civilizations of America, there has been no substantial change in 7000 years in the fundamental botanical characteristics of the corn plant."[52]

Describing Mangelsdorf's reconstructed wild corn, Dobzhansky put it this way:

> "This is already a developed, cultivated, not a wild, plant; but it is a dwarf compared to the ear in modern corn."[53]

A creationist viewing these same data would suggest that probably the corn with the little cobs was simply one of many varieties possessed by early people in Central America. As they progressed in their corn breeding, these people abandoned that variety for others that were more productive. If this particular kind of corn had tassels attached to the ear, such a characteristic has been found in modern corn and it depends simply on a shift of alleles at two gene loci.[54] Thus one need not postulate that this early corn was necessarily "primitive" because of its tassel morphology.

No discussion of the history of corn would be complete without adequate mention of teosinte which is a tall, grass-like plant with leaves not quite as broad as those of corn (see Figure 3). In some earlier papers, Archeson, Vavilov,[55] and then Darlington[56] asserted that teosinte was somehow the ancestor of corn.

> ". . . the tremendous range of variation of this species [corn] under cultivation makes it more likely that it arose by selection under cultivation from plants closely resembling *Euchlaena mexicana* or annual teosinte, a plant which exists both as an arable weed and in cultivated forms as a forage grass."[57]

Beadle has recently revived this same idea that corn came directly from teosinte. Based on large scale breeding experiments, he has concluded that corn and teosinte differ from each other by only five gene pairs.[58] To make such a claim, he used a method known to geneticists by which one may ascertain the number of

Figure 3. An ear of teosinte *(Euchlaena mexicana)* with sheathing leaves—sketch after photograph on page 79 of Baker. Some workers believe this plant was the ancestor of corn, others believe it arose from a cross between corn and a grass, *Tripsacum*. We see at least one other possibility: that both corn and teosinte are distinct "kinds", separate since the creation.

pairs of segregating alleles which differ between two parents by crossing them to produce an F_1 hybrid population and then crossing those F_1 individuals among themselves to yields an F_2. The worker must then determine how many of the F_2 organisms are as extreme as either parent and from the expression $1/4^n$ he can solve for "n" which is the number of gene pairs which differed between the original parents.

If one offspring among sixteen is as extreme as one of the original parents, for example, two gene pairs would be involved because $1/16 = 1/4^n$ where $n = 2$. Thus Beadle found about one in 500 of the offspring was exactly like the teosinte parent in his F_2. He therefore concluded that only 5 gene pairs differ between teosinte and corn because 1/500 is more than $1/4^n$ where $n = 5$; for $4^5 = 1024$.

A careful analysis of page 116 in Beadle's paper, however, reveals that he did not produce a simple F_2 generation as this computation demands but instead performed a backcross of his F_1 (corn X teosinte) hybrid to teosinte before proceeding to produce the F_2 generation. This extra backcross thrown into the sequence certainly invalidates Beadle's claim that only 5 pairs of segregating genes distinguish corn from teosinte.

In his studies, Beadle showed by crossing corn and teosinte that repeated back crossing of the hybrid to teosinte yields a plant that has a small ear closely resembling the Tehuacán cobs which Mangelsdorf considered to be "wild corn." These ancient small cobs may thus have been the result of similar crosses between corn itself and teosinte thousands of years ago. But if so, such evidence fits our contention that something quite like modern corn must have existed back in those early days for teosinte to hybridize with it to yield the ancient miniature variety!

In his paper, Beadle attempted to forge a strong case for similarity between corn and teosinte. In the characteristics where corn and teosinte vary, he maintained that teosinte has the traits that would be of greatest survival value in the wild environment—reduced seed production under environmental moisture stress and disarticulation of individual fruits from the stalk, for example. Where teosinte has a gene that leads to production of fruit inside a hard fruit case, pod corn has the "tunicate" mutation in which the fruit cases are replaced by a series of shallow cups and the kernel is encased in a husklike covering. Beadle maintained that this tunicate mutation would have changed teosinte into something like pod corn. Although Beadle dealt specifically with this tunicate locus only, we suspect that teosinte and corn differ at many other gene loci. Beadle concluded that most probably teosinte was the direct ancestor of modern corn and that:

> ". . . cytologically and genetically corn and Mexican teosinte could even be considered one species."[59]

If it could be demonstrated that corn and teosinte are varying forms of the same species, then corn was one of those crop plants that was derived from wild forms by descendants of Noah after the flood.

Beadle does not show in stepwise fashion how the five factors were added to teosinte to convert it to corn. If they occurred as mutations, the Aztecs must have been quite accomplished plant breeders to have combined such a complex group of genes.

Following a different line of reasoning based on other evidence, Mangelsdorf and his coworkers assumed that the fossil corn pollen was valid and not contamination. On that basis they concluded that teosinte is an unlikely evolutionary progenitor for corn because the dates assigned to the earliest teosinte deposits are relatively recent—1800 B.C. in feces from Romero's Cave,[60] while corn pollen is present in deposits that are assigned an age of 80,000 years!

Instead of assuming that teosinte was an ancestor of corn, Mangelsdorf at first maintained that teosinte was the product of hybridization between corn and *Tripsacum* (gama grass). Mangelsdorf and Reeves hybridized corn with teosinte and corn with *Tripsacum*. Baker summarized the results of the corn x *Tripsacum* cross as follows:

> "Yet, from the partially fertile hybrids between these very dissimilar plants, further generations were raised and some plants from these generations resembled teosinte in a number of characters. If teosinte really originated this way, it would represent a case of hybridization between a crop plant and a weed growing nearby to produce another weed."[61]

We hardly need to state that if the foregoing did occur, it does not explain the origin of corn! But Stebbins had certain reservations even about the cross between corn and *Tripsacum* because the styles of corn had to be artificially shortened to make the process work—something that would seldom if ever occur in nature.[62]

In facing the evidence against the origin of corn via *Tripsacum*, Mangelsdorf more recently proposed that modern corn came from wild popcorn also known as "pod corn" and that teosinte came from this same wild corn by way of mutation. But Beadle argued that "If corn could have given rise to teosinte, surely the reverse is also possible. I would say it is much more probable since teosinte is a highly successful wild plant and corn is not."[63]

Evolutionists are thus unsettled at this point in time as to the origin of corn. Some of them argue vigorously that teosinte came from wild corn while others assert with equal vigor that corn arose from teosinte.

What they both neglect is that a strong third alternative is possible as we indicated earlier—that teosinte and corn are simply two very similar species which have existed independently since the time of creation. Certainly creationists and others should begin to undertake research on aspects of the origin of corn such as the following:

1. Try genetic experiments similar to those undertaken by Beadle but involving a true F_2 generation to find how many genes actually differ between corn and teosinte and what these genes are.
2. Reinvestigate the discoveries at San Marcos and Tehuacán caves to see if there was a discreet layering of corn (as Mangelsdorf implied) or if there was actually somewhat of a mixture at various levels—evolution theory having been used to segregate the corn into successive "stages".
3. Recheck all C^{14} dates and correct these according to preflood factors.

The Changes in Wheat

Wheat is a crop that is as ancient as archaeology itself. Both diploid and tetraploid wheats are found in the Jarmo deposit, dated at 7000 B.C. The basic number for one chromosome set or genome in wheat is 7 (n = 7). In the diploid wheats (such as *Triticum boeoticum* and *Triticum urartu* of today), the nuclei have two of each chromosome type or 2 sets, giving a total of 14 (2n = 14). These diploid wheats are sometimes called "einkorn" wheats because the individual flower stalklet produces just one grain (see Figure 4).

The tetraploid wheats like *T. dicoccoides* and its cultivated descendant *T. dicoccum* are called "durum" wheats are are used to make macaroni and spaghetti. They have 28 chromosomes which is exactly twice the number present in the diploid strains and four times the haploid genome number, 7.

Finding a situation like this where chromosomes fall into a series based upon a common number such as 7, biologists are tempted to assume that the tetraploid strains arose by hybridization of two diploid types followed by a doubling of chromosome numbers ("allopolyploidy" or "amphidiploidy" as described earlier.)

It was previously assumed that the grass *Aegilops speltoides* (also called "sitopsis") hybridized with diploid wheat *(Triticum boeoticum)* in such a manner. If we let the symbol *A* represent a genome (set of 7

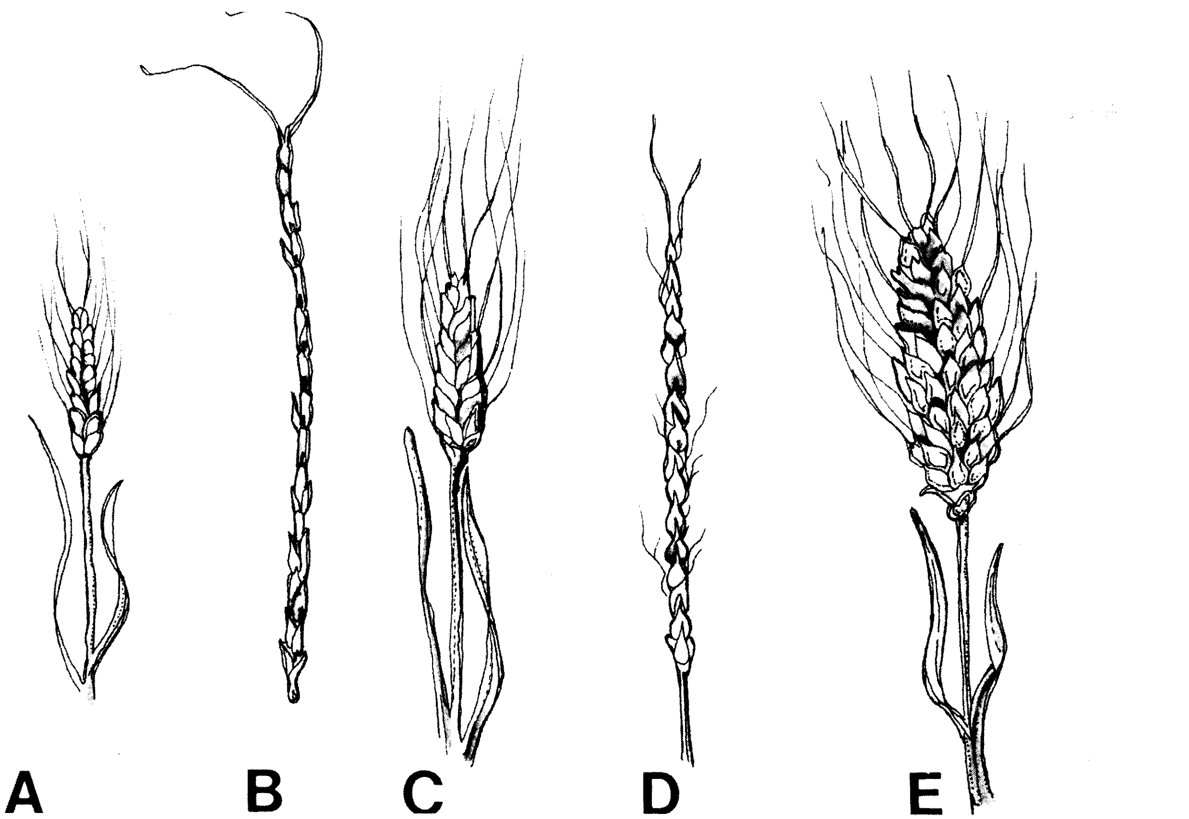

Figure 4. Three types of wheat and two species of *Aegilops* grass. A. A cultivated form of diploid einkorn wheat, 2n = 14. B. *Aegilops speltoides*, a grass. C. Tetraploid macaroni wheat, 2n = 28. At first it was imagined that tetraploid wheats such as this arose by allopolyploid crosses involving the grass *A. speltoides* and one of the diploid wheats. Later, Johnson demonstrated the probability that these tetraploid wheats arose from an alloploid cross between two different types of diploid wheat without the involvement of *Aegilops speltoides*. D. *Aegilops squarrosa*, goat grass. E. Hexaploid bread wheat, 2n = 42. Much evidence supports the belief that tetraploid bread wheats such as this arose from an amphidiploid cross involving the grass *A. squarrosa* and one of the tetraploid wheats. In all of these proposed events, no real "evolution" can be said to have occurred but only some crosses and chromosome doubling that represents the sort of variation possible within the created "kinds." Sketches by John Schilling based on Harlan, Baker, and to some extent on Stansfield.[74]

chromosomes) from the *T. boeoticum* wheat and let *B* represent the other genome, then *T. dicoccoides* (the wild tetraploid wheat) may be symbolized *AABB* (28 chromosomes in all). It has been assumed and widely reported[64,65] that tetraploid wheat arose by a gamete of diploid wheat *(A)* uniting with a gamete from the grass *Ae. speltoides (B)* and then doubling (AB→*AABB)* to produce a cell from which arose the wild type of tetraploid wheat which we now call *T. dicoccoides* and from which were derived cultivated strains of tetraploid wheat such as *T. dicoccum.*

Recently, however, Johnson and coworkers have reported several types of experiments and numerous chromosomal observations that point toward a different ancentry for the B genome of tetraploid wheat. He performed electrophoretic analyses of seed albumin from two diploid wheats *(T. boeoticum* and *T. urartu)* and the wild tetraploid wheat *T. dicoccoides.* He found that the electrophoretic profile of proteins in the tetraploid had a distribution of bands such as would be expected if it had arisen as an allotetraploid of the two diploid wheats, *T. boeticum* and *T. urartu.*[66] Hybridizing the two diploid strains of wheat *(boeoticum* and *urartu),* he induced tetraploidy by means of colchicine.[67] Similar amphidiploid crosses were made using *T. boeoticum* and *Aegilops speltoides.*

The results of the cross between *boeoticum* and *urartu* wheats on the one hand produced an amphidiploid that closely resembled the wild tetraploid wheat *(T. dicoccoides)* while the cross with *Ae. speltoides* did not:

> "The synthetic *boeoticum-urartu* amphidiploid was virtually identical morophologically with the wild tetraploid wheats, whereas various boeoticum-Sitopsis *[Aegilops speltoides]* amphidiploids were markedly different."[68]

According to these data the progenitor of the tetraploid emmer wheats arose by an allopolyploid cross between two diploid wheat strains and did not involve the grass *Aegilops speltoides.*

While both Baker[69] and Johnson have assumed that man's role was only that of bringing the two putative parent wheat types close to each other by cultivation, such an event was more likely the result of deliberate hybridization practiced by early plant breeders since the tetraploid wheats were already present in the earliest Jarmo deposits.[70]

But the story of wheat does not stop here. There is yet another strain which is hexaploid, having 42 chromosomes or exactly six times the basic number 7. There are several hexaploid varieties which may be discussed collectively as *T. aestivum* or *T. vulgare,* the "bread wheats". Besides the A and B genomes already discussed, the hexaploid wheats contain another genome labeled D and their entire chromosome genome complement may be symbolized AABBDD. Johnson[71] confirmed that the donor of this D genome was the grass *Aegilops squarrosa* (not to be confused with *Ae. speltoides* which Johnson ruled out as a contributor of the B genome in the tetraploid). The electrophoretic profiles of albumin proteins produced by a 2:1 mixture of proteins from the cultivated diploid wheat, *T. dicoccum* and the grass *Ae. squarrosa* very closely simulated the pattern produced by electrophoresis of seed albumin from the hexaploid bread wheat, *T. Aestivum.* Evidently after a gamete from the diploid *T. dicoccum* (carrying the A and B genomes) united with one from the grass *Ae. squarrosa* (carrying the D genome), the fertilized egg (ABD) underwent doubling (AABBDD) producing a cell from which grew the hexaploid progenitor of our modern bread wheats (see Figure 4).

It is difficult to perform this cross, although Lammerts has repeated it following the instructions of Johnson. Lammerts is also presently striving to secure perennial or ornamental wheat by crossing *T. orientale* which has lovely black beards with the perennial rye *(Secale cereale).* The F_1 hybrids are vigorous but sterile and thus far chromosome doubling has been unsuccessful.

In 1944 McFadden and Sears succeeded in making the cross to produce the hexaploid bread wheat. It is somewhat presumptious, however, to postulate that such a complicated series of events could occur naturally since all these wheats are obligately and tenaciously self-fertile. It would be difficult to imagine a situation in which a cross between the tetraploid wheat and the grass *Ae. squarrosa* would occur naturally. Instead the wheat *T. dicoccum* would simply fertilize itself unless the flowers were emasculated very early in development. Another factor which points to men's intervention is the understanding that the *cultivated* tetraploid wheat, *T. dicoccum,* and not the *wild* tetraploid *T. dicoccoides,* was the putative parent of the hexaploid. But even if the cross somehow occurred spontaneously, surely man preserved it.

In summary, the derivation of hexaploid wheat illustrates the principle that polyploid crop plants are regularly based on specific preexisting diploid types—einkorn diploid wheats, for example, being still in cultivation! There is no reason to believe that the original diploid wheat strains arose from anything but wheat—which was evidently created as a separate entity. Yet the tetraploid macaroni wheats and the hexaploid bread wheats both show evidence of having been produced by allopolyploid crosses which implicate man's care and intervention. And although these are significant changes we have discussed, they can hardly be classed as "evolution" if by such we mean that a new entity, (able to perpetuate itself in nature) has arisen. Rather, as in the case of corn, we have data that fit quite naturally with the idea that the basic diploid species were created and then later certain modification took place under the selective cultivation of man.

The Origin of Rose Varieties

Only a very few rose varieties trace back as far as 1500 AD, and only *Rosa centifolia* seems to have been known to the Romans before 270 B.C.[72] It was as late as 1810 that the original tea rose with double blush pink flowers was introduced into England from China where it grew without much care. Oddly enough, the oriental people were not much interested in the rose and did very little to improve the species, which was mostly single-flowered and occurred in white, light pink, salmon pink and light yellow colors.

The pale yellow double flowered variety *R.* x *odorata ochroleuca* or Park's Yellow Tea-scented China was introduced into England in 1824. By crossing forms of this particular type between themselves and with *R. chinensis* the modern tea rose was developed. Later this was crossed with other garden roses to give the hybrid teas. None of these varieties, however, had the lovely dark golden yellow to coral to flame colors we now enjoy.

The years 1900-1920 begin the golden era of modern rose breeding. Following the inspiration of a dream, or one might say a vision, Marie Pernet-Ducher pollinated the hybrid perpetual Antoine Ducher with pollen of the Persian Yellow, a variety of *R. foetida persiana*. Though many pollinations failed, finally one hip developed and actually set a few seeds. Even more wonderful, one of the seeds germinated, and the resulting seedling was the startling golden orange to nasturtium red Soleil d'Or. From it, all the deep golden yellow and flame colored roses we now admire so much developed.

The Pernetiana yellow rose line traces from Soleil d'Or to Mme. Melanie Soupert (1906), to Rayon d'Or (1910), to Constance (1915), and finally to Souv de Claudius Pernet, introduced by this distinguished couple in 1920 and named in honor of their son Charles who was killed in World War I. This variety was the culmination of the Pernetiana line as far as the Pernet-Ducher family is concerned. It is a fragrant pure sunflower yellow. Their work however, was continued by F. Guillot who crossed Souv. de Claudius Pernet with an unnamed seedling also of Pernetiana stock, and succeeded in creating the famous Soeur Therese with the long streamlined bud, introduced in 1930. Thus a period of over thirty years of inbreeding had been carried on by the famous French rose breeders.

The red rose ancestry line is even more complex. The main line of development traces from the salmon flesh tinted yellow seedling of Ophelia (1912) crossed to the rosy carmine Mrs. Charles E. Russel (1914) resulting in the greenhouse rose, Premier (1918), a dark velvety rose-red. Then the fragrant glowing crimson Hoosier Beauty crossed with Premier resulted in Sensation (1922), which has a scarlet crimson color. Meanwhile Kordes in Germany had been intercrossing the Pernetiana roses Willowmere and Mme. Caroline Testout and one of the most promising seedlings of this union was in turn hybridized with Sensation, resulting in the lovely light red variety Cathrine Kordes (1930). Kordes then crossed the crimson to maroon red W. E. Chaplin (1929) with Cathrine Kordes, and obtained the justly famous Crimson Glory (1935). By this time the effects of inbreeding the red rose line were becoming obvious; for, though a beautiful deep red of exquisite bud form, Crimson Glory did not grow very vigorously in many gardens, particularly on the west coast. Accordingly it seemed to Lammerts rather important that the best varieties of the yellow and red rose lines be intercrossed in order to restore as much as possible of the original vigor, by the phenomenon of hybrid vigor, which usually occurs when very distinctive lines with a species group are intercrossed. Just as expected, most of the seedlings from these crosses were very vigorous, and one of them, Charlotte Armstrong, combined vigor with a very lovely streamlined spectrum red bud. It resulted from crossing Soeur Therese with Crimson Glory, and quite evidently the lovely bud form of Soeur Therese had been combined with the dark red color of Crimson Glory, to give the spectrum red bud of Charlotte Armstrong, longer even than Soeur Therese.

Many beautiful roses were developed from Charlotte Armstrong, such as the orange to Indian red Sutter's Gold hybridized by Herbert Swim, as well as his pink to apricot Helen Traubel.

Meanwhile in 1944 a most unusual Floribunda rose was introduced by Mathias Tantau. It was a very vigorous hybrid of Baby Chateau x *R. roxburghii* and had large sprays of lovely slightly fragrant cinnabar-red flowers. Because this was such a wide cross Lammerts felt that it should give a much needed boost in vigor to the Charlotte Armstrong line of hybrids. He therefore crossed Charlotte Armstrong with Floradora, the hybrid described above, and grew a rather small population of not more than a hundred plants since he expected that intercrossing would be necessary to recover good bud form and the unusual color of Floradora. Though all the seedlings were quite vigorous, one was unusually so. It had unusually clear pink flowers of a carmine rose color, and bore them singly and in clusters. The foliage was very large and glossy, of a dark green color and abundantly clothed the plant. Quite clearly this was neither a floribunda or hybrid tea in habit of growth. At the All America Rose Selection meeting there was unanimous approval of it as being worthy of an award but much perplexity as to how it could be introduced. Since it was so tall and vigorous in habit, and bore its flowers both singly and in clusters it was decided to create a new class for it, namely the Grandiflora class. Meanwhile Manfred Meyberg had secured permission of the Queen of England to name it in her honor should it receive an award. Accordingly it was introduced as Queen Elizabeth in 1954, as the first of a new class of roses. Since then there have been quite a few grandifloras but not one of them has quite the combination of vigor and bud form, characteristic of it. When in Chile in October and November of 1979 Lammerts was amazed to see plants of it over ten feet high and six feet in diameter, literally covered with flowers. It is also used as a hot-house rose in Chile. This award-winning rose is pictured in Figure 5 and on the cover of this issue.

We have gone into considerable detail as regards the rose breeding activities of various individuals to show that rose breeding is a complicated sort of business. Most certainly new varieties of roses could never arise spontaneously under natural conditions. If by some strange fluke of chance rearrangements of genes from two different species, a vigorous new variety did come into being, it would soon be lost because of poor seed production and germination.* Thus vigorous as Queen Elizabeth is, even this variety would soon disappear were it not kept alive by asexual reproduction, i.e. budding into understock, forcing by the removal of the understock cane, after bud union, and careful growth of the young little plants. Though many very beautiful

*Those plants which did germinate would grow into plants either very weak in growth because of defective gene recombinations, or quite sterile and so incapable of continued reproduction.

Figure 5. Queen Elizabeth Roses. The history of modern rose varieties such as this one illustrates the fact that plant breeding is a complicated business and that useful new varieties do not just arise by chance. But all of this is not "evolution" since only the original species of roses from which these varieties were developed would continue to survive under natural conditions.

rose varieties have been created by various rose hybridizers in the past several hundred years, only the original species roses from which these varieties were developed will continue to survive under natural conditions.

A Brief History of The Strawberry

Beginning on page 3262 of *Bailey's Cyclopedia of Horticulture* is a history of the strawberry from which the following details have been extracted.[73] They have been in garden cultivation for less than 600 years, and in commercial agriculture for less than 200 years. The wood strawberry *(Fragaria vesca)* was first raised in French gardens. The wild strawberry of North America, *F. virginiana*, was brought to Europe early in the 1600's. Neither showed much promise as a cultivated plant. *F. chiloensis*, which was native to the Pacific coast of America, was introduced to Europe from Chile in 1712 by a Frenchman, M. Frazier. Both *virginiana* and *chiloensis* are octaploids having 56 chromosomes. The basic chromosome number in strawberry is 7. Although *chiloensis* produces large berries, it was not popular either because of its low yield and the poor quality of its fruit.

By the mid 1800's, the Pine strawberry (so-called because of its pineapple fragrance) appeared. It became the principal forerunner of our modern garden fruit. The origin of the Pine strawberry is unknown. Some believe that it came as a hybrid of *F. chiloensis* with *virginiana* in gardens of Europe.

Great progress was made by T. A. Knight who grew 400 hybrid seedlings in 1817 and from them selected the varieties Downton and Elton. As G. M. Darrow has indicated in his U.S. Dept. of Agriculture publication The Strawberry, these hybrids were all probably seedlings resulting from the crossing of *F. chiloensis* and *F. virginiana*, and these varieties were used by later strawberry breeders.

But the first of our modern large strawberries was the Keen's Seedling, originated by Michael Keen, of England, in 1819; and it was a Pine. From Keen's Seedling have developed most of the varieties grown in Europe today. Our modern American varieties were developed from the Hovey which is also partly a Pine, having resulted in all probability from backcrosses of the European hybrids to the American wild strawberry —*F. virginiana*.

Since wild strawberries grew abundantly, there was no garden culture of strawberries in America until about 1770. Several European types were introduced but did not gain popularity. Americans preferred the transplanted wild plants called Scarlet *(F. virginiana)*.

Commercial culture in the United States began shortly after 1800 near certain large eastern cities such as Boston, New York, and Philadelphia. The varieties first used were called Large Early Scarlet, Hudson's Bay, Early Hudson, and Crimson Cone—improved types of *F. virginiana*.

Hovey was the first strain to result from handcrossing by the Bostonian C. M. Hovey. It was successful as an amateur variety but not as a commercial strain. Interest grew, and as a result the Wilson (developed by James Wilson of New York in 1851) was the first commercial strawberry in this country. Like some of the others, it was a derivative of Hybrids of *chiloensis* and *virginiana*.

A. F. Etter of Ettersburg, California, worked with *F. chiloensis* and California mountain types of strawberry such as *F. californica* and *F. virginiana* var. *platypetala*. Varieties presently raised in California trace back to strains that he introduced and they also carry factors derived from lines introduced in the eastern United States.

In 1979 R. Bringhurst and his associate V. Roth released three short-day commercial and three neutral-day garden varieties to the trade. These are patented. Their parentage is very complicated as may be seen from the pedigree of the variety Brighton which is shown in Figure 6.

Obviously varieties so highly heterozygous as these will not breed true from seed, and in due course unless cared for under garden conditions and propagated by runners as roses are by budding will revert back to the parental species *F. virginiana* and *F. chiloensis*.

Thus strawberries represent that class of fruits which have been cultivated for just a short time. Evidently they were not part of the repertoire of crops carried by Noah and his descendants in early migrations. The history of the strawberry also shows that long time periods are by no means necessary to account for a great deal of diversity, once plant breeders become interested in developing species which have the genetic potential for improvement.

In the above discussion it should be noted that although simple selection had a part to play in the origin of commercial varieties, by far the most important progress was due to *planned hybridization*. Not only is this true of the strawberry but of such diverse crops as corn, wheat, apples, roses, begonias, and especially the orchids which we study next.

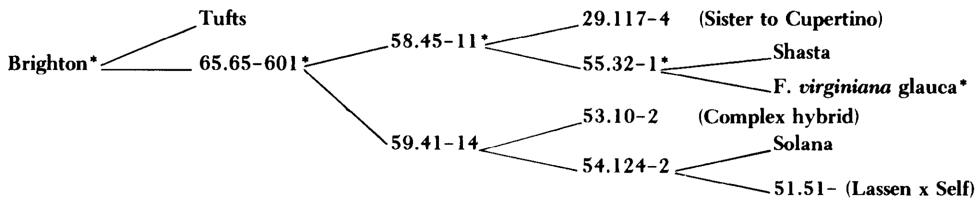

Figure 6. The pedigree of the Brighton strawberry, a day-neutral type introduced recently. The asterisk indicates the presence of the day-neutral trait in each generation.

On the Origin of our Modern Orchids

The orchids as they occur naturally are a vast assemblage of plant species (over 15,000 of them) occurring over all parts of the world except the polar regions and the great deserts. However, about 80% of the species occur in tropical and sub-tropical zones, where they are found mostly in the mountainous areas. As individual plants they are seldom abundant in any place. The most widely distributed species are found in the north temperate and sub-arctic zones, and include such forms as *Calypso bulbosa*, *Microstylis monophyllos*, *Liparis lasselii*, and species of the genus *Orchis*. The tropical Asian and American regions furnish by far the most genera and species, relatively few coming from tropical Africa.

At first the growing of seedlings from the imported types was most indifferently successful. It was found ultimately that special root fungi were necessary for the germination of the seed. Orchid growers now normally place pieces of the roots infected with this mycorrhizal in the sphagnum bed in which seedling are grown.

The first orchid hybrid to be produced in cultivation was *Calanthe dominii*, a cross between two other species. It was raised by a Mr. Dominy in the nursery of James Veitch & Son and flowered in 1856. In 1861 the same grower produced the first bigeneric hybrid, *Goodyera dominii*, a cross between *Haemeria (Goodyera) discolor* and *Dissinia marmorata*. There are now over 5000 interspecific and intergeneric orchid hybrids.

There are at least two facts of great interest here to creationists. One is the very great recency of the knowledge and importation of the many species. Thus in "Species Plantarum" in 1763, Linnaeus described only 36 species under the genes *Epidendrum* which at that time was made to include all epiphytic orchids from the tropics. In 1805, however, in his edition on "Species Plantarum" Willdenow already listed 391 species of orchids including 140 epiphytic ones.

In the nineteenth century, due to the work of many collectors, the number of known tropical species rose rapidly. Attempts to cultivate the tropical orchid did not begin until early in the eighteenth century, and it was not of importance commercially until about the middle of the nineteenth century. By this time the newly imported species were commanding fantastic prices, and this served as a spur greatly to increase the search for tropical orchids.

The other important fact which we as creationists may deduce from this history of the orchids is that once man gets really interested in a certain plant, things happen mighty fast! Who knows then how rapid the development of such plants as the tetraploid wheat, our modern hexaploid wheat, and corn really were?

Data Regarding the Origin of the Apple

According to Bailey, the apple has been cultivated since time immemorial. Charred remains of its fruit have been found in the prehistoric dwellings of Switzerland. As creationists we do not acknowledge the usual glacial time scale and yet it must be conceded that the culture of apples was apparently quite ancient.

The apple comes from *Pyrus malus*, and the crab apples from *Pyrus baccata*. Large-fruited crab apples such as the Transcendent and Hyslop have come as hybrids between the two.

Actually, most of the varieties which we now grow are rather recent discoveries. Thus the Baldwin was found by Samuel Thompson while surveying in Wilmington, Massachusetts, in 1793. The "Primate" apple was introduced by Calvin D. Bingham in 1840 on his farm near Camillus, New York. The famous Northern Spy apple was found in a seedling orchard planted by Heman Chapin about 1800. This orchard was near Bloomfield, New York. The Wealthy was found by Peter Gideon among seedlings grown by him on his ranch near Excelsior, Minnesota in 1864. As early as 1773 Thomas Jefferson recorded in his "Garden Book" the grafting of the Newtown Pippin in Albemarle County, Virginia.

Although the apple may have been grown from time immemorial, the varieties could not have been very outstanding, or it would not have been so relatively easy for farmers to have found so much better ones. More research is needed on the origin of the apple from our young-earth creationist viewpoint.

The apple exemplifies that class of cultivated plants which was grown for many years but improved only in very recent times.

Although we might discuss the history of many other cultivated plants, the stories of these few show that some were cultivated before the flood (wheat, apple, and probably corn). Others like strawberry, rose, orchid, and sunflower seem to have been brought into civilization in recent times. All crop plants manifest the marks of design in two important aspects:

1. The original types each appear to have been *created* and not to have descended from anything unlike themselves.
2. Directed changes after creation from man's activities in cultivating, selecting, and hybridizing

various strains. Thus the entire pattern of origins for cultivated plants fits squarely with a scientific model which includes the creation, the fall, and the flood.

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