The Cultivated Artichoke — *Cynara scolymus* Its Probable Wild Ancestors

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INTRODUCTION

Students of the origin of cultivated plants still know very little about the mode or origin of the cultivated artichoke *Cynara scolymus* L. De Candolle (1886), in his classic book, came to the conclusion that this vegetable was derived from the cardoon, *C. cardunculus* L., a wild and weedy *Cynara* that is widespread in the west Mediterranean countries. But until recently no cytogenetic analysis was attempted in *Cynara*, and virtually no information was available on the genetic affinities between the cultivated crop and the wild species of *Cynara*.

Taxonomically *Cynara* is recognized as a relatively small genus, confined to the Mediterranean region. In addition to the cultivated vegetable, botanists conventionally place in the genus *Cynara* three closely related wild species: *C. cardunculus* L., which is widely distributed in the western and central parts of the Mediterranean Basin, *C. sibthropiana* Boiss. et Heldr., which occurs mainly in the Aegean islands (including Crete and Cyprus), and *C. syriaca* Boiss., distributed in the Levant and south Turkey.

This note aims at a preliminary assessment of interrelationships within *Cynara*. It reports on our examination of the genetic affinities between the cultivated artichoke and *C. syriaca*, and it reviews the available information in the relationships between this crop and yet another wild species, *C. cardunculus*. On the basis of this evidence an attempt is made to identify the wild progenitor (or progenitors) that could have participated in the formation of the cultivated artichoke.

THE RELATIONSHIPS BETWEEN *C. SYRIACA* AND THE CULTIVATED ARTICHOKE

In 1971 we collected a sample of *C. syriaca* in the Valley of Jezreel, Israel, and transplanted it to the experimental farm of the Hebrew University in Jerusalem. We crossed this wild artichoke with a commercial variety "Camus Gros de Bretagne", a cultivar used in Israel. The cultivated line was employed as a mother plant: A head of this highly protrandic vegetable was bagged before anthesis and subsequently brushed with *C. syriaca* pollen. This cross yielded a F_1 hybrid that could be easily identified by its intermediate morphology and by a combination of traits that characterized its strikingly different parents. (*C. syriaca* differs conspicuously from the Camus plants by a whole syndrome of vegetative and floral characters such as the shape and texture of the leaves, spininess, the shape and size of the head and its bracts, and the branching of the corymb).

The *scolymus* × *syriaca* F_1 hybrid was raised in 1971-1972 and manifested pronounced hybrid vigor. In its first growing season it developed a robust rosette and several flowering heads. Significantly this

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hybrid turned out to be completely fertile. Anthers were found to contain normal pollen (more than 95% of well developed and normally stained pollen grains were scored in the F_1 hybrid after staining in 2% aceto carmine). In fact, pollen fertility in the hybrid exceeded that encountered in the seed parent! Back pollination of the hybrid to both parental species confirmed the pollen fertility picture and resulted in production of numerous well developed seed.

The results obtained demonstrate that cultivated *C. scolymus* and *C. syriaca* are interfertile. Admittedly we still need corroborative evidence from one or two more crosses involving other varieties of the two species, as well as checks on chromosome behavior in meiosis. But the observed fertility of the available interspecific F_1 hybrid indicates clearly that *C. scolymus* and *C. syriaca* are genetically very closely related.

There is yet another piece of information that points to the same direction. In field survey of *C. syriaca* in Israel, and in places where this wild plant grows adjacent to artichoke cultivation, we encountered occasional intergrading individuals. These are apparently intermediates and recombinants resulting from sporadic spontaneous hybridization between the wild and domesticated artichokes.

All in all the evidence from the F_1 hybrid, and variation patterns in contact places strongly implicate wild *C. syriaca* in the ancestry of the domesticated vegetable. This fits very well with the Mishna documentation that the artichoke (*Kinras* in Hebrew) was already grown in Palestine during Roman times, and probably even earlier.

THE RELATIONSHIPS BETWEEN *C. CARDUNCULUS* AND THE CULTIVATED ARTICHOKE

Already De Candolle (1886) noted that in the Western Mediterranean Basin intergrading plants interconnect the cultivated artichoke and the wild *C. cardunculus*. Recently Foury (1967, 1969, and personal communication) crossed the cultivated *C. scolymus* with what he called a "wild *Cynara* species" he collected in Spain. From personal communication with Foury we understand that this wild Spanish material agrees closely with the description of *C. cardunculus* and less with that of *C. sibthropiana*. Significantly the F_1 hybrids produced by Foury turned out to be fertile. This cross suggests that also *C. cardunculus* is genetically closely related to the cultivated artichoke.

DISCUSSION

There seems to be an obvious parallelism in the relationships of (*a*) *C. scolymus* and *C. syriaca* (in the East Mediterranean) and (*b*) *C. scolymus* and *C. cardunculus* (in the West Mediterranean). Both the wild Syrian artichoke and the wild cardoon appear to be interfertile with the cultivated vegetable. Both are not fully reproductively isolated from it. This strongly suggests that these three artichokes do not represent three independent species, but rather a variable complex of loosely interconnected wild races, weeds and cultivars. (It is also possible that *C. sibthropiana* shows similar affinities, and when we gain more information on this wild *Cynara* we will have to add it to the complex as well). If this is indeed the case, our conventional concepts on species delimitation in *Cynara* will have to undergo a thorough revision and the main types should be lumped together in a single collective species.

In summation, the available evidence — fragmentary as it is — still merits the following working hypothesis: In *Cynara* (and parallel to numerous other crops) we are confronted with a reticulate, variable complex of wild forms, weedy races and cultivars which occupy the entire Mediterranean Basin. At least two major wild types, conventionally treated as *C. syriaca* and *C. cardunculus* have already been demonstrated to be interfertile with the cultivated vegetable and in contact places apparently exchange genes with *C. scolymus*. At present it is hard to decide in what part of the Mediterranean the artichoke was domesticated. On the available

genetic evidence the domestication of this vegetable could have originated from either major wild race, i.e., either in the east or in the west. But both the Syrian wild artichoke and the wild cardoon seem to have contributed to the genetic variation present in the cultivated crop. Both should be regarded as potential wild genetic resources for future breeding work in the artichoke.

POSTSCRIPT

Since the submission of the manuscript we have repeated Foury's experiments with *C. cardunculus* and crossed a wild Cardoon form obtained from Spain with our cultivated line "Camus". Also in our case the *scolymus* x *cardunculus* F_1 hybrids manifested normal vegetative growth and full pollen and seed fertility.

LITERATURE CITED

De Candolle, A. 1886. Origin of Cultivated Plants (second edition). Hafner Publishing Comp. New York. (pp. 92-95).

Foury, C. 1967. Etude de la biologie floral de l'artichaut (*Cynara scolymus* L.). Application a la sélection (part 1) Ann. Amélior. Plantes **17**: 357-373.

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Book Reviews *(continued from page 198)*

a photograph of one or more herbarium specimens, a distribution map, and a "discussion" are given for each species. A highly workable key to all taxa is included.

The first part of the book—before the "Systematic treatment"—includes text on "Taxonomic relationships," "Classification of *Salix* in Alaska and the Yukon," "Hybridization," "Polyploidy," and "Ecology." Pages 197–270, "Specimen citations," present a computer print-out of label data from the *circa* 5000 herbarium specimens that Argus studied. An indication of the thoroughness of this work is given by the fact that "many long hours" were spent in looking up latitude and longitude for those collections whose labels lacked these data.

This work, authoritative, well done, and well produced, is available from National Museums of Canada, Marketing Services, Ottawa K1AOM8.

J.W.T.

Aristocrats of the Trees. Ernest H. Wilson, Facsimile of the 1930 edition. 279 pp. illus. Dover Publications, New York, 1974. $3.50

This book is an informal paean to trees by a botanist whose interests in trees and searches for new plants took him repeatedly to Asia and other parts of the world. He is remembered as an indefatigable plant collector, a prolific writer, and a skilled photographer. *Aristocrats of the Trees* was published just before his death in 1930.

The author explains that his book is a collection of writings on trees, gathered from scattered "ephemeral print." The chapters first appeared as separate articles and, at first perusal, the contents seem to be a hodgepodge of tree lore. Such is not the case. Wilson's enthusiastic (and sometimes quaint) writing and his vast wealth of tree knowledge somehow are combined to produce a reasonably coherent total entity.

Homage to trees is the theme of the first few chapters. Tribute is paid to the largest, tallest, oldest, noblest, most revered, most picturesque, etc. Repeatedly, he analogizes trees to humans, with comparisons and contrasts accompanied by such statements as "trees are virtuous citizens of the earth, rich in permanent qualities—indispensables."

He includes a long sequence of chapters with bestowed names such as "Patriarchal Ginkgo," "Kingly Oak," "Queenly Elm," "Princely Maple," "Noble Beech," and "Stately Pine." A final group of chapters treats categories of trees on the basis of use or form: dwarf, pendent, upright, etc.

The chapters in this book were written about 5 decades ago, yet certain comments are surprisingly pertinent today. Wilson bemoans the over-encroachment of concrete on trees in towns and cities and cautions against the use of certain trees in urban areas because of air pollu-

Book Reviews *(continued on page 237)*