DEDICATION TO GEORGE F. HOWE

George Franklin Howe was born in Buffalo, New York where his father was a mechanical engineer and his mother was a pianist. His family moved several times during his early childhood and so he attended grammar schools in Akron, Ohio; Ridgewood, New Jersey and Wyoming, Ohio. His study of science began with bird books, birdwatching, and Thornton Burgess animal stories at the age of nine. He and other members of his family received faith in Christ as Savior when he was nine years old.

He graduated from Wyoming High School after which he majored in botany at Wheaton College, receiving the B.S. degree with high honor. He earned the M.S. and Ph.D. degrees in botany at The Ohio State University where he was a Charles F. Kettering Fellow. His thesis research covered several facets of photosynthesis.

For nine years he served as professor of biology at Westmont College in Santa Barbara, California. Since 1968 he has been Chairman of the Department of Natural Sciences at The Master's College (formerly Los Angeles Baptist College) in Newhall, California where he was twice voted "Teacher of the Year." He has participated in several National Science Foundation Institutes covering the topics of radiation biology, desert biology, and botany.

Dr. Howe is a member of the Society of the Sigma Xi (an honorary research organization), the Southern California Academy of Sciences, and the Creation Research Society since it was founded in 1964. In the Creation Research Society he has held several different board offices. He was elected as a Fellow of the Society in 1989. He has published technical papers on the subjects of photosynthesis, chaparral regrowth after fire, fossil pollen, quasihuman ichnofossils, and pollination of the camphor weed. He has authored numerous papers on various aspects of biological origins and he lectures widely on the subject of scientific creationism.

Dr. Howe and his wife, Luella, have four children and four grandchildren. He has one brother who is a retired professor from Dallas Theological Seminary, Dallas, Texas. Dr. Howe is active as a deacon in his local Baptist church. His hobbies include studying the Bible, spending time with his family, doing creation field research, photographing plants, and playing the violin.

Wilbert Rusch, Sr., L.L.D.

EUPHORBIA ANTISYPHILITICA (THE CANDELILLA PLANT) DEMONSTRATES PROVIDENCE, DESIGN AND TYPOLOGY IN CREATION

GEORGE F. HOWE* AND EMMETT L. WILLIAMS**

Received 20 April 1990; Revised 13 August 1990

Abstract

Wax produced by candelilla sterns is useful in many ways. These stems also show a complexity of design that fits with the creation view of origins. By analyzing candelilla and other plants in the genus Euphorbia, it can be seen that the Creator has produced many different stem and leaf patterns within the same type, as evidenced by the unique inflorescence called a cyathium.

Introduction

Euphorbia antisyphilitica is a native of Mexico, the southwestern United States, and Central America—Purseglove (1968, p. 139). Its common name is "candelilla." Its species name was given to it by Zuccarini who originally described the shrub in 1829 after having learned that its milky latex had been used widely in Mexico to fight venereal disease — Hedge and Sineath (1956, p. 136). The Creator may have programmed certain plants to yield biochemicals that assist in treating diverse ailments. The tranquilizer industry, for example, was born when pharmacognocists seriously studied the *Rauwolfia serpentina* plant from which people of India for generations had made a tea that calms the emotions. The possible use of candelilla latex sap as a source of drugs against sexually transmitted diseases deserves a second look.

Of even greater interest in demonstrating God's providences is the fact that the candelilla stems exude a useful wax -- (Hodge and Sineath 1956) and Hodge (1955). Arising in crowded clusters, these slender stems

*George F. Howe, Ph.D. is a botanist. He teaches at The Master's College, P.O. Box 878, Newhall, CA 91321.

**Emmett L. Williams, Ph. D., 5093 Williamsport Dr., Norcross, GA 30092, is editorial assistant, *CRSQ*.

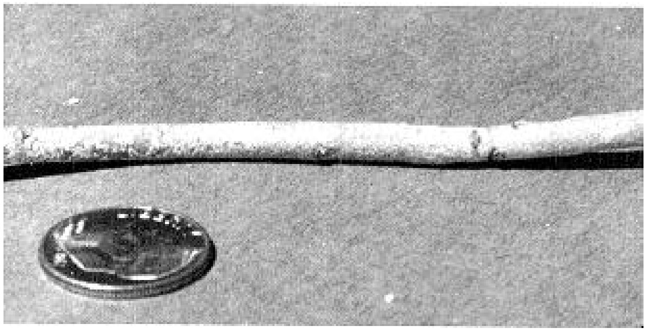

Figure 3. Candelilla stem with U. S. dime for perspective.

are leafless and resemble a little candle as in the common name, "candelilla," see Figures 1 and 2 (Cover photographs A and B). The stems are covered with wax (Figures 3 and 4) which can be removed with a razor blade as seen in Figures 5 and 6.

Candelilla wax is the basis of a migratory industry in Texas and Mexico—Maxwell (1968, pp. 95-99). Donkeys transport the harvested stems to camp where the wax is extracted using portable equipment. The itinerate harvesting of these shrubs had led to the depletion of candelilla; see Hodge (1955, p. 102). The stems are boiled in large water vats to which sulfuric acid is added—Usher (1974, p. 245), Correll and Johnston (1970, p. 965), and Hedge and Sineath (1956). The wax floats to the surface and is skimmed off for further processing and purification. There is about a 3.5% to 5% yield of wax which in 1956 sold for 70 cents per pound—Hodge and Sineath (1956) and Krochmal *et al.* (1954, p. 6). The wax consists of hydrocarbon molecules with chains from 17 to 25 carbon atoms in length, as reported by Balandrin (1984, p. 129).*

Refined candelilla wax finds many uses including the manufacture of waterproof boxes, waterproof fabrics, and sealing wax—Roecklein, (1987, p. 113), Usher (1974, p. 245). When mixed with rubber it is used to make electrical insulators and dental molds. Candles can be made from a mixture of candelilla wax and paraffin. It is also an extender for carnuba wax in producing polishing compounds. Certain factors, including financial constraints, militate against producing candelilla shrubs agriculturally—Hodge and Sineath (1956, p. 154). Yet we believe the possible cultivation of this plant on semi-arid lands warrants further study.

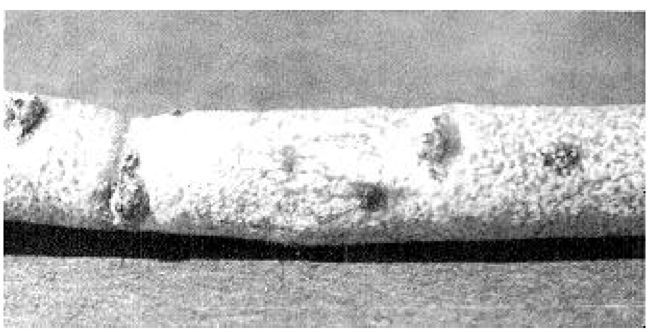

Figure 4. Closeup of the same stem (Figure 3). Note wax flakes on stem surface.

*Recently the authors had the opportunity to visit a candelilla wax extraction facility. See Figures 15-18.

Design

Not only providence but also complexity of design is found when candelilla stems are seen as photographed under the scanning electron microscope.* In Figure 7 a candelilla stem is seen in cross section. It shows that the Creator has endowed these plants with a vascular system that conducts water and dissolved minerals in vessels and tracheids of the xylem. Conduction in plants follows a marvelous design—see Howe (1975a), (1975b), and (1978, p. 17).

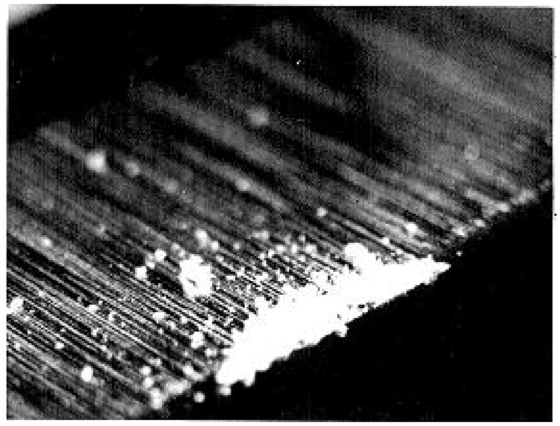

Figure 5. Candelilla wax on a razor's edge.

Figure 8 shows the hairs on the bract below the male flower. Figure 9 is a scanning electron photomicrograph of the stem epidermis after rinsing with acetone to remove most but not all of the adherent wax. Wax is still visible in some areas on the surface of cells. This wax helps conserve internal water during the hot summer days characteristic of the Chihuahua Desert. Plants growing in less stressful environments have been noted to produce smaller amounts of wax.

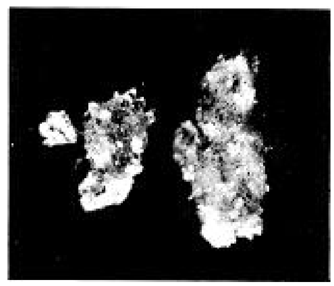

Figure 6. Microphotograph of candelilla wax.

Higher magnification pictures of the epidermis (Figures 10 and 11) reveal the jewel-like character of the many epidermal cells that secrete the wax. Also visible are guard cell pairs located in sunken areas. They open and close stomate pores that allow for rapid diffusion of photosynthetic gases into and out of the stem. Their sunken position serves as another water conserving feature. In a previous paper we commented extensively on guard cells—Howe, Williams and White (1987).

*Note scanning electron photomicrographs are by Williams (Figures 7-11) while the other photographs are by Howe (Figures 1-6, and Figures 12, 15-18).

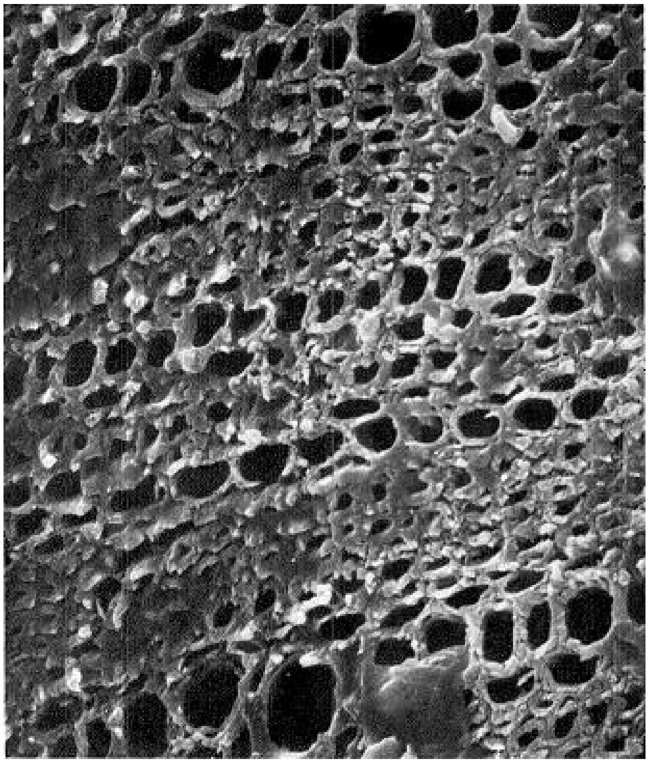

Figure 7. Scanning electron photomicrograph of candelilla stem cross section, approximate magnification 450X. Xylem vessels and tracheids visible.

Guard cells can open stomates in the light and routinely close these same pores in darkness. The guard cell mechanism and the entire epidermis is a tribute to the Designer's skill.

Figure 8. Hairs on bract subtending a male flower -- *Euphorbia antisyphilitica* approximate magnification 140X.

Typology

The study of candelilla plants supports typology which is the recognition that all of the different organisms belonging to the same type manifest specific key attributes of that type. Although representative mammals like the dog, the porpoise, and the bat, for example, differ widely, each fully demonstrates all the characteristics of the mammal type such as hair, three earbones, mammary glands, and relative constancy of body temperature. All of them are fully “mammal” and none of them is half mammal and half of some other type. Michael Denton (1986) has recently noted that typology is strong evidence against macroevolutionist. His book is being increasingly noted in scientific circles. This book presents strong evidence against evolution even though Denton himself is not a creationist.

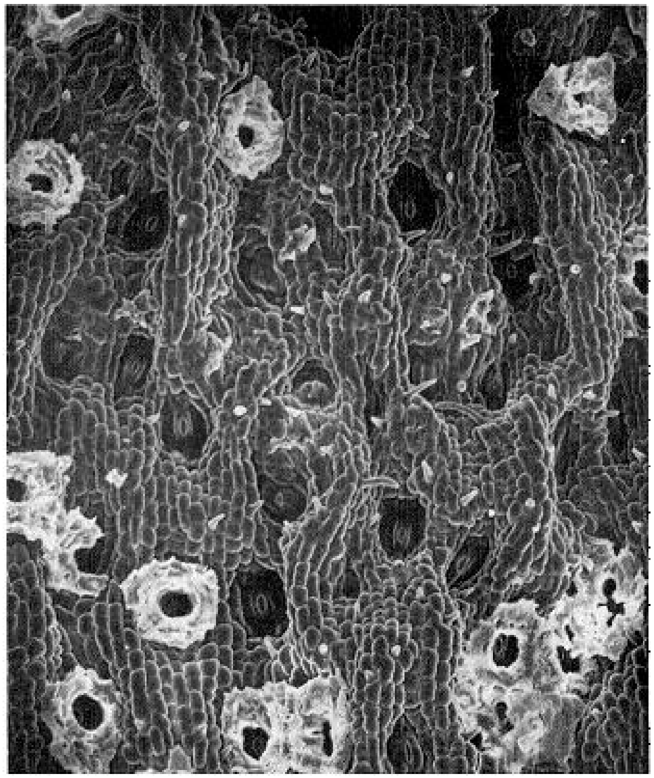

Figure 9. Scanning electron photomicrograph of candelilla epidermis after partial wax removal, approximate magnification 100X. Note circular patches of wax which remain.

Members of the plant genus *Euphorbia* illustrate typology. They differ widely from one another in the form of their leaves and stems but their flowers are uniquely similar. Thus spotted spurge seen in Figure 12, for example, has tiny leaves clustered on vine-like stems that hug the soil while *Euphorbia valida,* a native of South Africa, altogether lacks leaves. It has, instead, a thick, pleated stem which closely mimics the succulent stems of the cacti which are plants of an entirely different family—Figure 13. Like *E. valida,* candelilla stems lack leaves but their thin wax-covered stems are also very different from the cactus-like stems of *E. valida. Euphorbia pulcherrima* (the poinsettia) on the

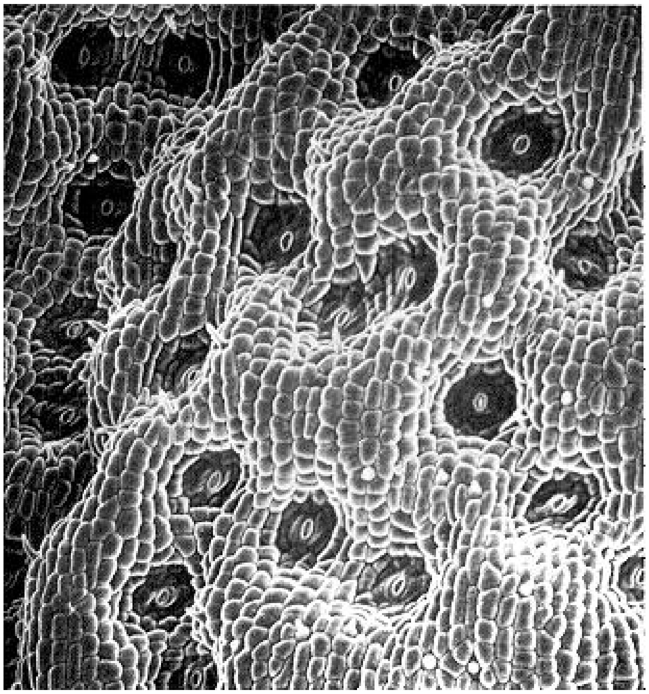

Figure 10. Scanning electron photomicrograph of candelilla epidermis after total removal of wax, approximate magnification 100X. Guard cell paris barely visible in pits.

other hand, has large green leaves borne on the lower portion of its stems and brightly colored red leaves above, near the flowers. Many people wrongly call these red poinsettia leaves "flowers."

In the midst of such great variability of leaves, there are several features which bind these plants together as

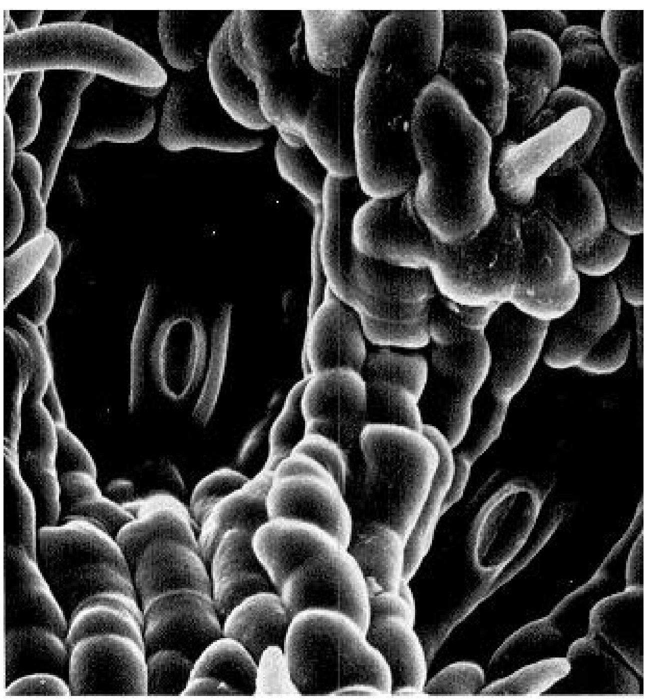

Figure 11. Scanning electron photomicropgraph of candelillla, epidermis -- closer view showing guard cell pairs with stomates closed, approximate magnification 500X.

members of one genus; all members of the *Euphorbia* group have their flowers produced in a distinctive cluster known as a "cyathium." The cyathium inflorescence is a condensed series of flowers that resembles a single flower. It contains a bowl-like involucre that is formed from leaf-like bracts that have fused. Male flowers are hidden from view, attached to the inner lining of the involucre, as seen in the cutaway sketches of Figure 14—Jones and Luchsinger (1979, pp. 278-80), Hickley and King (1981, pp. 242-46), Smith (1977, pp. 161-63), and Bailey (1976, pp. 461, 465).

A single female flower is produced in the center of the cyathium on a pedicel stalk that elongates causing the tripartite ovary to project out from the involucre—see Figure 14. This bizarre flower cluster is found only on plants of the genus *Euphorbia* and nowhere else in the plant kingdom. Every member of the Euphorbia genus, from the lowly spurge to the succulent South African euphorbs, has a cyathium. There is a whole origins position known as cladism and its advocates cling to typology as a fundamental concept. Colin Patterson of the British museum is a cladist who has recently challenged evolutionism.

Figure 12. Leaves and flowers of *Euphorbia paplus,* the spurge. Bottle of correction fluid gives perspective. Note tiny leaves.

A study of candelilla supports the conclusion that the Creator produced plants of widely distinct vegetative form but gave them all the same pattern of inflorescence. The consistency of the cyathium inflorescence structure points toward a creation in which many divergent species were produced separately but each was given the same flower cluster. From the areas of providence, is God, not macroevolution, who deserves design, and typology, itfrontline credit for producing the candelilla and all the *Euphorbia* members.

Acknowledgments

We thank the Research Committee of the Creation Research Society for supplying part of the funding for this research. We thank the donors who have contributed to the C.R.S. Laboratory Fund, interest from which

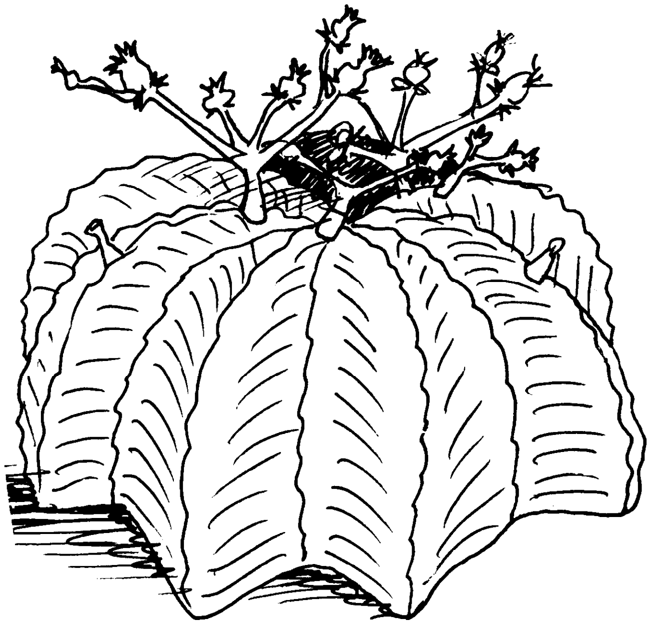

Figure 13. *Euphorbia valida* -- a South African plant lacking leaves and having an inflated stem like a cactus. Sketch by Ross Marshall after Bailey (1976).

is used to perpetuate creation studies. We gratefully acknowledge the help of Ms. Lazella Lawson in securing bibliographic information on this topic, and of Mrs. Phyllis Hughes for preparing the manuscript.

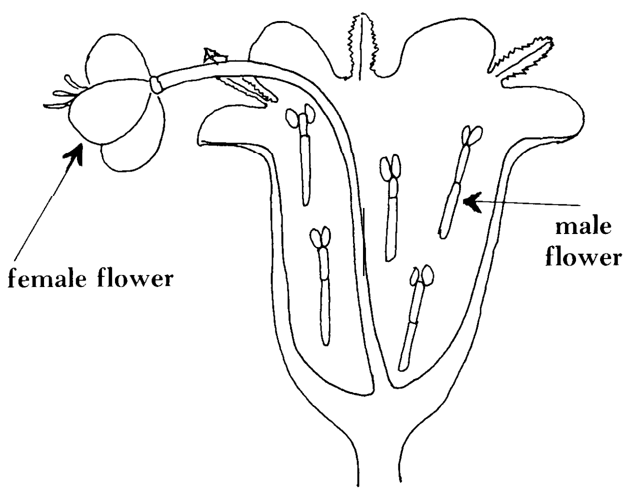

Figure 14. Generalized cyathium inflorescence characteristic of all *Euphorbia* members. Sketch by Howe after several sources.

References

CRSQ—Creation Research Society Quarterly.

Bailey, L. H. 1976. Hortus third: a concise dictionary of plants cultivated in the U.S. Macmillan. New York.

Balandarin, M. F. 1984. Whole-plant nonpolar lipids and hydrocarbons as industrial raw materials. Symposium: Economic Phytochemical Products (Phytochemical Section) 71 (5, part 2):129.

Correll, D. S. and M. C. Johnston. 1970. Manual of the vascular plants of Texas. Texas Research Foundation. Renner, TX.

Denton, M. 1986. Evolution: a theory in crisis. Adler and Adler. Bethesda, MD. pp. 93-118.

Hickley, M. and C. King. 1981. 100 families of flowering plants. Cambridge University Press. Cambridge.

Hedge, W. J. and H. H. Sineath. 1956. The Mexican candelilla plant and its wax. *Economic Botany* 10(2):134-45, 154.

Hedge, W. J. 1955. Some new or noteworthy industrial raw materials of the plant origin. *Economic Botany* 9(2):102-103.

Howe, G. F. 1975. Conducting vessels in plants: problems for evolutionists and creationists. *CRSQ* 12:47-51.

__________ 1975. Plants show internal communication between parts. *CRSQ* 12:70-71.

__________ 1978. Do plant vessels vary with climate? A plumbing problem. *CRSQ* 15:71.

__________ E. L. Williams and R. R. White. 1987. Horsetails *(Equisetum* sp): design or evolution? *CRSQ* 24:141-43.

Jones, S. B., Jr. and A. E. Luchsinger. 1979. Plant systematics. McGraw-Hill. New York.

Krochmal, A., S. Paur and P. Duisberg. 1954. Useful native plants of American southwestern deserts. *Economic Botany* 8(1):6.

Maxwell, R. A. 1968. The Big Bend of the Rio Grande (Guidebook 7). Bureau of Economic Geology. University of Texas. Austin.

Purseglove, J. W. 1968. Tropical crops: dicotyledons (volume 1). John Wiley. New York.

Roecklein, J. C. 1987. A profile of economic plants. Transaction Books. New Brunswick, NJ.

Smith, J. P., Jr. 1977. Vascular plant families. Mad River Press Eureka, CA.

Usher, G. 1974. A dictionary of plants used by man. Constable. London.

Figure 15. Candelilla wax extraction facility. A fire is produced in the pit seen here. Candelilla stems are placed in a boiling sulfuric acid solution above.

Figure 16. Donkeys are used to carry heavy bundles of candelilla stems to form a large pile at the extraction site. This pile contains already processed stems.