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TAXONOMIC STUDY OF THE FOSSIL SPECIES OF THE GENUS *CRYPTANTHA* (BORAGINACEAE)

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ABSTRACT. Distinguishing features of the fossil species of *Cryptantha* from the Pliocene Ogallala Formation are discussed. Comparisons are made to extant species where possible. Distributional ranges of the species are presented.

Great quantities of fossil fruits, particularly of the plant family Boraginaceae, are represented in the Pliocene Ogallala Formation by nutlets of the extinct fossil genus *Biorbia* and the extant genus *Cryptantha*. The genus *Biorbia* has recently been studied (Segal, 1965); but except for a brief nomenclatural clarification (Segal, 1964) the fossil members of the genus *Cryptantha* have not been taxonomically treated since their original description (Elias, 1932). As Elias (1946) says, specific identification of *Cryptantha* fruits is possible. If other parts were involved they would be merely assigned to organ-genera (such as *Borraginites*) of problematic affinities.

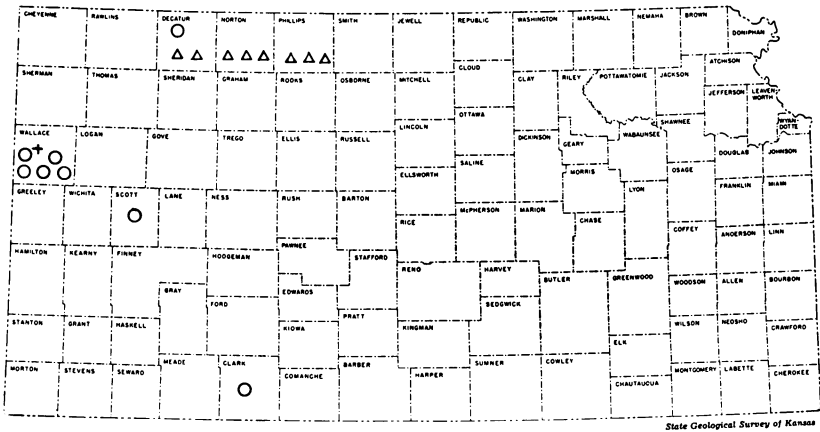


Fig. 1. Known localities of fossil fruits of *Cryptantha* in Kansas. *C. coroniformis* is found additionally in Yuma County, Colorado, immediately adjacent to Cheyenne County, Kansas. Plus sign, *C. chaney*; triangle, *C. coroniformis*; circle, *C. auriculata*. The number of times a symbol is repeated indicates the number of sites in a county.

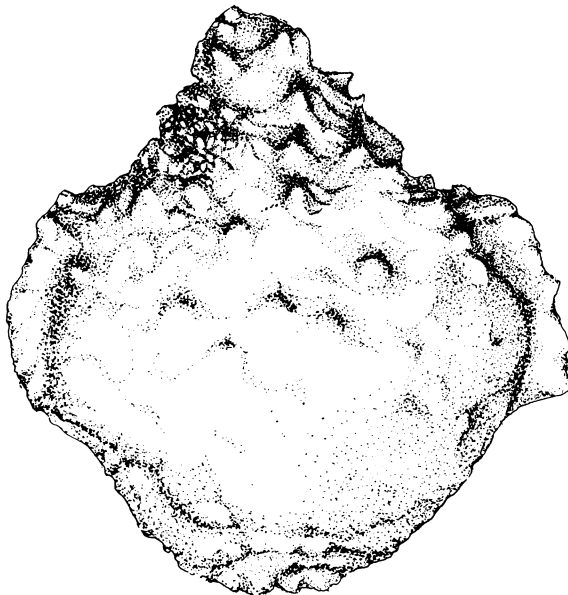


Fig. 2. Drawing of *Cryptantha chaneyi*.

Each of the three fossil species discussed in this paper has unique features. No difficulties are encountered in identifying and distinguishing them. It is interesting to note that although extensive field work has been done in other areas by various workers (in addition to publications cited elsewhere: Elias, 1942; Frye and Leonard, 1957; Leonard, 1958), fossil species of *Cryptantha* are known only from Kansas, and one immediately adjacent site in Yuma County, Colorado (fig. 1). The genus *Biorbia*, on the other hand, is known to occur from South Dakota to Texas in abundant quantities.

Key to the fossil species of *Cryptantha*

- A. Nutlet margin winged B
- Margins without wings C. *coroniformis*
- B. Nutlet width 1.4–1.6 mm C. *auriculata*
- Nutlet width 2.4–2.6 mm C. *chaneyi*

1. *Cryptantha chaneyi* (Elias) Segal, Trans. Kans. Acad. Sci. 67: 203, 1964. *Krynitzkia (Oreocarya) chaneyi* Elias, Kans. Acad. Sci. 67: Bull. 20: 357–358, pl. 30, figs. 4a, 4b, 4c, 4d, 1932. Geol. Soc. Amer., Spec. Paper 41, 160, pl. 7, fig. 7, 1942. Type locality: south side of Goose Creek, Wallace County, Kansas.—Only nutlets known; hollow, greatly inflated, triangular-ovoid, acute at apex; triangular areola at base of scar of attachment on ventral surface; areola narrowing into

a groove which does not quite reach the apex; ventral side smooth and without tubercles; rounded dorsal side heavily tuberculate; margins winged, short and dentate, restricted to the flanks; length and width each about 2.5 mm. *Collection locality*: Kansas: NE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 31, T. 12 S., R. 42 W., *Segal 116*, July 11, 1964 (KANU).

C. chaneyi is not like any living member of the Boraginaceae. *C. holoptera* (Gray) Macbr., known only from the deserts of California and Arizona, has characteristics that invite comparison to *C. chaneyi*. The dorsal side of these triangular-ovate nutlets are tuberculate, but the wings are continuous around the entire margin rather than being restricted to the flanks (fig. 2).

C. chaneyi is the most elusive fossil member of this genus. Frye et al. (1956) were unable to locate *C. chaneyi* in their extensive field work done in conjunction with their stratigraphic studies of the Ogallala Formation of northern Kansas. I found one pocket containing several hundred fragmentary specimens and 20 complete nutlets at, or at least near, the type locality in Wallace County.

2. *Cryptantha coroniformis* (Elias) Segal, Trans. Kans. Acad. Sci. 67: 203, 1964. *Krynitzkia (Cryptantha) coroniformis* Elias, Kans. Univ. Sci. Bull. 20: 356-7; pl. 30, figs. 1a, 1b, 1c, 1d, 1932. Geol. Soc. Amer., Spec. Paper 41, 160, pl. 7, fig. 5, 1942. Type locality: Black Wolf Creek, near Beecher Island, Yuma County, Colorado.—Only nutlets known: hollow and erect, with acute apex; scar of attachment deltoid at base; short and distinct projection protruding out of scar below base; areola gradually narrowing into a groove which is closed at apex; dorsal side rounded; appearance from basal view coroniform. Nutlets heteromorphous, being either densely tuberculate on dorsal and lateral surfaces or perfectly smooth; both forms 2.0 mm long and 1.5 mm wide (fig. 3).

Collection localities: COLORADO: Black Wolf Creek, near Beecher Island, Yuma Co., *Elias*, 1932. KANSAS: NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 34, T. 1 S., R. 27 W., Decatur Co., *Frye, Leonard, & Swineford*, 1956. Sec. 2, T. 1 S., R. 29 W., Decatur Co., *McGregor 17421*, July 29, 1962 (KANU); *Segal 93*, Sept. 5, 1963 (KANU). W $\frac{1}{2}$ Sec. 16, T. 2 S., R. 21 W., Norton Co., *Segal 91*, Sept. 4, 1963 (KANU); *Frye, Leonard, & Swineford*, 1956. Center W. line Sec. 29, T. 2 S., R. 22 W., Norton Co., *Frye, Leonard, & Swineford*, 1956. W $\frac{1}{2}$ Sec. 30, T. 5 S., R. 22 W., Norton Co., *Frye, Leonard, & Swineford*, 1956. NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 30, T. 1 S., R. 19 W., Phillips Co., *Frye, Leonard, & Swineford*, 1956. SW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 31, T. 1 S., R. 19 W., Phillips Co., *Frye, Leonard, & Swineford*, 1956. SE corner Sec. 36, T. 1 S., R. 20 W., Phillips Co., *Elias* (KANU).

Heteromorphous nutlets occur in many living species of the genus *Cryptantha*. The fruit of *C. crassispala* (T. & G.) Greene consists of

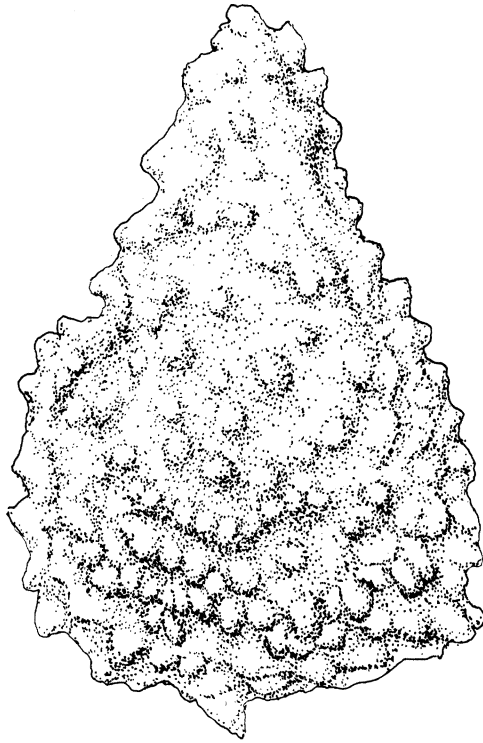


Fig. 3. Drawing of *Cryptantha coroniformis*.

three tuberculate and one smooth nutlet, the ratio consistently being 3:1; in other species with heteromorphous nutlets this ratio may vary since one or more of the nutlets may abort before maturity. In *C. maritima* Greene only one or two of the heteromorphous nutlets matures; frequently only one nutlet will mature, it being smooth (Abrams, 1951). *C. texana* (A. DC.) Greene and *C. decipiens* (Jones) Heller are examples of species in which only one nutlet normally matures, and in these instances it is the granulate or tuberculate form (Johnston, 1925).

The above information is cited because the heteromorphous nutlets of *C. coroniformis* are not found in a constant ratio throughout their range. We have found both tuberculate and smooth forms (160 tuberculate to 80 smooth) at our collection site in Norton County, Kansas, while in nearby Decatur and Phillips Counties, only tuberculate specimens were found.

It is obvious that the smooth forms could not have been produced by mechanical abrasion of the tuberculate nutlets. There are no ambiguous intermediate forms, and furthermore, all of the delicate details of

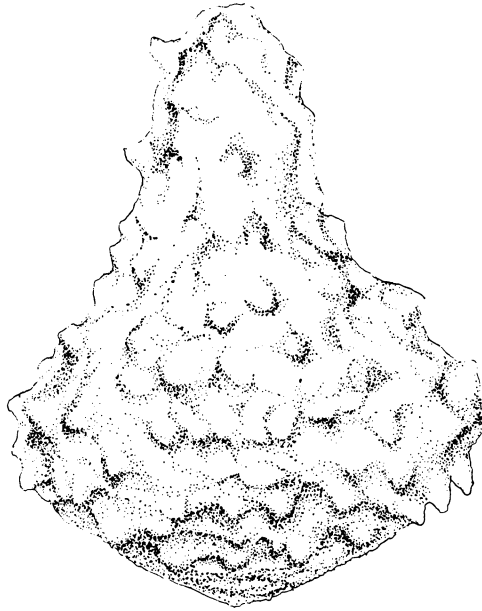


Fig. 4. Drawing of *Cryptantha auriculata*.

the scar of attachment and median groove are equally well-preserved in both forms.

There are notable similarities between *C. coroniformis* and two closely related plants of the Great Plains, namely, *C. crassisejala* and *C. minima* Rydb. In both of these extant species, three nutlets are tuberculate and one is finely granulate (and also considerably larger, unlike the extinct form). On the whole, the resemblance between these fruits is striking and it is likely that there are close phylogenetic affinities between them.

In contrast to *C. auriculata*, *C. coroniformis* is not widespread but is found only in a tier of counties (Decatur, Norton, and Phillips) across northern Kansas; it also barely extends into eastern Colorado (Yuma County), where it occurs at a latitude corresponding to that in Kansas.

3. *Cryptantha auriculata* (Elias) Segal, Trans. Kans. Acad. Sci. 67: 203, 1964. *Krynitzkia auriculata*, Elias, Kans. Univ. Sci. Bull. 20: 358, pl. 30, figs. 5a, 5b, 5c, 5d, 1932. Geol. Soc. Amer., Spec. Pap. 41, 160, pl. 7, fig. 6, 1942. Type locality: Sec. 4, T. 12 S., R. 42 W., Wallace Co., Kansas.—Only nutlets known: hollow, inflated, triangular, acute at apex; scar of attachment deltoid at base, narrowing into a groove which extends to apex of nutlet; dorsal surface covered with tubercles;

ventral side without tubercles; each flank with a small but distinct wing; about 2.4 mm long, 1.5 mm wide.

Collection localities: KANSAS: Clark Co. State Park, Clark Co., *Segal 87*, June 13, 1963 (KANU). SW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 24, T. 3 S., R. 30 W., Decatur Co., *Frye, Leonard, & Swineford*, 1956. SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 2, T. 16 S., R. 33 W., Scott Co., *McGregor 17229*, June 25, 1962 (KANU). Sec. 4, T. 12 S., R. 42 W., Wallace Co., *Elias*, 1932. NE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 3, T. 12 S., R. 42 W., Wallace Co., *Frye, Leonard, & Swineford*, 1956. NE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 31, T. 12 S., R. 42 W., Wallace Co., *Segal 116*, July 11, 1964 (KANU). SE $\frac{1}{4}$ Sec. 11, T. 13 S., R. 42 W., Wallace Co., *McGregor 17401*, July 28, 1962 (KANU); *Frye, Leonard, & Swineford*, 1956. NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 17, T. 14 S., R. 39 W., Wallace Co., *Segal 101*, Sept. 6, 1963 (KANU).

I have not been able to find any extant species with nutlets very similar to *C. auriculata*. Many species of *Cryptantha* are comparable in shape and sculpture but do not exhibit the unusual flange-like wing on the flanks of the fossil nutlet (fig. 4).

The Scott County and Clark County, Kansas, sites represent new stratigraphical records and extend the range of *Cryptantha auriculata* southward.

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