Proceedings of the Iowa Academy of Science

Volume 8 | Annual Issue Article 31

1900

Notes on the Early Development of Astragalus caryocarpus

F. W. Faurot

In regard to the first, the law usually permits the sale of mixtures or compounds, provided they are labeled "mixture" or "compound," but the end of the law is defeated in some instances. For example, such goods as compound pancake flour, compound syrups, etc., are perfectly legitimate articles of food. But when it comes to compounding spices, it is evidently a different matter. The consumer may know, in a sense, what he is getting, but a label that confesses the crime, is evading the law in a bold manner.

In regard to guilty knowledge on the part of the vendor of adulterated foods it is difficult to convict. It will be claimed in his behalf that intent is the essence of crime. But if a saloon-keeper unintentionally sells to a minor, still he offends, and may be prosecuted successfully for his offense.

It will work no hardship in the long run to hold the grocer responsible for the purity of his goods. It is successfully done both in Michigan and Wisconsin. The grocer takes pains to buy his goods from a reliable house under written guarantee, then if he is prosecuted he can fall back on the wholesaler, likewise the wholesaler can fall back on the manufacturer.

NOTES ON THE EARLY DEVELOPMENT OF ASTRAGALUS CARYOCARPUS.

F. W. FAUROT.

While a student at the University of Nebraska the writer became interested in plant embryology, a subject which has attracted much attention during the past few years, especially since the remarkable work of Strasburger[1], Guignard[2], and other European botanists. Many American botanists, however, have since done much work along embryological and cytological lines, viz.: Chamberlain, Webber, Schaffner, Harper, Coulter, and others. Most of the work that has been done is of a purely technical and botanical character, excepting that done in the

PLATE IX.

Fig. 1. Young flower in which the pistil is not completely formed.

Fig. 2 Very young pistil showing budding of nucellus, *n*

Fig. 3. Young ovule with an archisporial cell (*a*), and showing origin of the integuments (*b*), dermatogen of nucellus *d*.

Figs. 4-5. There are two archisporial cells, *a*.

Fig. 6. Four archisporial cells, *a*; shows also decreased amount of nucellar tissue, *nt*, and integuments, *b*.

PLATE X.

Fig. 7. The lower archisporium (*a*) developing into macrospore at the expense of the other three cells, a_1.

Fig. 8. The macrospore (*a*) has attained nearly its full size, and only rudiments of the other three cells are present, a_1.

Fig. 9. A two-celled embryo sac, *a*.

Fig. 10. A four-celled embryo sac (*a*), the tip of which is now in close relationship to dermatogen, *d*.

Fig 11. An eight celled embryospsac (*a*), but only two cells of egg apparatus (*e*) are shown. Three antipodal cells (*at*), polar nuclei which have not yet united, *pn*.

Fig. 12. The same as 11, but a little later stage, polar nuclei *pn*, in process of fusion.

Fig. 13. Mature embryo sac ready for fertilization. Egg apparatus *e*, definutive nucleus *dn*, antipodals *at*.

Fig. 14. Egg cell undergoing process of fertilization. Egg nucleus *en*, pollen nucleus *pn*, pollen tube *pt*.

Fig. 15. Fertilized egg *e*; endorsperm nucleus *end*.

Fig. 16. Egg cell *e*, endosperm, *end*.

PLATE XI.

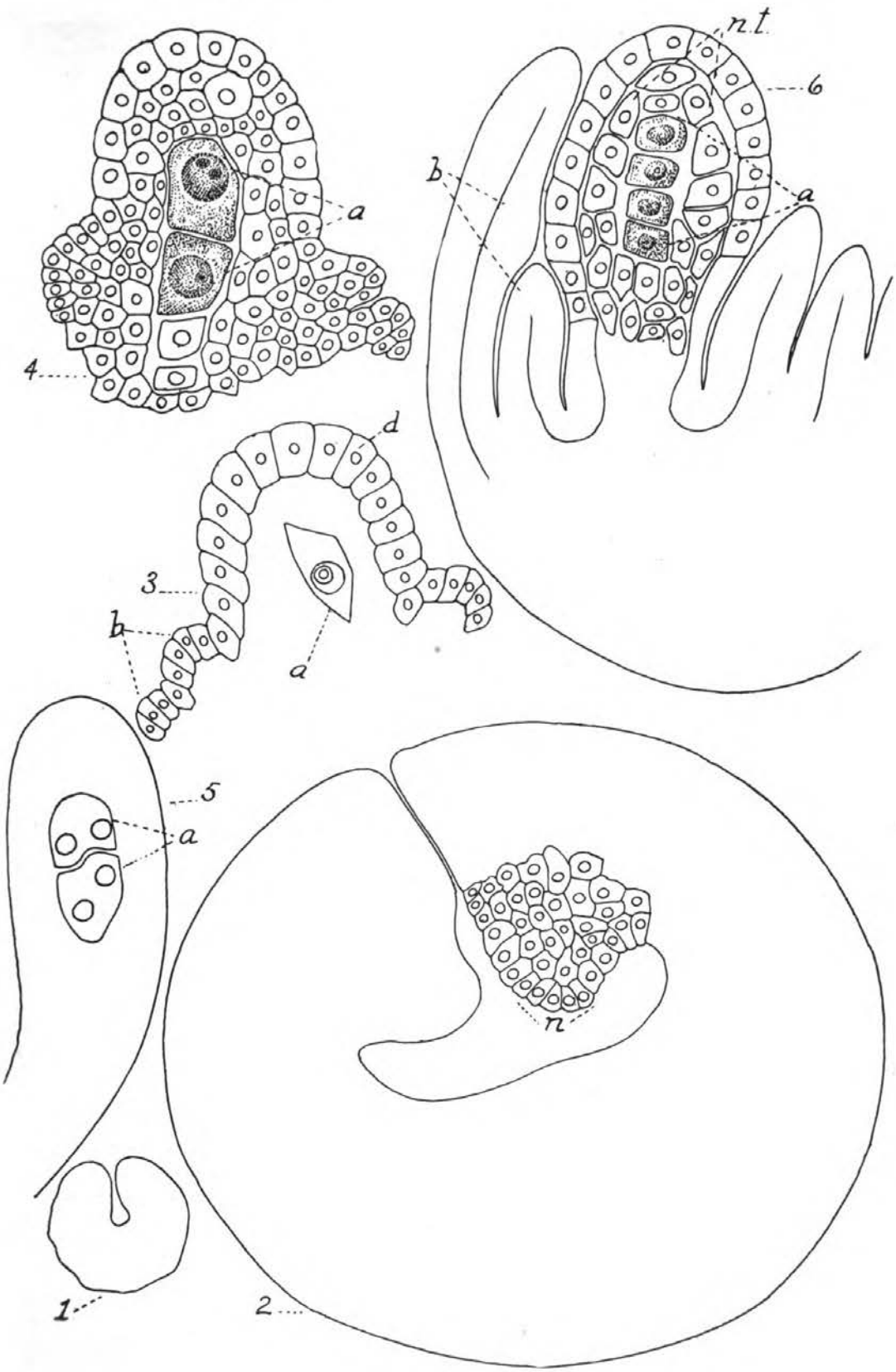
Fig. 17. Suspensor *s*, embryo *em*, endosperm, *end*.

Fig. 17½. Suspensor *s*, embryo *em*.

Fig. 18. Same os 17½, slightly older.

Fig. 19. Embryo and endosperm *a*, embryo enlarged. *b*.

Fig. 20. Nucellus, *auc;* integments, *it*, Micropyle, *m;* Embryosac, *em;* funiculus, *f*.


n.t.
6
b
a
4
d
3
b
a
5
a
n
1
2

U. S. Department of Agriculture, where it has been carried on especially with reference to fertilization and its results[3]. Botanists have usually selected such material as could be most easily worked up, *e. g.*, such plants as many of the Ranunculaceæ and Liliaceæ, plants which have large pistils and large cells, and are easily oriented in paraffine. The Leguminous plants have not been so generally worked with, because they are ordinarily more difficult to handle.

The material used in the preparation of this paper was in all cases collected in close proximity to the laboratory and carried there before killing. Various killing mixtures were employed, viz.: Aqueous solution of corrosive sublimate. Distilled water, 100 parts, by weight. Sodium chloride, 6 parts. Acetic acid, 6 parts. Mercuric chloride, 3 parts. One-third per cent. aqueous solution of platinic chloride. Flemming's weaker solution:

Chromic acid, one per cent , 25 vols.
Osmic acid, one per cent., 10 vols.
Acetic acid, one per cent., 10 vols.
Distilled water, 55 vols.

Hermann's solution:

Platinic chloride, one per cent., 15 vols.
Glacial acetic acid, two per cent , 15 vols.
Osmic acid, two per cent., 2 vols.

After killing, the material was hardened in alcohol and stored in 80 per cent. alcohol. It was imbedded in paraffine and sectioned, 6–10 u, generally 6 u.

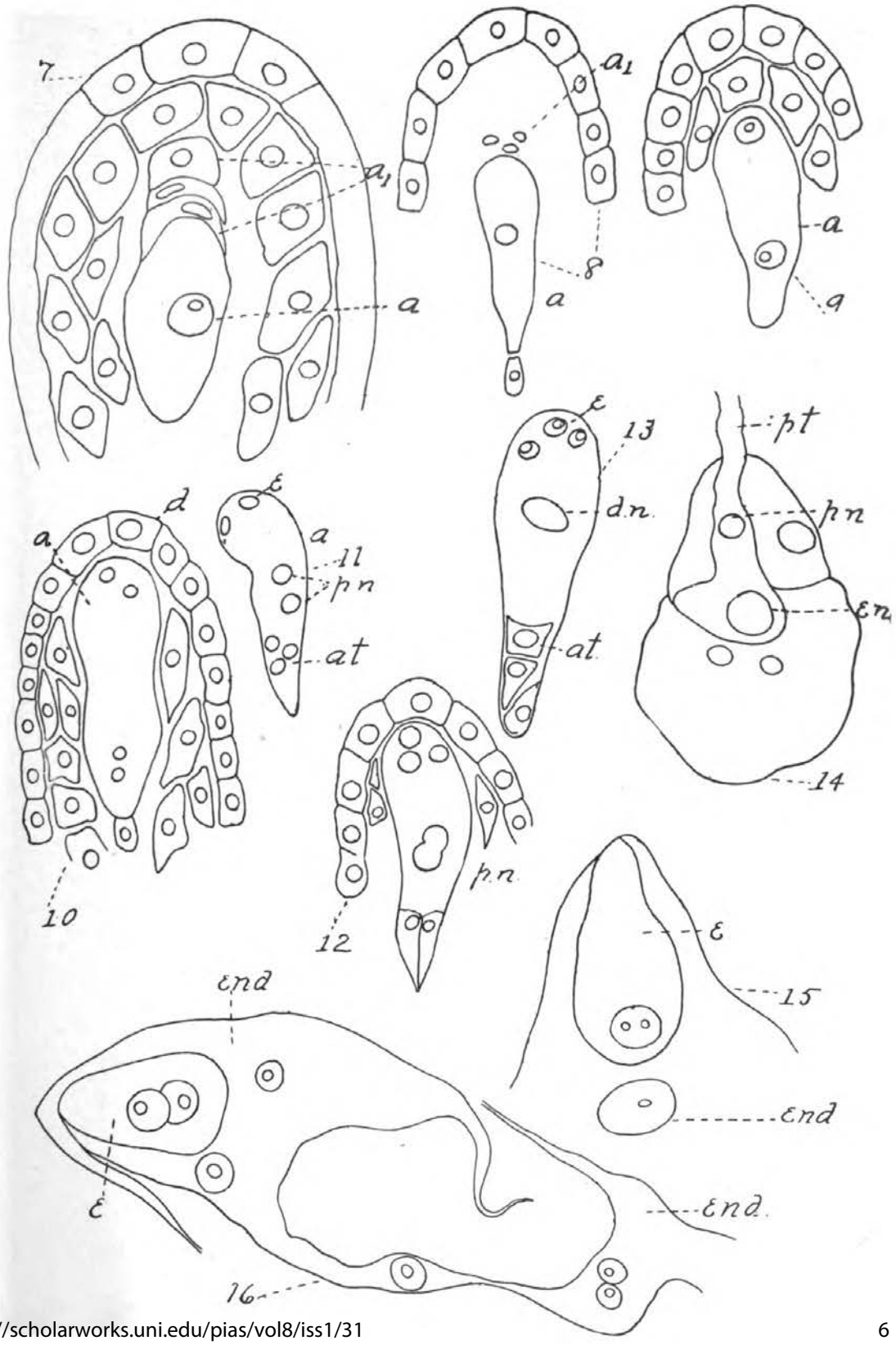
The best results were obtained from material killed in Flemming's. Good results were also obtained after platinic chloride. Hermann's, although one of the best killing reagents did not yield good results because the material was not decolorized, thus rendering staining very difficult. In imbedding, much difficulty was experienced in orienting the specimens. In very young pistils no trouble of this kind is met, but as they become older and the ovules are developing rapidly, they crowd each other out of position and drop in the cavity of the pistil, and the way they

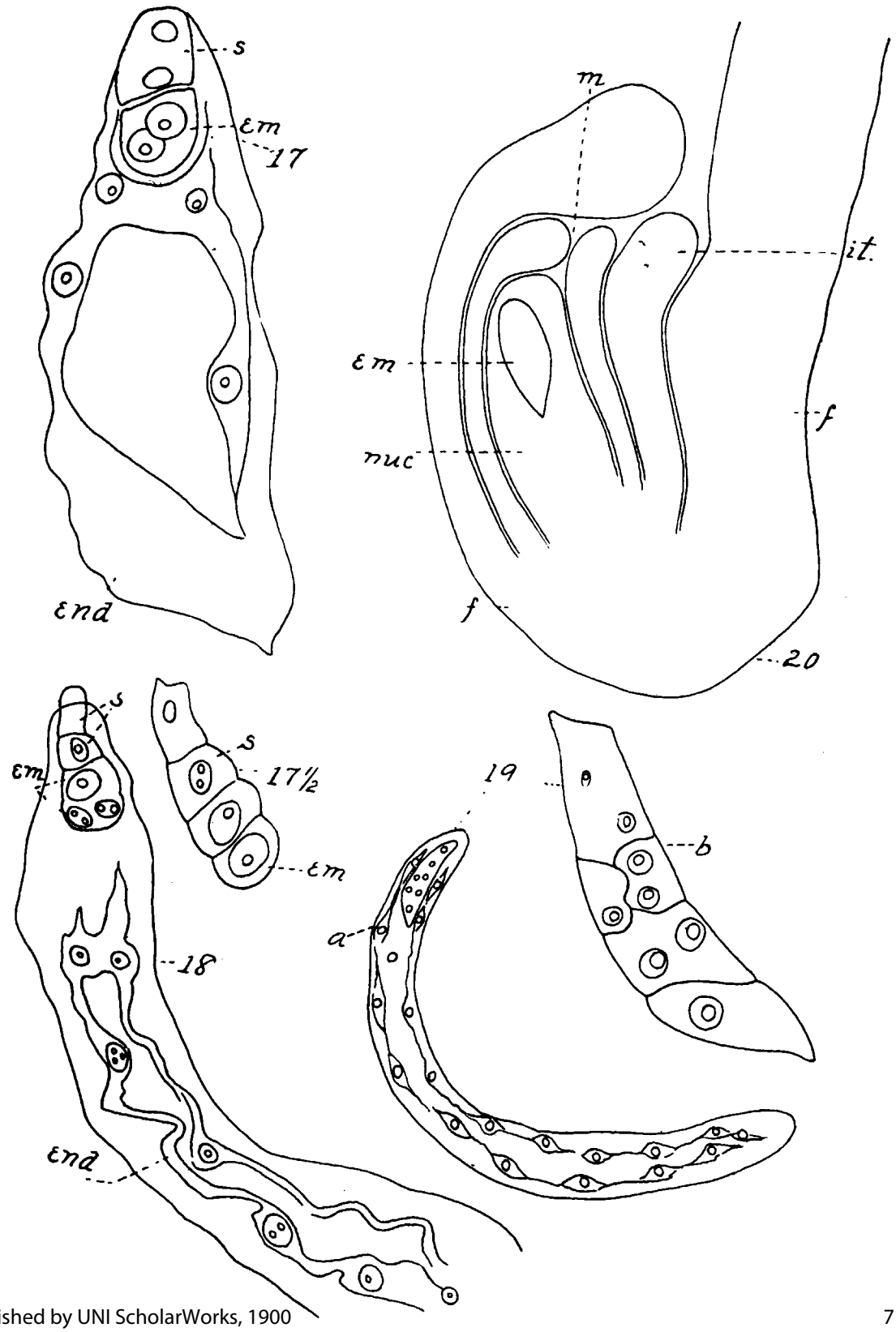
droop probably depends on the way the flower hangs. This trouble begins about the time of formation of macrospores, and especially about the time of fertilization. In staining no attempt was made to obtain nuclear results in the way of karyokinetic figures, because of the extreme smallness of the cells. Only the most common stains were used, either Delafield's hæmatoxylon or a combination stain of eosin and hæmatoxylon. In all, about 500 flowers were sectioned, but only a few of this number were of any value, because so many were cut obliquely.

As soon as the leaf which forms the pistil has folded together, there is a proliferation of cells on either side of the suture formed by the fusion of the two edges of the leaf. As a result of the increased number of cells in this region, the nucellus is produced (Fig. 2) and soon becomes a prominent protrusion into the cavity of the pistil.

In the apical region of the nucellus one of the hypodermal cells undergoes marked differentiation. It increases greatly in size, becomes granular, and has a large nucleus. At about the time of the formation of the archisporial cell, the integuments are first making their appearance, the inner one appearing slightly before the outer one (Fig. 3).

The archisporial cell divides into two, and each of the resulting cells divides again, instead of two or three cells being cut off the tapetal end of the first cell formed, as is frequently the case. The presence of two nuclei in each archisporium (Fig. 5) in the two-celled stage, and the position of the cells in the four-celled stage (Fig. 6) indicates that each of the first two cells formed divides again. It is the lower cell of the row of four which develops into a macrospore at the expense of the other three (Fig. 7). After the first division of the nucleus of the embryo sac, and about the time or just before the fusion of the two nuclei which form the definetive nucleus, cell walls are formed around the antipodal cells (Fig. 12). The form of the antipodals is generally triangular. Concerning the position of the egg apparatus, it may be at one side of both synergids or below them Figs. 12, 13). The mature


7
a1
a
a1
8
a
a
9
ε
13
d.n.
at
pt
pn
εn
14
d
a
a
11
pn
at
10
12
pn
ε
15
end
ε
end
end
16


s
em
17
end
m
it.
em
nuc
f
f
20
s
s
em
17½
em
18
end
19
a
b

embryo sac, ready for fertilization, measures approximately 52 u in length and 22 u in width, and occupies much less than one-third of the length of the nucellus in the one to the four-celled archisporial stage. There are generally about two layers of cells of nucellar tissue between the archisporium and the dermatogen of the nucellus (Fig. 3–6). From the four-celled archisporium to the two-celled embryo sac there is generally one layer of cells between the macrospore and the dermatogen, and by the time the embryo sac has reached the four-celled stage, the tapetal end of it is in close connection with the dermatogen, there being no tissue between the two.

At about the time the pollen tube enters the egg cell one of the synergids disappears. The other one remains apparently unchanged until the process of fertilization is completed, after which it is no longer present. The fusion of the generative pollen nucleus with the egg cell and the fusion vegetative nucles with the endosperm nucleus seem to occur at about the same time. The fertilized egg cell, before any division takes place, measures about 33 u long by 14½ u wide. The endesperm nucleus divides once before the first division of the egg nucleus takes place; the first division of the endosperm being in the direction of the long axis of the embryo sac. The second division is at right angles to the first, and it occurs at or just before the time that the egg nucleus divides the first time. The third division occurs in the lower two cells, resulting from the second division, and also occurs in the same direction as the second (Figs. 15, 16). The upper cells resulting from the first division do not divide until two or three divisions have taken place in the lower cells. But by the time the embryo has reached the four-celled stage the endosperm has extended well up along the side of the embryo (Fig. 17).

The first division of the egg cell is at right angles to the long axis of the cell, and it is the lower one of these cells that gives rise to the embryo. The upper one forms the suspensor. The embryo cell now divides once transversely, *i. e.*, in same direction of first division of egg cell.

The lower one of the two embryo cells now divides longitudinally. Just how further divisions of the embryo occur, it has not been possible yet to determine, because the sections were cut in an oblique plain.

The oldest embryo sectioned is shown in Fig. 19.

WORKS CONSULTED.

1. Strasburger, E.. Die Angiospermen und die Gymnospermen. 1879.
2. ————. Zellbildung und Zelltheilung. 1880.
3. Guignard, M. L. D'Embryogenie Vegetale Comparee. 1st Memoire. Legumineuses. Ann. Sci. Nat. Bot., VI, 14: 5–166. 1881.
————. Sur Le Sac Embryonaire Des Phanerogames Angiospermes. Ann. Sci. Nat. Bot. VI, 13: 136. 1882.
3. Webber, H. J.. Pollen Tube of Zamia. Bot. Gaz., 23: 453–459, also 24: 16–22, 225–235. 1897.
————. Xenia, or the immediate effect of pollen in Maize. Bull. U. S. Dept. of Agrl., Div. of Veg. Path. and Phys. 22. 1900.
4. Vines, S. H.. Student's Text Book of Botany: 431–462. 1896.
5. Strasburger, Noll, Schenck, and Schimper.. Lehrbuch der Botanik fur Hochschulen, 389–393. 1894.

THE THISTLES OF IOWA, WITH NOTES ON A FEW OTHER SPECIES.

BY L. H. PAMMEL.

I have for some years been interested in a study of our thistles. During my study in St. Louis I had occasion to examine the rich collections of the Gray Herbarium, Harvard University, as well as that of the Engelmann Herbarium and the Missouri Botanical Garden, besides a considerable collection in the Parry and I. S. C. Herbaria. I should not attempt the publication of only a partial paper