appreciably larger than melanogaster are found only in Drosophila; the "costal index" (length of second section of costa divided by length of third section) averages lower in Sophophora (range from 1.2 to 3.1) than in Drosophila (2.8 to 4.3, with *D. guttifera* at 2.0); the "sterno-index" (length of anterior sternopleural bristle divided by length of posterior—Kikkawa and Peng 1938) averages lower in Sophophora (0.3 to 0.6) than in Drosophila (0.5 to 0.9, with *D. busckii* at 0.3 and *D. guttifera* at 0.4).

The present account is not to be considered as a final one. Several of the characters used are unsatisfactory, and others are not yet measured accurately. It is hoped that, with improved classification of these and with the utilization of more characters, the method may be extended to indicate still finer subdivisions of the genus. It is also probable that additional species will be studied, and these may require some modifications of the scheme here outlined—though partial analysis of several aberrant types has, so far, suggested that such modifications will consist chiefly in the addition of new subgenera, rather than in the rearrangement of the species here considered.

[1] This is the species known to all geneticists under this name (synonym, *D. ampelophila* Loew). Some authors now use the name *D. fasciata* Meigen. There is some reason for this substitution; but I am not convinced that the argument for it is conclusive. In any case there is no other species to which the name *melanogaster* is properly applicable; and with so widely known and unambiguous a name I am convinced that too close adherence to the strict rules of taxonomy is only pedantic and confusing.

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EMBRYO-SAC DEVELOPMENT IN PLUMBAGELLA

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Dahlgren[2] in 1916 reported on the development of the embryo sac in the Plumbaginaceae. Throughout the family the primary archesporial cell gives rise to a parietal cell and a macrospore mother cell, the latter of which functions as an embryo-sac mother cell. In the sub-family Plumbagineae, of the four nuclei formed by the meiotic divisions two lie at one end of the embryo sac separated from the two at the other end by a large

vacuole (this vacuole appears at the 2-nucleate stage in *Plumbagella*). The nucleus nearest the chalazal end becomes the nucleus of the single antipodal cell; that nearest the micropylar end becomes the nucleus of the egg; and the other two nuclei unite to form a 2 *n* primary endosperm nucleus. In contrast, members of five genera of the sub-family Staticeae examined by Dahlgren form typical 8-nucleate embryo sacs.

Dahlgren's studies included the following members of the Plumbagineae: *Ceratostigma plumbaginoides* Bunge, *Plumbago capensis* Thunb., *P. pulchella* Boiss., *P. zeylanica* L. and *Plumbagella micrantha* (Ledeb.) Spach. *Plumbagella micrantha* was studied more extensively than the other species.

Dahlgren's story has figured prominently in the literature since its publication. Its prominence is due chiefly to the fact that only the meiotic divisions seem to be involved in embryo-sac formation, the gamete (egg) nucleus resulting from the second of these divisions. No similar case of complete reduction of the macrogametophyte is known in any angiosperm.

Haupt[3] reinvestigated the development of the embryo sac in *Plumbago capensis*. His story agrees with Dahlgren's up to the 4-nucleate stage. The four nuclei now present divide and the daughter nuclei remain in pairs. Thus an 8-nucleate embryo sac is formed. One micropylar nucleus becomes the egg nucleus. Four nuclei, one from each pair, migrate to the center, where they fuse to give a 4 *n* primary endosperm nucleus.

Dahlgren[4] has more recently concluded that embryo-sac development in *Plumbago zeylanica* and *Ceratostigma plumbaginoides* follows the sequence reported by Haupt for *Plumbago capensis*. Dahlgren considers, however, that his investigation of *Plumbagella micrantha* was so thorough that his report of the history in that species can hardly be in error.

Before the appearance of Dahlgren's paper last cited, the writer had begun studies on embryo-sac development in the Plumbaginaceae. Emphasis has since been shifted to a study of *Plumbagella micrantha*.

According to my observations, the second meiotic division in this species follows immediately after the first in the enlarged macrospore mother cell. Up to this time, no large vacuoles are present. The four nuclei, each with *n* (6) chromosomes, commonly occupy positions corresponding approximately to the four points of a diamond (Fig. 3), although they sometimes have a more nearly linear arrangement. The micropylar nucleus begins to enlarge and very soon is surrounded by a region of dense cytoplasm. The other three nuclei migrate to the chalazal end (Fig. 4). During this period of migration, the embryo sac elongates considerably, a large vacuole appears between the three chalazal nuclei and the micropylar nucleus, and a small vacuole appears between the latter and the micropylar end. The three chalazal nuclei approach each other while the micropylar nucleus continues to grow.

The nuclei in the chalazal region unite in varying degrees of complete-
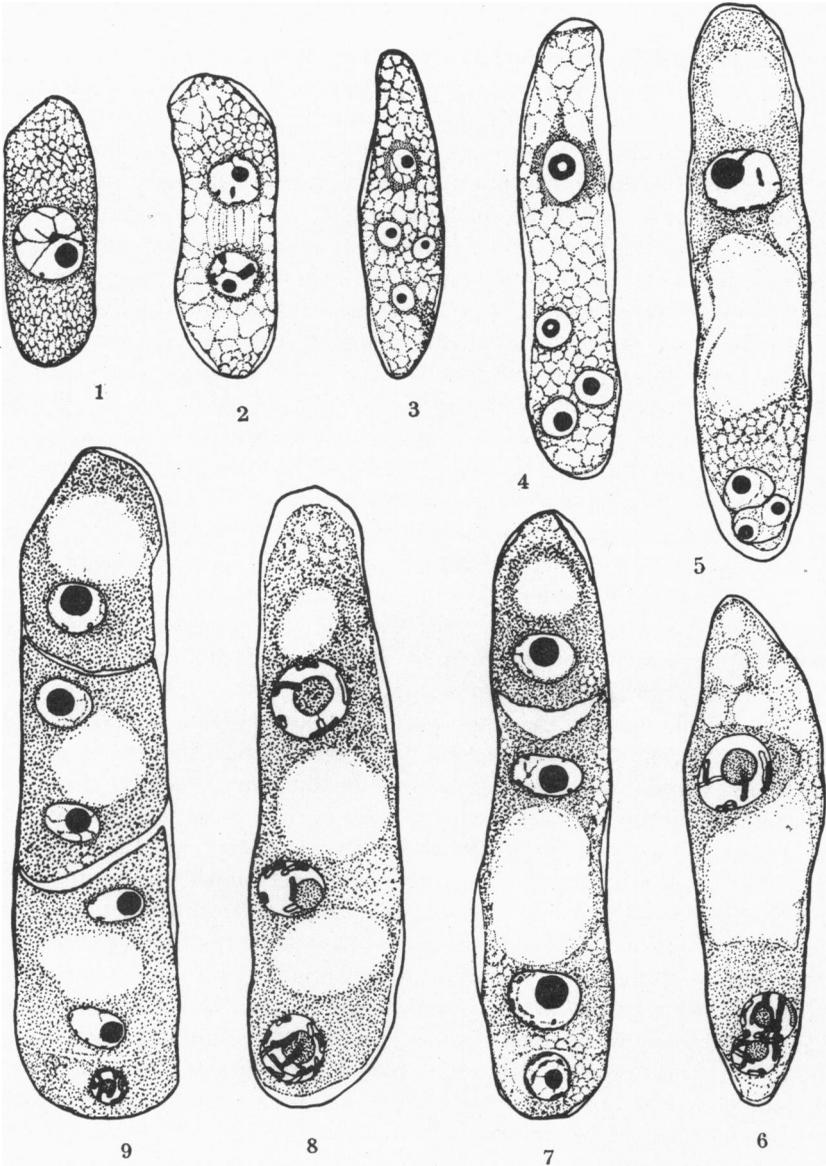
Figs. 1–7. Development of the usual 4-nucleate embryo sac: 1, macrospore mother cell; 2, 2-nucleate stage; 3, young 4-nucleate stage; 4, migration of 3 nuclei to the chalazal end; 5, two chalazal nuclei uniting, with a third nucleus very close; 6, chalazal nuclei uniting and in prophase; 7, newly formed later 4-nucleate stage.

Figs. 8, 9. Origin of 6-nucleate embryo sacs: 8, 3-nucleate stage with 2 n chalazal nucleus; 9, 6-nucleate embryo sac. All figures × ca. 920.

ness.   Before the beginning of the prophases, three separate nuclei may be present; two nuclei may have partly united (Fig. 5) or have fused completely, in which case two separate chalazal nuclei enter the prophases; or all three nuclei may have united so that a single $3 n$ nucleus is present.

During the prophases the nuclear fusions already under way continue (Fig. 6).   In one case 18 ($3 n$) chromosomes were clearly counted in a single chalazal nucleus.   A third series of divisions takes place, with 6 (n) chromosomes on the micropylar spindle and 18 ($3 n$) chromosomes on one, or on two closely associated, spindles at the chalazal end.   This gives, in either case, a row of only four nuclei; two nuclei at the micropylar end, each having 6 chromosomes; and two at the chalazal end, each with 18. These nuclei are separated from the nucleus of the macrospore mother cell by three divisions, not by two as Dahlgren concluded.

The micropylar nucleus becomes the nucleus of the egg; the nucleus nearest the chalazal end becomes the nucleus of the single antipodal cell (Fig. 7).   A period of growth of the embryo sac follows.   Then the remaining chalazal nucleus (with $3 n$ chromosomes) migrates toward the micropylar region where it meets and unites with the polar nucleus (having n chromosomes) from the micropylar end.   At the time of fusion, it is clear that one polar nucleus is larger than the other.   Thus a primary endosperm nucleus, having $4 n$ chromosomes, is formed.

About four per cent of the embryo sacs (12 out of 280 observed) become 6-nucleate.   From the observation of younger material it would appear that these exceptional cases arise in the following way.   After the meiotic divisions, when three nuclei are migrating toward the chalazal end, one nucleus lags behind and is separated from the other two by a large vacuole (Fig. 8).   Apparently the nuclei which reach the chalazal end unite, as do the three in the more common case.   All nuclei then undergo a division. As a result, the embryo sac has six nuclei, two at the micropylar end, each with n chromosomes, two in the central region of the embryo sac each with n chromosomes and two at the chalazal end each with $2 n$ chromosomes. In the youngest 6-nucleate embryo sac observed, the nuclei form a longitudinal row, the two nearer the micropyle separated from the four nearer the chalazal end by a large vacuole.   The nucleus nearest the micropylar end becomes the nucleus of the egg, the next two nuclei are cut off in a single cell as also are the next two, leaving a single nucleus for the antipodal cell (Fig. 9).   Later stages of these 6-nucleate embryo sacs have not been fully studied.

Other exceptional nuclear conditions have been observed, though they are rare.   These will be described more fully at a later time; for the present it suffices to say that they are all easily explainable on the basis of the interpretation given above, but seem inexplicable on the basis of the developmental scheme suggested by Dahlgren.

Summary.—1.   The egg nucleus in *Plumbagella micrantha* is not, as Dahlgren concluded, one of the four resulting from the meiotic divisions.

2.   The egg nucleus is separated from the nucleus of the macrospore mother cell by three divisions.

3.   After the second meiotic division three nuclei migrate to the chalazal end of the embryo sac and there commonly unite.   One nucleus remains at the micropylar end and divides at the same time that the newly formed chalazal nucleus divides.   Of the four resulting nuclei, one (with *n* chromosomes) becomes the nucleus of the egg, another (with 3 *n* chromosomes) becomes the nucleus of the single antipodal cell and the other two nuclei (with *n* and 3 *n* chromosomes, respectively) unite to form a 4 *n* primary endosperm nucleus.

4.   The present scheme for *Plumbagella* resembles in certain respects that suggested by Haupt and confirmed by Dahlgren for *Plumbago*, especially in the production of a 4 *n* primary endosperm nucleus.

5.   This method of embryo-sac development somewhat resembles that reported for *Lilium* by Bambacioni[5] and Cooper.[6]   Three chalazal macrospore nuclei frequently unite in *Plumbagella* before the formation of spindles whereas in *Lilium* the three spindles unite.   In *Lilium* there is a fourth division resulting in an 8-nucleate embryo sac, whereas *Plumbagella* remains in the 4-nucleate condition.

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THE DISTRIBUTION OF INTERMEDIN IN THE PARS ANTERIOR OF THE CHICKEN PITUITARY

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Intermedin regulates melanophore activity in lower vertebrates and recent reports[1] indicate that in mammals this hormone also acts as a specific metabolic principle.   Production of intermedin is independent of pars neuralis in amphibians[2] and in pituitaries of those birds[3] and mammals[4] which lack an anatomically distinct pars intermedia, the hormone is found