[Proc. Roy. Soc. Victoria, **51** (N.S.), Pt. II., 1939.]

Art. X.—*Additional Notes on Petaline Vestiges in Eucalyptus.*

By A. D. HARDY.

[Read 10th November, 1938; issued separately, 24th July, 1939.]

Attention was directed by the author in a paper on "Petaline Vestiges in Eucalyptus" (Rept. A.N.Z.A.A.S. XXII, p. 372, 1935) to the fact that the bud-cap or operculum in *Eucalyptus* was not always a complete, hollow cone as it was generally thought to be, but was in a transitory stage, frequently bearing indications of petaline lobing at the apex. It was noted as significant that the comparatively few species then examined were of the section Corymbosae and therefore nearest to the reputed ancestor of the genus—*Angophora.*

Since that date, many species have been under observation and the 55 now recorded include some of such diverse character and habitat that they may be taken as a fair sample of the total species of the genus. Further examination has shown that the minute lobing which can be microscopically seen in the buds of many species is a character of frequent occurrence and one which, though not essential, is still worthy of inclusion in any extended description of this genus.

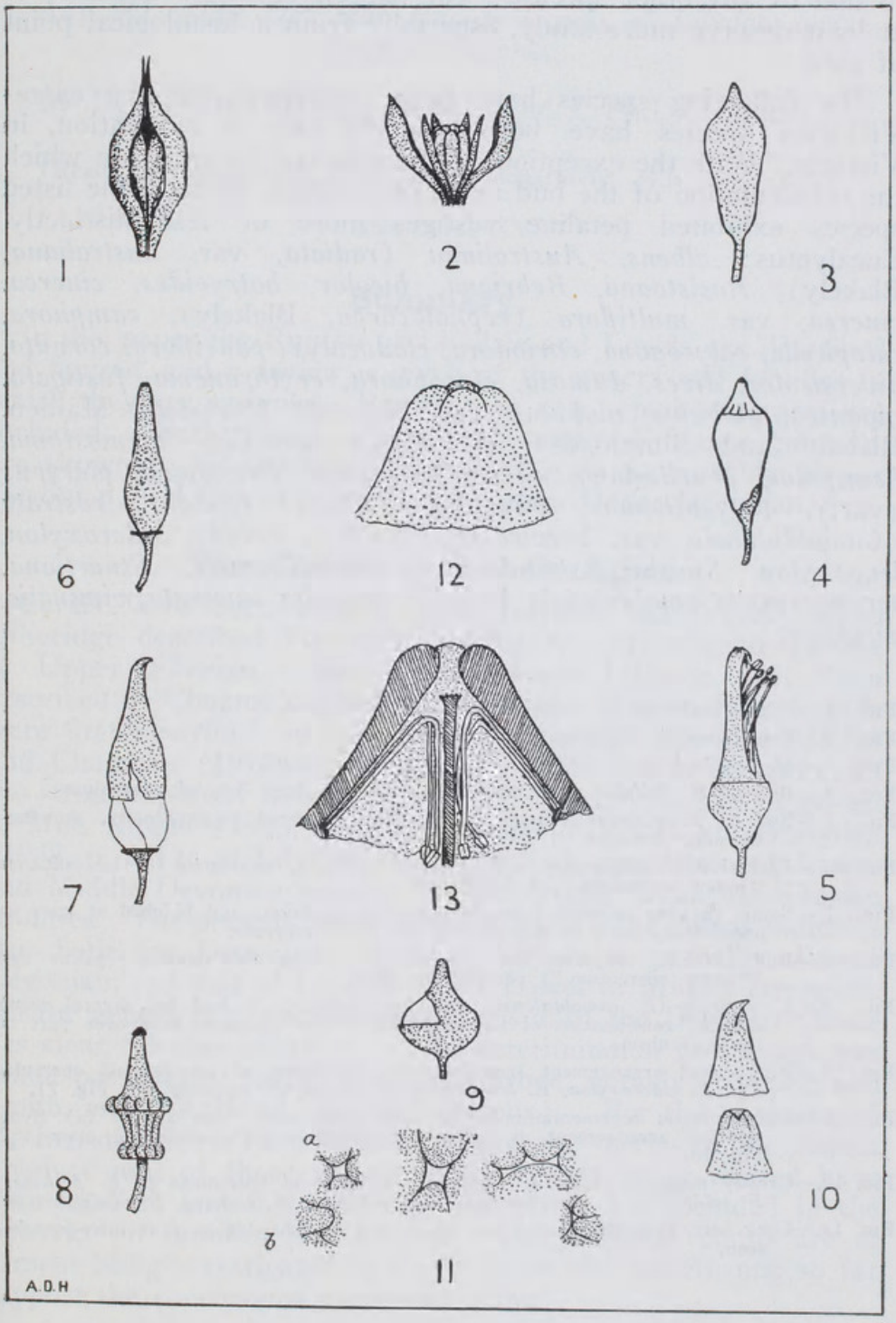
Although the lobing occurs in the same species in various localities, apparently unaffected by climate, altitude, aspect or soil, the arrangement of the lobes is as a rule irregular; the umbels on any tree may not be similarly affected nor in any umbel may the buds bear the indications equally. Macroscopically, the lobes are barely visible, the apex of the bud appearing as a rosy red point, but through a pocket lens, magnifying 10 diameters, they are seen to be a group of 2–4, rarely 5 papillae. Magnification of about 50 diameters reveals distinctly the lobes and, not infrequently, a pore (fig. 11), which communicates between the staminal chamber and the exterior. The pore may not be continuous; it may end indefinitely in the soft tissue of the bud-tip, or may be stopped by the stigma. A less common occurrence is seen in some buds of species which have a long-pointed operculum. In these, the apex may be bi-lobed, a superior lobe curving over like the upper mandible of a hawk's beak (fig. 10). This has been seen occasionally in *rostrata, leucoxylon* and *sideroxylon.* The ideal disposition is a symmetrical group of four lobes as in many young umbels of *calophylla* (figs. 12, 11A). The immature buds of calophylla (fig. 2), &c., have the apical lobing developed while still enclosed by the bracts of the umbel (fig. 1).

The fact that most of the examined opercula of matured or half-grown buds bore stomata is not enough, in itself, to decide whether the operculum is a fusion of calycine and corolline elements or is corolline only. In the absence of a calycine structure, the corolla in modified form may have learned to function as such. The scar at the base of the operculum (fig. 5, *platypus* var.), as seen in most species, is visible at a very early stage and persists till the bud's maturity, and it marks the line of circumcision whence the outer member of the modified floral envelope appears to have vanished. On many maturing buds of some species, and seen as a black spot on the apex, there appears to be the perched sepaline cap of the juvenile bud, e.g. *torquata* (fig. 8). Sometimes a portion of the epidermis is continuous from the thalamus tube, part of the way or even quite to the apex, interrupting the line of circumcision and preserving the unbroken profile curve of the bud (fig. 9, *rostrata* = *Camaldulensis*). The unbroken profile curve is a normal feature of *calophylla, ficifolia* (fig. 3), &c., and suggests a composite structure of the operculum in these species; but if, after maceration, the bud is skinned it sometimes appears as in fig. 4. If it were common to all species, it would make more acceptable a suggestion, made to me by the late Professor A. J. Ewart, that the lower part of the operculum might, after histological search, prove to be an extension of the thalamus tube.

If the lower part of the operculum is the concrescence of the members of a whorl, such concrescence appears to have occurred during the development of the primordial papillae.

The petaline feature described above cannot be seen satisfactorily in herbarium or shrivelled specimens. The buds must be freshly gathered, or studied on the tree (as in the present investigation with *ficifolia, calophylla, torquata, rostrata,* and *platypus* var., from infancy to maturity.

Something analogous can be seen in the calycine calyptra of some Papaveraceae and, of the Melastomaceae, *Pternandra cordata*. Of the former, the long calpytra of *Eschscholtzia Californica* (figs. 6, 7) is, from a basal circumcision, pushed up and off by the expanding petals, but this is frequently accompanied by a partial splitting from the base upwards. It has a minutely lobed apex in which, when bi-lobed, the "hawk-beak" arrangement occurs. In *Papaver nudicaule* var. *radicata,* there is a tendency to throw off the sepals in the form of a cap, which are often seen perched on the expanding corolla and parted at the base only. A rare occurrence in *Eucalyptus* is that which was seen in seven buds of *platypus* var. (fig. 5). In these cases, all on one tree, the buds had partly opened by a longitudinal fissure in the operculum, from a little above the base to or nearly to the apex, and through this opening a few of the crimson stamens protruded; but this may have been due to mechanical injury, as other buds were not ready for normal opening.



FIGS. 1-13.

Because of the importance of the operculum in systematic work on this genus, more interest attaches to the bud than perhaps to that of any other species. The subject seems to demand, or at least deserve more study, especially from a histological point of view.

The following species have been examined, but the extra-Victorian species have been observed only in cultivation, in Victoria. With the exception of *globulus* and *bicostata*, in which the tuberculation of the bud made observation difficult; the listed species exhibited petaline vestiges more or less distinctly. Eucalyptus: *albens*, *Australiana* (*radiata*, var. *australiana*, Blakely), *Bosistoana*, *Behriana*, *bicolor*, *botryoides*, *cinerea*, *cinerea*, var. *multiflora* (*cephalocarpa*, Blakely), *camphora*, *calophylla*, *calycogona*, *citriodora*, *cladocalyx*, *pauciflora*, *cornuta*, *diversicolor*, *dives*, *dumosa*, *elaeophora*, *erythronema*, *fastigata*, *gigantea*, *globulus*, *globulus*, var. *bicostata* (*bicostata*, Maiden, Blakely and Simmonds), *goniocalyx*, *gracilis*, *haemastoma*, *hemiphloia Muelleriana*, *nitens*, *paniculata*, *Preissiana*, *platypus* (var.), *polyanthemos*, *punctata*, *radiata*, *regnans*, *rostrata* (*Camaldulensis*, var. *brevirostris*, Dehn.), *rubida*, *sideroxylon*, *leucoxylon Smithii*, *stellulata*, x *Studleyensis*, *Stuartiana*, *tereticornis* (*Camaldulensis*, Dehn.), *torquata*, *uncinata*, *viminalis*, *viridis*.

EXPLANATION OF FIGURES.

FIG. 1.—Bracts enclosing an umbel of *Eucalyptus ficifolia*.

FIG. 2.—Young umbel emerging.

FIG. 3.—Mature bud of *E. ficifolia*. No circumcision scar.

FIG. 4.—Bud of *E. ficifolia* after maceration, showing base line of operculum.

FIG. 5.—Bud of *E. platypus* (var.). Operculum ruptured longitudinally, showing extruded stamens.

FIG. 6.—*Eschscholtzia californica*, with calycine calyptra, analogous to the caducous "outer operculum" of *Eucalyptus*.

FIG. 7.—Same, showing calyptra freed by basal circumcision; and bi-lobed at apex as occasionally seen in this species and in *Eucalyptus*.

FIG. 8.—Bud of *Euc. torquata*, nearly mature, showing the minute sepaline cap ("outer operculum") perched on apex.

FIG. 9.—*E. rostrata* (*E. camaldulensis*, var. *brevirostris*). A bud (of several seen) showing continuation of the epidermis of the thalamus tube over part of the operculum.

FIG. 10.—Bird-beaked arrangement seen in some specimens of long-pointed opercula, e.g., *E. sideroxylon*, *E. leucoxylon*, *E. oleosa*, *E. torquata* (cf. Fig. 7).

FIG. 11.—Diagrammatic representation of various pores seen from above: (*a*) Symmetrical arrangement as infrequently seen. (*b*) Bird-beaked apex (cf. Fig. 10).

FIG. 12.—Greatly magnified apex of operculum as seen in specimens of *E. ficifolia*, *E. calophylla*, *E. platypus* (var.), *E. rostrata*, *E. regnans*, *E. viminalis*, &c.

FIG. 13.—Long. sect. through apex of bud of *E. ficifolia*, showing pore as infrequently seen.