

*Corolla* (Fig. 2, A). The corolla is much larger than that of *D. stramonium* and has 10 lobes; the midribs run into the 5 short acuminate lobes which have filiform twisted tips; the remaining 5 alternating lobes are larger, broadly triangular and are folded inwards in the plicate and twisted corolla. The tube measures approximately 12 to 16 cm. in length and the lobes are about 1 cm. long.

*Andræcium* (Fig. 2, A). The stamens are very similar to those of *D. stramonium*, except in size; the free part of the filament measures approximately 5 to 6 cm. in length, the adherent part about 9 to 10 cm.; the anther lobes are about 11 to 12 mm. long and 3 mm. wide.

*Gynæcium*. The ovary is similar to that of *D. stramonium* but is larger in size and the spines are longer. The style is about 15 cm. in length; the stigma (Fig. 2E) has a papillose receptive surface in the form of a band passing over its apex and formed by a proliferation of the central pith as in *D. stramonium*.

*Fruit*. The fruit is similar in shape to, but much larger than, that of *D. stramonium*; the persistent part of the calyx forms a wider flange which is only slightly recurved. The entire calyx, before dehiscence, bulges out, due to the growth of the fruit and the spines; it remains covering the fruit during the early part of its development until nearly full grown, as also does the withered corolla which hangs on by its vascular tissue and by support from the withered style.

The seeds are yellowish to dark-brown, ear-shaped to sub-reniform about 4 to 5 mm. long, 3 to 4 mm. broad, 1 to 1.5 mm. thick and flattened; the surface has uneven shallow depressions and is finely pitted; the margin is somewhat wavy and the edge exhibits a triple ridge.

#### HISTOLOGY OF THE CALYX

*Outer (abaxial) epidermis*. The cells are similar in form to the corresponding cells of *D. stramonium* but are somewhat larger in size; on the lobes (Fig. 1, Ao) the cells measure approximately L and T\* = 30 to 45 to 60 to 135  $\mu$  and R = 15 to 24 to 36  $\mu$ ; at about the middle of the tube they measure approximately L and T = 15 to 24 to 60 to 140  $\mu$  and R = 15 to 20 to 30  $\mu$  and at the base of the tube (Fig. 1, Co) L and T = 9 to 30 to 45 to 60  $\mu$  and R = 15 to 21 to 45  $\mu$ .

*Stomata*, of the cruciferous (anisocytic) type, are frequent over the entire epidermis. The following kinds of trichomes are present: *small glandular trichomes* with a multicellular head; numerous *long glandular trichomes* with a unicellular head similar to the typical trichomes of the foliage leaf of *D. innoxia*; also tapering *covering trichomes* more slender than those of *D. stramonium*; the proportion in which these different types of trichomes occur varies in different samples. There are present in many cells of the epidermis especially along the midribs, some exceptional crystals which have rounded ends and a ragged central core (Fig. 1, Bv, c<sub>1</sub>).

\* When recording measurements, the letters L, T and R are used to indicate measurements in a longitudinal, tangential and radial direction respectively, the directions having reference to the axis of the relevant plant member.

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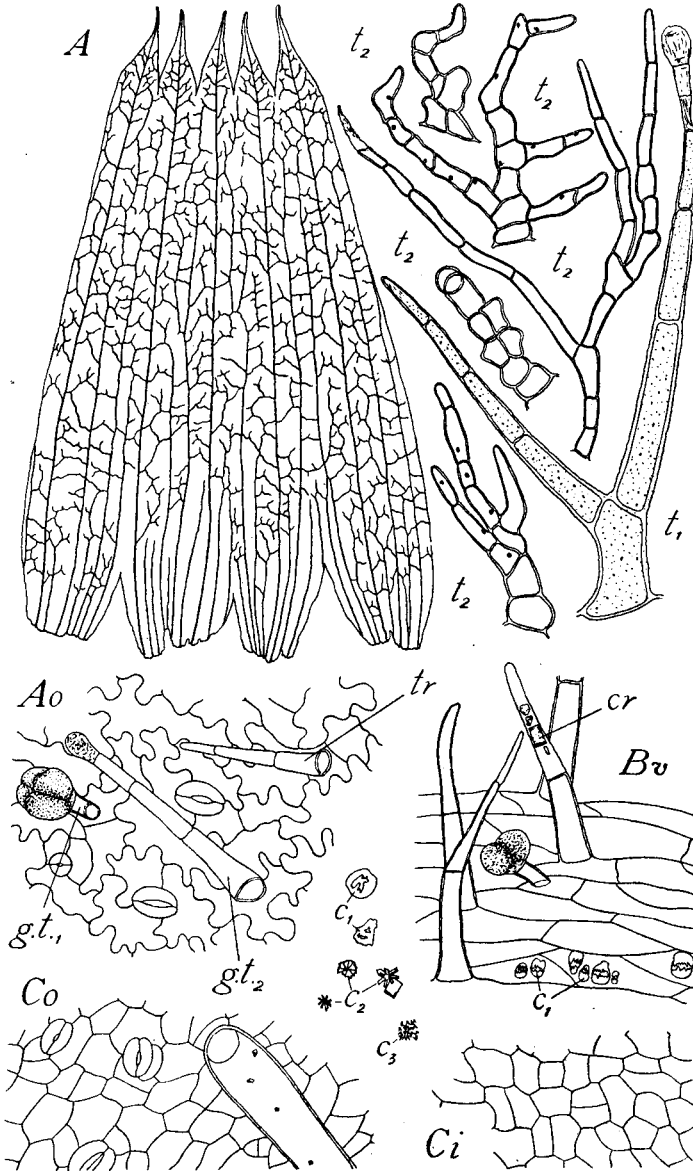


Fig. 1. *D. innoxia* Miller, Calyx. A, calyx spread out showing the form and the position of the widest part at about one-tenth of the distance from the base, and also the venation ( $\times 1$ ). Ao, outer epidermis on the lobe; Bv, outer epidermis on midrib at the middle of the calyx; Co, outer epidermis at the base; Ci, inner epidermis at the base.  $c_1$ , peculiar crystals with a ragged core;  $c_2$ , crystal aggregates from the mesophyll of the calyx;  $c_3$ , micro-sphenoidal crystal-sand from an idioblast; cr, crystal in trichome;  $gt_1$ , clavate glandular trichome;  $gt_2$ , long glandular trichome;  $t_1$ , warty branched trichome from the edge of the calyx lobes;  $t_2$ , peculiar simple and branched trichomes from the edge of the calyx lobes; tr, covering trichome. All  $\times 160$ .

*Inner (adaxial) epidermis.* The cells are similar to the corresponding cells of *D. stramonium*; they measure approximately L and T = 15 to 36 to 60 to 150  $\mu$  and R = 18 to 33  $\mu$  on the lobes and L and T = 9 to 24 to 60 to 75  $\mu$  and R = 15 to 24  $\mu$  at the base of the tube (Fig. 1, Ci). *Stomata* are common and more frequent on the tube. *Trichomes.* All three types of trichomes are present in varying proportions and frequency in different samples, but are much less frequent than on the outer epidermis.

*Trichomes.* (a) The *small glandular* trichomes (Fig. 1, Ao, g.t.<sub>1</sub>) with a unicellular stalk and commonly a 5-celled globular or clavate head, having 4 cells arranged vertically over a platform cell, measure approximately: stalk, 24 to 30 to 36  $\mu$  in length and head, 30 to 36 to 45  $\mu$  in diameter.

(b) *Long glandular* trichomes (Fig. 1, Ao, g.t.<sub>2</sub>) having a 2- to 5-celled slender uniseriate stalk and an elongated globular or ellipsoid unicellular head, such as are typical of the foliage leaf of *D. innoxia*, are common; they measure about 28 to 280 to 560  $\mu$  in length, 15 to 30 to 45  $\mu$  in diameter at the base, the diameter of the head being 15 to 21  $\mu$ .

(c) *Covering* trichomes (Fig. 1, Ao, Bv, tr) are slender and tapering with occasional prismatic and odd-shaped crystals in some cells (Fig. 1, Bv, cr); they measure about 15 to 30 to 90  $\mu$  in length, the diameter at the base being 15 to 30 to 45  $\mu$ ; some trichomes on the lobes have a warty cuticle.

(d) *Characteristic covering* trichomes on the edge of the lobes resemble those of *D. stramonium* but often have 2 and sometimes 3 or 4 branches (Fig. 1, t<sub>2</sub>); in some samples, however, they are rare and are replaced by conical warty covering trichomes which are sometimes branched (Fig. 1, t<sub>1</sub>).

The *Mesophyll* is similar to that of *D. stramonium*.

*Venation* (Fig. 1, A). The venation is similar to that of the calyx of *D. stramonium* and the midrib shows no particular difference in transverse section except for the absence of the projecting ridge.

#### HISTOLOGY OF THE COROLLA

*Outer (abaxial) epidermis.* The cells on the lobes resemble the corresponding cells of *D. stramonium* both in form and dimensions (Fig. 2, Ao); they differ, however, in having usually straight or slightly curved anticlinal walls. Certain epidermal cells on the lobes have the outer cell-wall collapsed and appear as brownish patches in surface view (Fig. 2, Ao, c<sub>1</sub>). The cells on the tube (Fig. 2, Bo, Co and Eo) show little variation from the corresponding cells on the corolla of *D. stramonium* except that they are larger in size; at a point near the middle of the tube, they measure approximately L = 180 to 255 to 330  $\mu$ , T = 15 to 18 to 33  $\mu$  and R = 18 to 21 to 30  $\mu$ ; at the base of the tube, the measurements are L = 150 to 210 to 300  $\mu$ , T = 15 to 30 to 45  $\mu$  and R = 18 to 30  $\mu$ .

*Stomata* are very rare or absent on the lobes but are frequent on the tube except towards the base; they are usually cruciferous (anisocytic). Clavate glandular *trichomes* are present in small numbers as in

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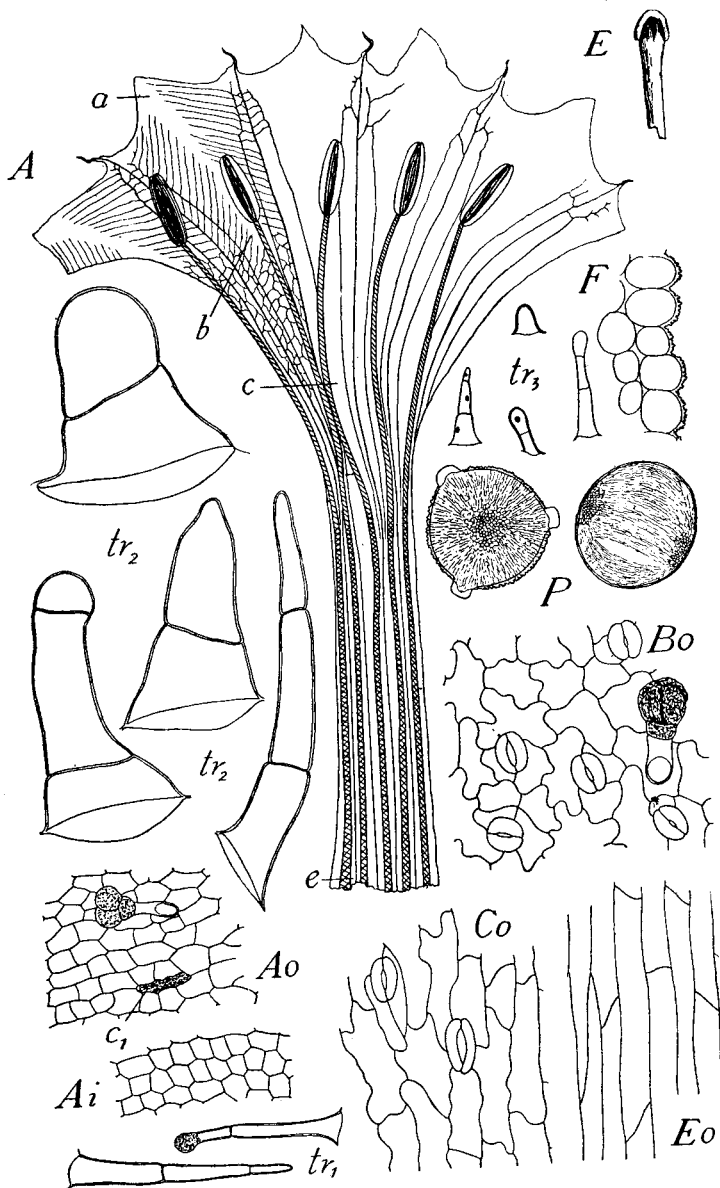


Fig. 2. *D. innoxia* Miller. A, corolla, with epipetalous stamens, spread out, showing venation of one petal ( $\times 1$ );  $Ao$ , outer epidermis of the corolla at *a* (as marked on A);  $Ai$ , inner epidermis of the corolla at *a*;  $Bo$ ,  $Co$  and  $Eo$ , outer epidermis of the corolla at position *b*, *c* and *e* respectively; E, stigma and upper part of the style ( $\times 2$ ); F, epidermis of style in transverse section showing striated cuticle; P, pollen grains in polar and side view ( $\times 280$ ).  $c_1$ , collapsed cell;  $tr_1$ , trichomes from the edge of the corolla lobes;  $tr_2$ , trichomes on the adnated part of the filaments;  $tr_3$ , trichomes from the ovary wall. All  $\times 160$  unless otherwise specified.

*D. stramonium*; slender covering trichomes and typical long glandular trichomes as found on the calyx, are present along the edge of the lobes (Fig. 2,  $tr_1$ ).

*Inner (adaxial) epidermis.* The cells in the different regions are in general similar to the corresponding cells on the corolla of *D. stramonium*. On the lobes (Fig. 2, Ai), the cells measure approximately L and T = 15 to 21 to 33 to 45  $\mu$  and R = 15 to 21 to 24  $\mu$ ; the cells on the throat of the tube often bear small papillæ as in the case of *D. stramonium*. The cells on the tube are much larger than those of *D. stramonium*; on the middle of the tube, they measure approximately L = 210 to 270 to 360  $\mu$ , T = 15 to 21 to 30  $\mu$  and R = 15 to 24 to 30  $\mu$ ; at the base L = 90 to 120 to 180  $\mu$ , T = 21 to 30  $\mu$  and R = 18 to 27  $\mu$ . *Stomata* are usually absent but occur quite frequently in the tube in certain samples. *Trichomes* are usually absent, but in some samples, some large conical or short covering trichomes with a rounded apex are present in the part of the corolla tube where the filaments are adnated.

*Mesophyll.* The mesophyll shows no noticeable difference from that of *D. stramonium* in either arrangement or contents of the cells.

*Venation.* The structure of the midrib in transverse section are similar to that of *D. stramonium*. The venation, however, differs slightly in the upper part of the corolla, since the numerous straight lateral branches from the apical part of the midrib run into the broader intermediate lobes and terminate in the median line of those lobes.

#### HISTOLOGY OF THE STAMENS

The *filament* is similar to that of *D. stramonium* except that the epidermal cells are longer. The numerous *trichomes* on the adnated part of the filament resemble those of the adjacent part of the corolla, but are larger in size (Fig. 2,  $tr_2$ ), their dimensions being often twice or rather more than twice those of the corresponding trichomes of *D. stramonium*.

The *anther* resembles that of *D. stramonium*, the cells being slightly larger in comparison. The fibrous layer is lignified, as in *D. stramonium*.

The pollen grains (Fig. 2, P) are spherical in polar view, but slightly oval in outline when viewed laterally; they have three small indistinct germinal furrows and three pores about 12 to 24  $\mu$  in diameter; the grains measure about 54 to 63 to 66 to 69  $\mu$  in diameter when mounted in lactophenol and warmed; they measure about 69 to 78 to 81 to 84  $\mu$  after boiling in solution of chloral hydrate. The exine is striate, the markings appearing as short, wavy, longitudinal ridges except at the poles where they reticulate. The grains contain oil globules and minute starch grains which measure up to 3  $\mu$  in diameter after treatment with a solution of chloral hydrate and iodine.

#### HISTOLOGY OF THE CARPELS

The *ovary* shows no appreciable difference from that of *D. stramonium*. The trichomes on the spines (Fig. 2,  $tr_3$ ) are mostly covering and less of the glandular type; in certain specimens, trichomes are rare or absent.

*Style and Stigma.* The cuticle on the style is more markedly striate

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longitudinally as compared with that of *D. stramonium* (Fig. 2, F). In addition to the two main bundles, one on either side of the oval region of small cells, a few small bundles occur in rare instances.

### POWDERED FLOWERS AND SUMMARY

Dried flowers of *D. innoxia* when reduced to No. 85 powder, yield a greyish-brown powder with a marked, heavy typical odour which quickly distinguishes it from the powder of the flowers of *D. stramonium*. The powder was examined after mounting it in various reagents and the characters which would help in identification are listed below in order of importance; they form a summary of the most diagnostic histological characters.

1. Pollen grains, which are not very frequent, measuring 54 to 69  $\mu$  in diameter in lactophenol and 69 to 84  $\mu$  in chloral hydrate solution and having the characteristic streaky striations on the exine, typical of the pollen of *D. innoxia*.

2. A few long glandular trichomes with a unicellular ovoid head characteristic of *D. innoxia*; the trichomes are usually very much broken and difficult to recognise.

3. Fragments of the fibrous layer which often give a slight reaction for lignification.

4. Fragments of the calyx, with small crystals present as prisms or aggregates; but these are of minor importance.

### KEY FOR IDENTIFICATION OF THE POWDERED FLOWERS OF THE MEDICINAL SOLANACEOUS PLANTS

A. Pollen grains, spherical, about 40 to 55 to 60  $\mu$  in diameter when mounted in chloral, with three distinct pores and three well-marked long germinal furrows. *Atropa belladonna* or *Hyoscyamus* spp.

(1) Cuticle of calyx without striations. Trichomes; large multicellular ovoid heads (about 10 to 30 cells) of glandular trichomes. Corolla; epidermal cells of the lobes with deep infoldings, cells of the inner epidermis at the base of the tube with pitted anticlinal walls. Pollen grains, exine irregularly pitted. *Hyoscyamus niger*.

(2) Cuticle of calyx striate—

(a) Trichomes, often branched, with unicellular globular glandular heads, basal cells covered with transversely striated cuticle. Pollen grains, exine with pits often in rows of 3 to 8. *Hyoscyamus muticus*.

(b) Trichomes with unicellular globular or uniseriate glandular head of 2 to 4 cells. Corolla; epidermal cells of the lobes papillose, yielding a pink tinge in chloral; sub-rectangular pits on the cells of the outer epidermis at the base. Pollen grains, exine with pits arranged in long longitudinal rows. *A. belladonna*.

B. Pollen grains, spherical to sub-spherical, about 50 to 65 to 80 to 85  $\mu$  in diameter when mounted in chloral hydrate solution, with 3 pores

varying in distinctness and very small furrows, sometimes apparently absent. *Datura* species.

- (1) Pollen grains, exine irregularly warty. Trichomes warty. *D. stramonium* and *D. tatula*.
  - (a) Fragments of corolla and anther yield a pink colour in chloral mounts. *D. tatula*.
  - (b) No colour patches in chloral mounts. *D. stramonium*.
- (2) Pollen grains, exine with longitudinal streaky markings except at the poles. Trichomes, rather slender with unicellular ovoid glandular heads. *D. innoxia*.

#### NOTE ON MAKING MICROSCOPICAL PREPARATIONS OF POLLEN GRAINS

When pollen grains are mounted in solution of chloral hydrate, the mountant has a remarkable action upon many of the grains if the preparations are boiled or are heated to near boiling for a short time. Since it is customary to boil mounts of powdered drugs in chloral hydrate in order to clear the particles sufficiently, the changes brought about must be noted.

These observations were first made when working with pollen of *D. innoxia*. The grains are first slightly swollen, the pores becoming more distinct, and then the contents escape through a pore, which may be somewhat enlarged by splits in the exine. When specimens which have been stored in solution of ethanol and glycerin are used, the liberated contents still enclosed by the intine, have the form of the pollen grains and show the position of the 3 pores as slight rounded projections; the spherical mass also becomes somewhat enlarged and the surface is smooth, the slightly granular contents being visible through it; if the outline is sharply focussed, no wall is visible. When dried specimens are used, the contents come out in irregular masses. At the same time, the shells which are composed of the exine and are sometimes ruptured and often shrunk, simulate smaller immature pollen grains. A similar phenomenon is observed with the pollen of *D. stramonium* but the action is slower. Mounts made by boiling in lactophenol behave similarly, but the action is less vigorous than with chloral hydrate.

It is therefore necessary to use care in making measurements, so as to avoid errors due to recording the diameters of the extruded interiors when using pickled specimens and of empty shells when using either the pickled or the dried specimens; the slide should also be allowed to cool before the measurements are made.

Pollen of species of *Hyoscyamus* behaves similarly but the action of the mountant is slower than with species of *Datura*, so that the majority of the grains give normal measurements. To what extent these changes occur with pollen generally, it has not been possible to investigate.

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