PHARMACOPŒIAL AND COMMERCIAL ACONITE.

WILLIAM MANSFIELD.

Various species of aconite have been used from ancient times, first for criminal purposes and in latter times for their medicinal value. The United States and British pharmacopœias recognize only the tuberous root of aconitum napellus, yet the requirements of the two pharmacopœias are quite different. There is no doubt about the kind of tuberous root official in the British Pharmacopœia as it states clearly that aconite must be grown in England and that the tuber must be collected in autumn and have an undeveloped flower bud. This means that it is the tuber separated from the tuber bearing the flower cluster at the close of the flowering season. The United States Pharmacopœia states that aconite is the dried tuberous root of aconitum napellus collected in autumn. In the description it says: "Slenderly conical, 4 to 10 cm. long, 10 to 20 mm. thick at the crown; occasionally split;" etc.; no mention being made of an undeveloped bud or a hollow stem base; so that apparently one may take his choice of a tuber with an undeveloped flower bud, which is a plump starchy tuber, or a tuber which is shriveled and heavily wrinkled, containing little starch and with a sunken stem base, that is, if the stem were cut on a level with the tuber.

Let us now consider the aconite of commerce. A very small percentage of commercial aconite consists of a starchy tuber with an undeveloped flower bud. These occur usually attached to the mother tubers. The tuber with the flower stem removed to the level of the tuber is not usual. The usual type of aconite of commerce is an aconite tuber which bore the flower cluster and with portions of the flowering stem, varying from ¼ to 3 inches in length. The United States Pharmacopœia does not allow any stem to be present, yet it is practically impossible to find a sample of aconite in the market without stems. This means that the average sample of aconite does not meet the requirements of the United States Pharmacopœia. Fortunately we have a chemical check on aconite, and if it yields 0.5 per cent of aconitine upon assay, it will meet the official requirements chemically, if not botanically.

In order to see if the starchy tuber contained as much aconitine as the non-starchy tuber, assays were made of the tubers occurring in pairs after being separated and reduced to a number forty powder. The result of the analysis showed the non-starchy tuberous root to be richer in aconitine than the starchy tuberous root. While the evidence is not conclusive it tends to show the comparative amounts of the active constituents present in the starchy and non-starchy tuberous root. Economically only the tuber which bore the flower stem should be used. The separated daughter tuber may be planted to produce the flower cluster and a daughter tuber which at the close of its flowering period may be collected for market. It interested me to note that through the short rhizome which connects the two tuberous roots, two vascular strands pass, each with a distinct endodermis. If observed closely, many of the specimens will show where this rhizome has been cut across separating the two tuberous roots and showing the two vascular strands.

Briefly stated, there are five types of aconitum napellus on the market: first,

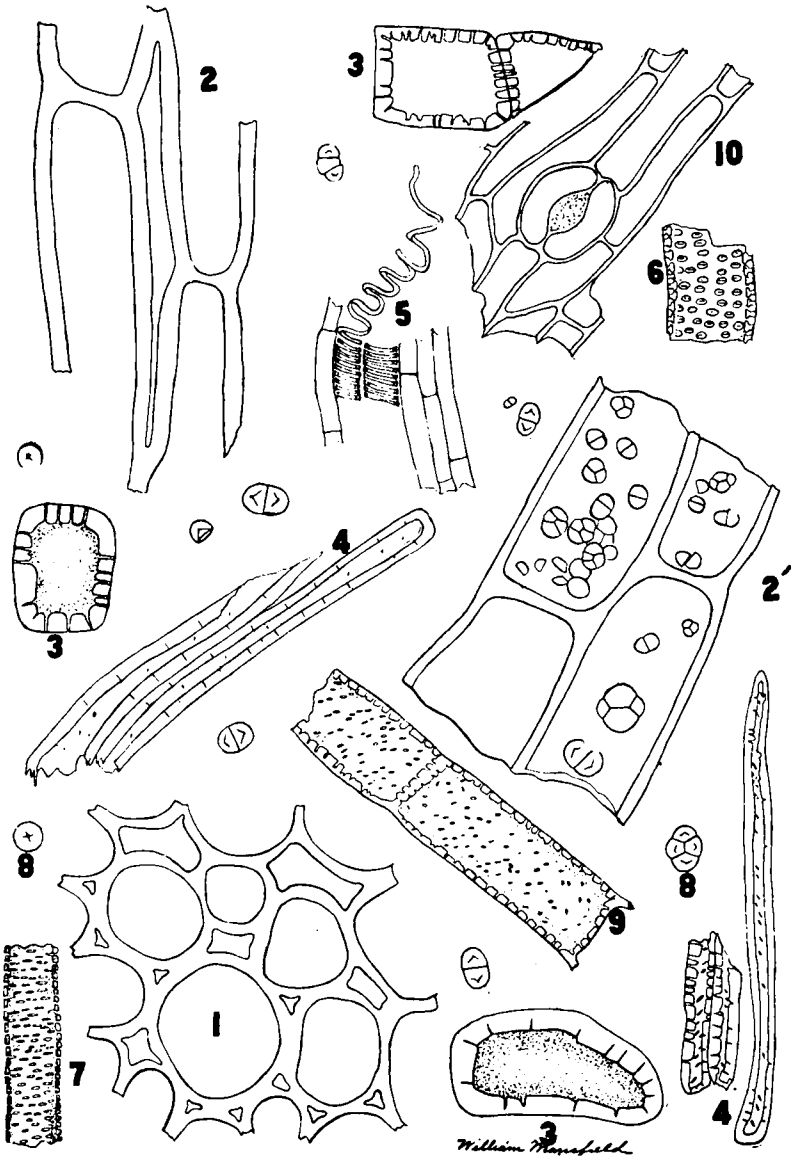

Figure 1.
(Powdered Aconite Stems.)

1. Transverse parenchyma with intercellular spaces. 2. Longitudinal parenchyma with intercellular space. 2' Longitudinal parenchyma with starch grains. 3. Stone cells (often with dark brown contents). 4. Fibers. 5. Conducting cells with spiral thickening and xylem parenchyma. 6. Part of a pitted vessel with bordered pores. 7. Reticulated conducting cells. 8. Starch, single and compound, scattered throughout the field. 9. Pith parenchyma with porous walls. 10. Stomata, guard cells and surrounding cells of the epidermis.

starchy aconite with an undeveloped terminal flower bud; second, non-starchy aconite with a hollow stem base; third, non-starchy aconite with stem base attached (usual type); fourth, aconite in pairs, the non-starchy tuber with a hollow stem base or a portion of the stem, together with a starchy tuber having an undeveloped flower bud; and fifth, combinations of the above four types.

If the non-starchy tuber only be collected there would be insured a constant supply. There is no question but that the tuber bearing flower cluster will, when freed from any portion of the stem, meet the official requirements. Specimen number one illustrates such a sample and assays 0.6 per cent. of aconitine. At any rate let the next United States Pharmacopœia state whether the tuberous root with an undeveloped flower bud, or the tuberous root which bore the flower cluster shall be used; and also what length of stem base, if any, will be allowed.

POWDERED ACONITUM NAPELLUS.

Powdered aconite stems exhibit many striking and characteristic cells. The epidermal cells occur usually as opaque or translucent reddish-brown fragments. It sometimes happens that the cell wall is broken and the contents forced out; it is then possible to see the outline of the epidermal cells and the stoma. The guard cells are clear and are found on a level with the surrounding cells (10). The transverse parenchyma (1) has about the same appearance in the powder that it has in the cross section. The longitudinal parenchyma with starch (2) is more abundant in a number eighty powder. Number 2' is longitudinal parenchyma with an intercellular space, but free from starch. The stone cells (3) vary in form and size and the walls and cell contents are often reddish-brown or, if the walls are whitish, the contents will be reddish-brown. The fibers (4) vary in length and diameter, the walls have simple pores and the one end is often square or blunt. The simplest conducting cells have spiral thickening of the walls, and this is often seen detached in the form of a true spiral (5). Pitted cells with bordered pores (6) and reticulate conducting cells (7) are found. Scattered throughout the field are found single rounded starch grains (8), with cleft hilum, two-compound grains with a V-shaped hilum, and compound grains with an indistinct hilum. The pith parenchyma cells (9) when seen in longitudinal view have numerous pores. The

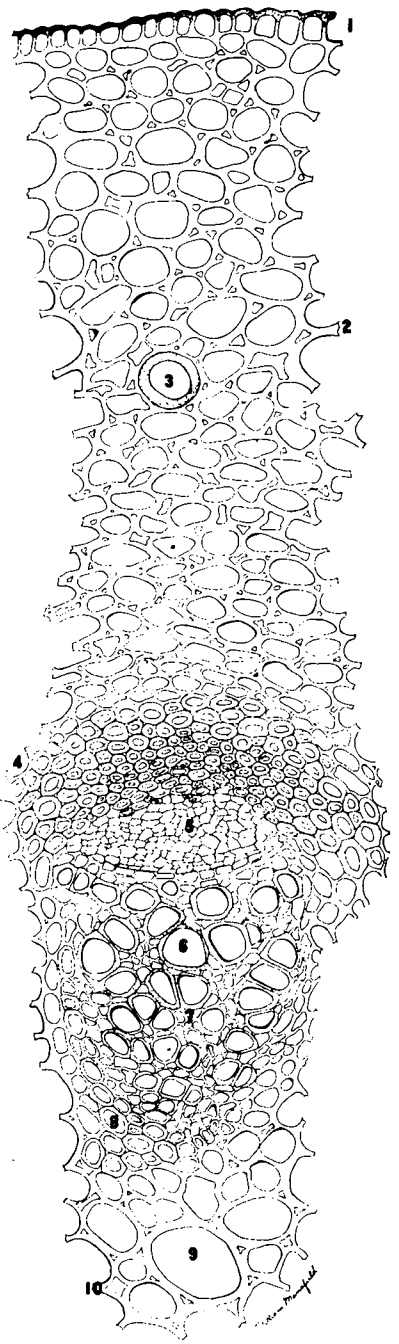

Figure 2.
Cross Section of Aconite Stem.
1. Epidermal cells with reddish-brown cell contents. 2. Cortical parenchyma with intercellular spaces. 3. Stone cells. 4. Fibers. 5. Sieve and surrounding cells. 6. Ducts and tracheids. 7. Xylem parenchyma. 8. Fibers. 9. Pith parenchyma. 10. Intercellular space.

presence of aconite stems in powdered aconite is clearly shown by the fibers (4), by the thicker-walled parenchyma cells (2), by the epidermis with stoma (10), and by fewer stone cells. The fibers can also be determined chemically by an estimation of the crude fiber.

STRUCTURE OF THE CROSS SECTION OF ACONITUM NAPELLUS STEM.

In the cross section of the larger stem bases of aconitum napellus, there are fifty or more bundles. The fibers form nearly a complete ring with an arch of fibers just outward from each phloem portion of the bundle and extending inward often completely enclosing the xylem and forming a closed collateral bundle. This is true only of the older formed bundles. As the stem increases in diameter new bundles are formed which at first have fibers surrounding only the phloem portion of the bundle and then only a few cells wide. The cross section exhibits the following structure: The epidermal cells (1) are radially elongated, thin-walled cells with reddish-brown contents; the cortical parenchyma cells (2) are thick-walled, nearly circular in outline, with prominent, mostly triangular intercellular spaces, becoming smaller and smaller as we near the fibrous sheath. Among the cortical parenchyma cells are found large thin-walled stone cells (3). Frequently not more than one is found between the epidermis and the fibrous layer, while in other sections several stone cells occur. The fibers (4) have a rounded outline, the walls are yellowish-white, thick, with small cell cavity and show clearly the line of separation of the fibers, which appear as a dark line between the cells. The fibers (8) inward from the xylem are thinner-walled than those surrounding the phloem. The cells of the phloem (5) are thin-walled and irregular in outline, no sharp distinction being seen between true sieve cells and surrounding cells. In some of the bundles the cambium cells are quite distinct; while in other bundles no characteristic cambium was observed. The conducting cells of the xylem (6) vary greatly in diameter and are surrounded by parenchyma cells (7). The pith parenchyma cells (9) are thick-walled, nearly circular in outline and fiilled with starch grains. The intercellular spaces (10) are larger than in the cortex and they are quite frequently quadrangular or pentangular.

THE AMERICAN PHARMACEUTICAL ASSOCIATION.

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