air, germination is said to be **epigeal** ("above the earth"). Bean and pumpkin are examples. When the hypocotyl does not elongate greatly and the cotyledons remain under ground, the germination is **hypogeal** ("beneath the earth"). Pea and scarlet runner bean are examples (Fig. 48). When the germinating seed lies on a hard surface, as on closely compacted soil, the hypocotyl and rootlets may not be able to secure a foothold and they assume grotesque forms. (Fig. 17.) Try this with peas and beans.

FIG. 17. — PEA. Grotesque forms assumed when the roots cannot gain entrance to the soil.

The first internode ("between nodes") above the cotyledons is the **epicotyl**. It elevates the plumule into the air, and *the plumule-leaves expand into the first true leaves of the plant.* These first true leaves, however, may be very unlike the later leaves in shape.

Germination of Bean. — The common bean, as we have seen (Fig. 15), has cotyledons that occupy all the space inside the seed-coats. When the hypocotyl, or elongated caulicle, emerges, the plumule-leaves have begun to enlarge, and to unfold (Fig. 18). The hypocotyl elongates rapidly. One end of it is held by the roots. The other is held by the seed-coats in the soil. It therefore takes the form of a loop, and the central part of the loop "comes up" first (*a*, Fig. 19). Presently the cotyledons come out of the seed-coats,

FIG. 18. — COTYLEDONS OF GERMINATING BEAN SPREAD APART TO SHOW ELONGATING CAULICLE AND PLUMULE.