

tunnels, their larvæ cutting cradles similar to those excavated by larvæ of the Ambrosia beetles already mentioned, and are thus in a manner intermediate in habit between *Xyleborus* and *Trypodendron*. The only Canadian species of the genus lays its eggs free in the ends of the tunnels, and its larvæ apparently do not cut cradles.*

The tunnels and cradles of Ambrosia beetles are lined with a fungus used for food and usually characteristic of the beetle species, or at least of allied groups of species. As this subject is to be discussed in greater detail elsewhere, it is sufficient here to observe that all Ambrosia beetle tunnels are characterized by the presence of one species of these fungi during the egg-laying season, and later contain, in addition, numerous saprophytic as well as parasitic forms. The tunnel walls are invariably stained brown or black by the action of the Ambrosia fungus upon the wood.

THE VENTILATION TUNNELS.

These are short tunnels cut at intervals along the roof of elongate egg-tunnels in certain species of *Dendroctonus* and *Ips*, directed outward towards or to the outer surface of the bark (Pl. 2, fig. 3). The length of these ventilation tunnels depends upon the thickness of the bark overlying the egg-tunnel, and may vary from a millimetre, or less, to more than an inch. They serve as turning-niches and storage-places for boring-dust, and in some measure may increase the air circulation within the egg-tunnels. Many such tunnels that I have examined ended bluntly in the outer layers of bark, and could only serve as turning-niches, storage-tunnels, and to increase the body of air available for the beetles. With certain species, as *Dendroctonus simplex* Lec., the long egg-tunnel is often blocked in places with boring-dust, so that these ventilation-tunnels are perhaps useful, in such cases, for air circulation, but are certainly necessary as turning niches for the female.

*According to Chamberlain, Or. Ag. Exp. Sta. Bul. 147, 1918, the larvæ of this species also cut cradles shortly before pupating.

PLATE 2.

TYPES OF EGG TUNNELS.

Fig. 1, Forked, longitudinal.

Fig. 2, Simple, longitudinal.

Fig. 3, Radiate, typical.

Fig. 4, Cave-tunnel.

Fig. 5, Radiate, modified; *Ips confusus* Maanh.—e.h., entrance hole; e.p., egg-pocket; e.t., egg tunnel; l.g., larval gallery; n.c., nuptial chamber.

Fig. 6, Irregular, short.

Fig. 7, Radiate, transverse.

Fig. 8, Forked, transverse.

Fig. 9, Radiate, longitudinal.

Fig. 10, Forked transverse, with larval mines, *Phthorophloeus*.

Fig. 11, Radiate, egg-tunnels commenced, *Ips pini* Say, from below.

Fig. 12, Ambrosia tunnels, simple, horizontal.

Fig. 13, Ambrosia tunnels, compound, social gallery, *X. saresceni* Ratze.

Fig. 14, Ambrosia tunnels, compound, with cradles, *Pterocyclon mali* Fitch.

Fig. 15, Pith tunnels, *Micracis*.

Fig. 16, Ambrosia tunnels, compound, with cradles, *Gnathotrichus*.

Figs. 17, 18, Ambrosia tunnels, simple, vertically branched; *Anisandrus*.