niche, reversed her position, and advanced head foremost into the tunnel to continue excavation and cover the egg with boring-dust. As the tunnel was by this time covered with celluloid, she first proceeded to close the cracks between it and the edges of the tunnel with boring-dust.

### Removing the Boring-dust.

In removing the boring-dust, the female scrapes it backward with the mandibles, which make a very efficient hoe. If she wishes to pack boring-dust into egg-niches or to fill cracks in the tunnel wall, the dust is pushed forward with the mandibles and packed by them into the proper position, but when ejecting boring-dust from the tunnel it is always scraped backward, first with the mandibles and then with the legs, working it beneath and behind the body. By moving backward and at the same time revolving in the tunnel, the insect is able to remove the dust without difficulty, and to eject it into the nuptial-chamber, or to extrude it through the exit hole. The tarsi are retracted more or less, and the outer edge of the tibiæ is used much in locomotion, and particularly in removing the boring-dust. The armature of the tibiæ, of course, assists considerably in both operations.

### A Method for Studying Habits.

(Pl. 4, fig. 6).

In studying the habits of Ipidæ, it becomes necessary to devise some method of watching the beetles at work. All their operations, with the exception of cutting the entrance-hole, are performed beneath the protecting cover of bark; and when the latter is largely removed they invariably cease work almost immediately and either leave the tunnels or retire to the uncovered portions. If the tunnels, with the beetles in them, are covered in the proper way with glass, celluloid, or mica, the excavation may be continued and much of the work may be observed. We have secured best results with smaller species working in thin bark, such as *P. hopkinsi* Sw., by removing the bark over the nuptial-chamber and a part of an egg-tunnel, and immediately pinning thereover

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### PLATE 5

### BARK-BEETLE TUNNELS (Original).

Fig. 1, *Pityokteines sparsus* Lec.; egg-tunnels in balsam fir; wood surface; twice natural size.
Fig. 2, *Dendroctonus obesus* Mannh.; tunnels in Sitka spruce bark; very much reduced.
Fig. 3, *Pityophthorus canadensis* Sw.; Pupal cells in pine, showing larva and pupa in position; about natural size.
Fig. 4, *Hylastinus obscurus* Mannh.; tunnels in red clover roots, showing a beetle, and the eggs in place in the niches; about natural size.
Fig. 5, *Phloeosinus canadensis* Sw.; tunnels in arbor vitae, wood surface; two-thirds natural size.
Fig. 6, *Hylurgopinus rufipes* Eichh.; tunnels in elm, inner surface of bark; about natural size.
Fig. 7, *Phthorophloeus liminaris* Harr.; tunnels in peach limb, showing a portion of the brood; one-half natural size.
Fig. 8, *Leperisinus aculeatus* Say; tunnels in ash, showing the brood in position; about natural size.
Fig. 9, *Pityophthorus nudus* Sw. tunnel in pine, wood surface; twice natural size.
Fig. 10, *Pityophthorus canadensis* Sw.; pupal cells in pine twig, showing full grown larvæ and pupae; natural size.
Fig. 11, *Phloeosinus canadensis* Sw.; tunnels in arbor vitae, showing eggs in situ; one and one-fourth natural size.