

at an average of \$5,000,000 per year; by bark and timber beetles of the Scolytidae family causing defective wood in felled timber, \$1,000,000, and by the same in timber injured by fires and other causes, \$1,000,000; by the Columbian timber beetle to standing and living timbers, an average of \$1,000,000 per year; by the oak timber worms and the carpenter worms to the different species of oak, an average of \$2,000,000 per year; to chestnut timber by the chestnut timber worm, which is rendering one of the most valuable woods almost worthless, an average of \$1,000,000; by wood borers of the family Cerambycidae to standing timber injured by fire, \$2,000,000; to felled timber and saw logs by the same kind of insect, \$2,000,000; by other wood-infesting insects to standing and felled timber, \$2,000,000; by foliage-infesting insects to living forest and shade trees, \$3,000,000; by the white pine weevil, plant lice, scale insects, etc., to young forest growth, \$1,000,000; by the powder-post beetles (Ptinidae) to forest products, such as seasoned handles, spokes, hoop-poles, building material, etc., \$100,000, and by miscellaneous insects not included in the above estimates, \$3,000,000—a total of \$25,000,000 direct annual loss from insect ravages, which is without doubt a low estimate.

To the above could be added the loss to manufacturers in manufacturing and disposing of defective material, to consumers from the use of the same, and to the indirect loss to the country in the diminished forest area due to insect ravages; all of which, could it be estimated in dollars and cents, would doubtless equal at least ten per cent. of the total value of the annual forest products of wood material in this country, or about \$100,000,000 annually.

#### WITH FURTHER KNOWLEDGE ON THE SUBJECT MUCH OF THE LOSS CAN BE PREVENTED.

Probably one of the principal reasons why the economic study of forest insects has been neglected in this country is the prevalent belief that few, if any, practical methods can be found to prevent loss from their injuries. It is true the methods used to prevent loss from the attack of farm, garden, and fruit insects can not, as a rule, be successfully used against those affecting forest growth; neither can many of the successful European methods of combating forest insects be adopted in this country. But there are simple, practical methods known which, if better understood by forest owners and manufacturers of forest products and properly applied by them, would prevent the annual loss of many millions of dollars' worth of timber.

Some of the results recently obtained and facts determined in the investigations now in progress in West Virginia in reference to the proper time to fell timber to prevent detrimental injury by insects, the utilization of defective material to the best advantage, and the introduction of predaceous and parasitic insects to prevent the undue increase of destructive species lead us to believe that many of the more serious troubles can be easily controlled when we learn more of the habits of the insects and the various conditions, favorable and unfavorable, for their development.

#### ADDITIONAL KNOWLEDGE AND MORE SPECIAL, ORIGINAL WORK NECESSARY.

Further original research and additional published knowledge are sadly needed in this branch of economic entomology. As compared with the knowledge of insects affecting other economic plants, scarcely anything is known of the life history and habits of even our commonest forest-tree insects. Consequently, the field for original work in forestry entomology is a broad one, rich in interesting material as well as in possibilities of important discoveries.

One of the most important aids toward advancement would be, in our opinion, carefully prepared monographs of the insects known to infest the different economic forest trees, on a similar plan to that adopted by Professor Forbes in his recently issued part of "A Monograph of insects injurious to Indian Corn."

Previous to the undertaking of work of this kind, however, further knowledge is necessary in reference to the food habits of the insects found upon or within the different host plants, and whether they are destructive, detrimental, beneficial, or neutral in their