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Annotated Bibliography of the Carpenterworm, *Prionoxystus robiniae*

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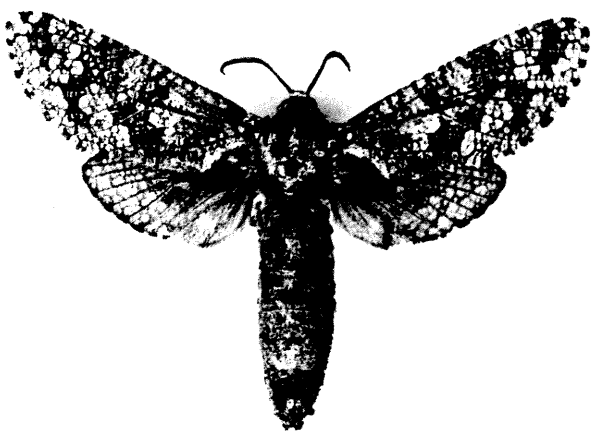

Southern Forest Experiment Station
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Annotated Bibliography of the Carpenterworm, *Prionoxystus robiniae*

J. D. Solomon[1] and C. J. Hay[2]

This bibliography has been prepared for entomologists, foresters, pest control personnel, and others who wish to refer to literature on the carpenterworm, *Prionoxystus robiniae* Peck (Lepidoptera: Cossidae).

The insect, the larvae of which cause severe economic loss by tunneling in the trunks of hardwood timber trees, was originally described in 1818 and named *Cossus robiniae*. The generic name was subsequently changed to *Xyleutes* Harris, then to *Xystus* Grote, and finally to *Prionoxystus* Grote. Common names include locust moth, locust cossus, locust carpenter moth, goat moth, carpenter moth, carpenter borer, locust tree borer, ash tree borer, and oak carpenterworm.

The carpenterworm is a native of North America and is widely distributed throughout the United States and southern Canada. In the Eastern and Southern U.S. the oaks are its principal hosts. Here and elsewhere, however, green ash, black locust, elm, maple, willow, cottonwood, and occasionally fruit trees and ornamentals are attacked.

The larvae hatch from eggs laid in crevices on the bark and promptly enter first the inner bark and then the sapwood. The larval stage may be completed within 1 or 2 years in the South, but may continue for 3 or 4 years elsewhere. The adult is a large grey moth. Fully grown larvae may be 12 mm in diameter, and their tunnels in the sapwood cause much loss from degrade when infested trees are sawn into lumber.

Over the years, considerable literature has developed. Early contributions were primarily descriptive, and dealt mostly with systematics and with damage and control in shade trees. Only within the past few decades has the carpenterworm's great importance in hardwood forest stands been recognized.

No previous attempt has been made to compile a complete bibliography, but Munro and Fox (1934) included 48 references in their paper on biology and control. The present bibliography is arranged in alphabetical order by author and is intended to cover all technical literature through 1972. Most annotations summarize the salient information in each publication but for literature that presents only brief or general treatment the annotation consists of a few keywords to characterize the content. Citations from USDA Cooperative Economic Insect Reports are presented in abbreviated form on page 2.

Readers who are beginning a study of the carpenterworm are particularly directed to papers by Hay, Morris, Munro, and Solomon. Older publications deserving attention are those by Burke, Doten, Felt, Fetch, Grote, and Packard. Information on specific aspects of the insect may be located through the subject index.

The initial sources of reference were the authors' files and the various forestry and entomological journals. Other important sources were *Biological Abstracts*, *Forestry Abstracts*, *Review of Applied Entomology*, *Zoological Record*, and *Index to the Literature of American Economic Entomology*. Citations in specific publications provided additional titles. Though considerable care was taken, there probably are omissions; notification of these will be appreciated.

Some of the references deal with uses of pesticides no longer approved by the U. S. Department of Agriculture. Before any pesticide is applied, its current registration should be checked with responsible State or Federal authorities.

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Tabulated annotations from USDA Cooperative Economic Insect Reports

Year	Vol., issue, and page No.	Hosts	State	Comment
1954	4(9):179	Turkey oak	Fla.	Death of several trees
	4(21):434	Oaks	N. Car.	Damaging trees
	4(27):612	Oaks	Va.	Dead and dying trees, most infested
	4(38):873	Oaks	Miss. & Va.	Damaging trees
	4(49):1062	Pecan	Tex.	Light to medium infestation
1956	6(52):1145	Shelterbelt trees	Mont.	Becoming of economic importance
1957	7(23):447	Oaks	Miss.	Damaging trees
1958	8(6):98	Pecan	S. Car.	Extremely serious damage
1959	9(3):24	Ash, cottonwood, elm boxelder, Chinese elm	Mont.	Attacks noted
	9(24):511	Pecan	S. Car.	15-20 large holes noted in some trees
	9(34):794	Elm	Calif.	A local problem
	9(48):1021	Calif. black oak	Calif.	Severe damage and killing
1960	10(15):250	Oak	Calif.	Medium infestation
	10(26):566	Elm	S. Dak.	Attacks noted
	10(35):813	Elm	Calif.	Medium infestation
	10(45):1055	Chinese elm	Calif.	Heavy infestation
1961	11(29):668	Ash	N. Dak.	Killing trees in 7-year-old shelterbelt
	11(43):1004	Shelterbelt trees	Mont.	Severe damage
1962	12(7):82	Pecan	Ala.	Moderate 20A infestation
	12(14):310	Calif. live oak	Calif.	Locally heavy
1962	12(14):329	Ash	N. Dak.	Severe infestations
	12(26):710		N. Dak.	Male moths taken at light trap
1963	13(3):29	Coast live oak	Calif.	Increase in infestation during 1962
1964	14(11):192	Peaches	Calif.	Medium infestation
	14(16):346	Poplar and oak	N. Dak.	Some damage in shelterbelts
		Shade trees and ornamentals	Colo.	Noted as a pest
	14(26):695	Ash	N. Dak.	Attacks noted
	14(31):870	Cherry	Wash.	Attacking winter-injured trees
	14(31):889	Oaks	Ind.	Considerable damage
	14(35):1003	Elm	Colo.	Attacks noted
1965	15(12):223	Cherry	Wash.	Damaging winter-injured trees
	15(16):354	Oaks	Central States	Damage and degrade severe
	15(20):486	Ash	Calif.	Pupae heavy locally in trunks
	15(51):1325	Boxelder	Calif.	Larvae heavy locally in trunks
1967	17(14):261-2	Hardwoods	Mo.	Serious log and lumber degrader
			Mont.	Abundant
		Cottonwood, walnut, ash	Calif.	Damage noted
	17(16):311	Pecan	Ga.	Heavy infestations
1968	18(13):246	Deciduous trees	Mont.	Destructive pest of deciduous trees
1969	19(13):229	Shade trees		
	19(26):476		Mont.	Increasing number
		Elms	Neb.	Severe larval damage
1969	19(36):706	Willows	Calif.	Heavy damage
1970	20(14):222	Shelterbelt plantings and ornamental trees	Mont.	Major pest
1971	21(16):284	Hardwoods	Mo.	Most destructive borer
	21(24):416	Green ash and Siberian elm	S. Dak.	Heavy damage

1. Anonymous. 1971. CONTROL OF BORERS IN PLANTED TREES IN THE PRAIRIE PROVINCES. Can. Dep. Agric. TN Pam. 2, 15 p.
The carpenterworm is a serious pest of trees planted for shade, ornamental, and windbreak purposes. Information on hosts, damage, signs of attack, stages, life cycles, prevention, and control.

2. Abrahamson, L. P., and McCracken, F. I. 1972. INSECT AND DISEASE PESTS OF SOUTHERN HARDWOODS. *In* Proc., Southeast. Hardwood Symp. (1971), p. 80-89. USDA For. Serv., Southeast. Area State and Priv. For., Atlanta, Ga.
In the Midsouth, carpenterworms spend up to 2 years constructing 6-inch long galleries in the trunks of oaks. The female sex pheromone is being investigated as a potential control.

3. Anderson, R. F. 1960. FOREST AND SHADE TREE ENTOMOLOGY, p. 325-327. Wiley & Sons, N.Y.
Biology, damage, and control.

4. Bailey, J. S. 1883. ON SOME OF THE NORTH AMERICAN COSSIDAE, WITH FACTS IN THE LIFE HISTORY OF COSSUS CENTERENSIS LINTNER. *In* USDA Div. Entomol. Bull. 3, p. 49-55, plates I, II.
P. robiniae *attacks oak, willow, and locust from California east to New York. Forms of* P. robiniae *are discussed.*

5. Baker, W. L. 1972. EASTERN FOREST INSECTS, p. 388-389. USDA Misc. Pub. 1175.
Biology, damage, control.

6. Barnes, W., and Benjamin, F. H. 1923. PRIONOXYSTUS ROBINIAE. Contrib. Nat. Hist. Lepid. N. Am. 5: 94-95.
Specimens vary little in appearance within a locality but show remarkable variation among geographic areas. Three races are described: mixtus, subnigrus, *and* flavotinctus.

7. Barnes, W., and McDunnough, J. H. 1911. REVISION OF THE COSSIDAE OF NORTH AMERICA. Contrib. Nat. Hist. Lepid. N. Am. 1(1): 3-35.
Two subfamilies of Cossidae, Hypoptinae and Zeuzerinae, are given and P. robiniae *is placed in Zeuzerinae. Systematics of the Cossidae are discussed and a key to the genera of the two subfamilies is presented.*

8. Beal, J. A. 1957. INSECT RESEARCH TO INSURE AND MAINTAIN TIMBER QUALITY. *In* Proc. Timber Quality Conf., p. 1-12. USDA For. Serv. For. Prod. Lab., Madison, Wis.
The greatest impact of trunk-boring insects on quality material is among the hardwoods in the eastern half of the country, especially in the Mississippi Valley. Research on controls is urgently needed.

9. Beal, J. A., Haliburton, W., and Knight, F. B. 1952. FOREST INSECTS OF THE SOUTHEAST: With special reference to species occurring in the Piedmont Plateau of North Carolina, p. 64-66, plate 12. Duke Univ. Sch. For. Bull. 14.
The carpenterworm has attracted most attention as a pest of shade and ornamental trees, but it also does much damage in forest stands. Briefly describes life stages, biology, hosts, and damage.

10. Blickenstaff, C. C. 1970. COMMON NAMES OF INSECTS, p. 4. Entomol. Soc. Am. Comm. on Common Names of Insects.
The approved common name of P. robiniae *is "carpenterworm."*

11. Boisduval, J. A. 1852. LEPIDOPTERES DE LA CALIFORNIE. Ann. Soc. Entomol., ser. 2, 10: 323.
Description, hosts.

12. Borror, D. J., and DeLong, D. M. 1954. INTRODUCTION TO THE STUDY OF INSECTS, p. 533. Holt, Rinehart, and Winston, N.Y.
Biology, key.

13. Borror, D. J., and White, R. E. 1970. A FIELD GUIDE TO THE INSECTS OF AMERICA NORTH OF MEXICO, p. 242-243, plate 12. Houghton Mifflin Co., Boston.
Description.

14. Boyd, W. M. 1945. INJURIOUS INSECTS OF NEW JERSEY NURSERIES, p. 138-139. N. J. Dep. Agric. Circ. 355.
Biology, damage.

15. Boyd, W. M. 1953. INSECTS OF IMPORTANCE IN NEW JERSEY NURSERIES, p. 167-168. N. J. Dep. Agric. Circ. 390.
Biology, damage, control.

16. Brimley, C. S. 1938. THE INSECTS OF NORTH CAROLINA, p. 313. N. C. Dep. Agric. Div. Entomol., Raleigh.
Moth emergence, distribution.

17. Britton, W. E. 1926. BORERS IN RELATION TO CAVITIES IN TREES. Tree Talk 7: 11-13.
P. robiniae *makes large cylindrical galleries in the trunks of ash, elm, oak, maple, and locust. Wounds should be dressed promptly to promote healing and prevent decay.*

18. Britton, W. E. 1933. PLANT PEST HANDBOOK FOR CONNECTICUT, I. Conn. Agric. Exp. Stn. Bull. 344, p. 126.
Damage, hosts.

19. Bromley, S. W. 1944. CONTROLLING BORERS IN TREES. Horticulture 22: 412.
Can be controlled by "cutting out," fumigation of galleries, and wrapping trunks.

20. Brown, H. P., and Panshin, A. J. 1940. COMMERCIAL TIMBERS OF THE UNITED STATES, p. 283-285. McGraw-Hill, N.Y.
Impact.

21. Brown, L. R., and Eads, C. O. 1965. A TECHNICAL STUDY OF INSECTS AFFECTING THE OAK TREE IN SOUTHERN CALIFORNIA, p. 60-63. Calif. Agric. Exp. Stn. Bull. 810.
Illustrated description of carpenterworm life stages with notes on life history. Control measures include mechanical methods (such as poking into tunnels with a wire), application of a chemical or spray, and injection of a fumigant into the tunnels.

22. Browne, F. G. 1968. PESTS AND DISEASES OF FOREST PLANTATION TREES, an annotated list of the principal species occurring in the British Commonwealth, p. 587-588. Clarendon Press, Oxford.
Distribution.

23. Bryan, W. C. 1958. DEFECT IN PIEDMONT HARDWOODS. USDA For. Serv., Southeast. For. Exp. Stn. Res. Notes 115, 2 p.
From 55 to 76 percent of oaks sampled had defects caused by borers. The percent of incidence of borer-damaged trees on various sites was as follows: ridge 26, slope 40, cove 32, and lowland or bottom 32.

24. Bryan, W. C. 1960. LOSSES FROM DEFECT IN PIEDMONT HARDWOODS. USDA For. Serv., Southeast. For. Exp. Stn., Stn. Pap. 109, 31 p.
Exclusive of growth defects, the most common source of hardwood defect was insect borers. Losses from insect-caused defects were least in cove sites, in stands of high basal area, and in trees of high vigor.

25. Burke, H. E. 1921. NOTES ON THE CARPENTERWORM (PRIONOXYSTUS ROBINIAE PECK) AND A NEW METHOD OF CONTROL. J. Econ. Entomol. 14: 369-372.
The carpenterworm is one of the worst pests of native live oak (Quercus agrifolia) *and introduced elm* (Ulmus campestres) *in California. For protection, placing a "knock down" screen cage around the trunk of shade trees from May through July is suggested.*

26. Burns, D. P. 1971. INSECTS THAT HURT THE BOURBON STAVE INDUSTRY. Wooden Barrel 38(6): 6-9, 12, 13.
Insect damage in white oak caused the rejection of 1.3-11.4 percent of the staves and stave blanks cut at three mills in Ohio. Grubs were most detrimental to logs of small diameter.

27. Chamberlin, W. J. 1953. INSECTS AFFECTING FOREST PRODUCTS AND OTHER MATERIALS, p. 29-31. Coop. Assoc. Rep., Oregon State Coll., Corvallis.
Systematics, description.

28. Chapman, J. W. 1911. THE LEOPARD MOTH AND OTHER INSECTS INJURIOUS TO SHADE TREES IN THE VICINITY OF BOSTON, p. 41. Bussey Inst., Harvard Univ., Contrib. Entomol. Lab.
Habits of carpenter moth and leopard moth are compared.

29. Chellmann, C. W. 1971. INSECTS, DISEASES AND OTHER PROBLEMS OF FLORIDA'S TREES, p. 27-29. Fla. Dep. Agric. Bull. 196.
The carpenterworm is not considered a serious forest pest in Florida. Habits, signs of attack, control.

30. Childs, L. 1914. OAK PESTS—THE CARPENTERWORM. Mon. Bull. Calif. State Comm. Hort. 3: 259-264.
California live oaks, poplars, willows, locusts, and elms are badly damaged. The adult is known in many places as the goat moth, so named because of its odor. Life history, distribution, and control.

31. Chu, H. F. 1949. HOW TO KNOW THE IMMATURE INSECTS, p. 156. Wm. C. Brown Co., Dubuque, Iowa.
Pictorial key.

32. Comstock, J. H. 1966. AN INTRODUCTION TO ENTOMOLOGY, p. 601-604. Comstock Pub. Associates, N.Y.
Biology, damage, distribution, systematics.

33. Comstock, J. H., Comstock, A. B., and Herrick, G. W. 1938. A MANUAL FOR THE STUDY OF INSECTS, p. 194, 196-197. Comstock Publ. Co., Ithaca, N. Y.
Description.

34. Cotton, E. C. 1906. THE LOCUST TREE CARPENTER-MOTH (PRIONOXYSTUS ROBINIAE PECK), p. 12-14. Ohio Nurs. Orch. Suppl. Bull. 7.
Much of the damage attributed to the locust borer is actually that of the carpenterworm.

35. Craighead, F. C. 1950. INSECT ENEMIES OF EASTERN FORESTS, p. 366, 497-502. USDA Misc. Pub. 657.
Biology, damage, key, control.

36. Dean, G. A. 1920. INSECT ENEMIES OF SHADE TREES AND ORNAMENTALS. *In* Kans. Hort. Soc. Bien. Rep. 35: 159-160.
Life history, control.

37. Doane, R. W. 1912. SOME INSECT PESTS OF CALIFORNIA LIVE OAKS. J. Econ. Entomol. 5: 346-348.
Introduction of carbon bisulphide into the galleries controlled the larvae.

38. Doane, R. W., Van Dyke, E. C., Chamberlin, W. J., and Burke, H. E. 1936. Forest Insects, p. 319-329. McGraw-Hill, N.Y.
Biology, damage, distribution.

39. Dolphin, R. E., Mouzin, T. E., and Cleveland, M. L. 1972. INSECTS ASSOCIATED WITH PEACH WOOD IN EASTERN UNITED STATES. Can. Entomol. 104: 1593-1608.
Host.

40. Donley, D. E., Hay, C. J., and Burns, D. P. 1969. BORERS IN OHIO OAKS. Ohio Woodlands 7: 17-18.
Causes degrade in both red and white oaks. Galleries start at a wound or an old borer gallery. They may be 1 inch in diameter and are always stained dark brown or black.

41. Doten, S. B. 1900. THE CARPENTERWORM. Nev. Agric. Exp. Stn. Bull. 49, 13 p.
A native of this country and very common in willow and wild cottonwoods in Nevada. Information on the appearance of the insect, recognition of damage, biology, and control. Woodpeckers devour the larvae.

42. Duncan, C. D., and Pickwell, G. 1939. THE WORLD OF INSECTS, p. 75-76. McGraw-Hill, N.Y.
Biology.

43. D'Urban, W. S. M. 1860. A SYSTEMATIC LIST OF LEPIDOPTERA COLLECTED IN THE VICINITY OF MONTREAL. Can. Nat. and Geol. 5(4) : 247.
Lists Cossus plagiatus *Walker in the family Zeuzeridae. Rare, collected in July.*

44. Dyar, H. G. 1902. LIST OF NORTH AMERICAN LEPIDOPTERA, p. 362-363. U.S. Nat. Mus. Bull. 52.
Lists Prionoxystus robiniae *and a variety* quercus. *Also lists as synonyms* plagiatus *Walker,* crepera *Grote,* reticulatus *Lintner, and* zabolicus *Strecker.*

45. Dyar, H. G. (rev. W. Schaus). 1937. FAMILY: COSSIDAE. MACROLEP. (ed. A. Seitz), p. 1263-1287. A. Kernen, Stuttgart.
Systematics. Includes list of the original descriptions of the American forms of Cossidae.

46. Ebel, B. H. 1967. PIEDMONT HARDWOODS—WHICH DO WOOD BORERS DAMAGE? South. Lumberman 215(2680) : 113-114.
In a mill-yard study in the Georgia Piedmont, 25 to 47 percent of the log ends of several species of oak showed insect-caused defects that were attributed largely to carpenterworms and cerambycid borers.

47. Ebel, B. H., Merkel, E. P., and Kowal, R. J. 1972. KEY TO DAMAGE OF SOUTHERN FOREST TREES BY INSECTS. For. Farmer 31(7) : 31-36.
Key to insect damage.

48. Edwards, H. 1891. INGUROMORPHA SLOSSONII HY. EDWARDS. Entomol. News 2: 71-72.
Discusses the synonymy of several cossid species and states that Cossus plagiata *is a synonym of* Prionoxystus robiniae.

49. Ehrmann, G. A. 1893. VARIETY OF PRIONOXYSTUS ROBINIAE. Can. Entomol. 25: 257.
P. robiniae *var.* quercus *is based largely on the following description: "The whole of the sub-central inner space of the secondaires (edging on the discoidal cell) in the female is semi-transparent orange, similar to that in the male."*

50. Essig, E. O. 1926. INSECTS OF WESTERN NORTH AMERICA, p. 753-754. MacMillan Co., N.Y.
Biology.

51. Essig, E. O. 1931. A HISTORY OF ENTOMOLOGY, p. 732, 926. MacMillan Co., N.Y.
Hosts.

52. Essig, E. O. 1942. COLLEGE ENTOMOLOGY, p. 444-445. MacMillan Co., N.Y.
Biology.

53. Essig, E. O. 1958. INSECTS AND MITES OF WESTERN NORTH AMERICA, p. 753-754. MacMillan Co., N.Y.
Biology, control.

54. Felt, E. P. 1905. INSECTS AFFECTING PARK AND WOODLAND TREES, p. 79-84. N. Y. State Mus. Mem. 8, vol. 1.
The carpenterworm produces serious deformities and thus renders trees unsightly. Information on early history of the insect, habits, description, distribution, hosts, and remedial measures.

55. Felt, E. P. 1930. MANUAL OF TREE AND SHRUB INSECTS, p. 33-35. MacMillan Co., N.Y.
Biology, damage, control.

56. Felt, E. P. 1942. BORERS OF SHADE AND ORNAMENTAL TREES. Trees 5(3) : 6, 8.
The carpenterworm, a serious pest on the West Coast, is credited with killing more oaks than any other insect. Practical control consists of either cutting the borers out or injecting an insecticide into the gallery.

57. Felt, E. P., and Rankin, W. H. 1932. INSECTS AND DISEASES OF ORNAMENTAL TREES AND SHRUBS, p. 154-155, 295, 325-326, 359. MacMillan Co., N.Y.
Biology, importance, control.

58. Fenton, F. A. 1939. CONTROL OF SHADE TREE BORERS, p. 22-24. Okla. Agric. Exp. Stn. Circ. 84.
In Oklahoma, the carpenterworm has been recorded only from Payne County, but is probably distributed throughout the eastern half of the State. The insect and its damage are described and control procedures are given.

59. Fernald, H. T. 1942. APPLIED ENTOMOLOGY. p. 231-233. McGraw-Hill, N.Y.
Damage, habits.

60. Filmer, R. S. 1945. WHAT ABOUT BORER CONTROL? Home Gard. 6(3) : 91-95.
Symptoms, control.

61. Fitch, A. 1859. REPORT ON THE NOXIOUS INSECTS OF THE STATE OF NEW YORK, p. 4-11. Fifth Rep., Trans. N. Y. State Agric. Soc.
The locust cossus, Cossus robiniae, *bores large holes in the solid wood of oaks and other trees, admitting air and moisture and causing their decay. The early systematics are discussed and the common name "locust cossus" is proposed. General information on its biology and control are given.*

62. Forbes, W. T. M. 1923. THE LEPIDOPTERA OF NEW YORK AND NEIGHBORING STATES, p. 516-520. Cornell Univ. Agric. Exp. Stn. Mem. 68.
Systematics.

63. Fowells, H. A. 1965. SILVICS OF FOREST TREES OF THE UNITED STATES, p. 579, 594-595, 601, 613, 617, 624, 630, 639. USDA Agric. Handb. 271.
Hosts.

64. Fox, A. C. 1933. EFFECTS OF THE CARPENTERWORM ON THE ASH TREE. Masters' thesis, N. Dak. Agric. Coll., Fargo, 59 p.
Green ash and several other hosts are damaged. Eggs are laid singly or in masses and hatch in 11-14 days. Birds aid in natural control. Fumigation of the galleries is the most practical control.

65. Fracker, S. B. 1941. THE CLASSIFICATION OF LEPIDOPTEROUS LARVAE, p. 39, 78-79. Contrib. Entomol. Lab. Univ. Ill. 43.
Systematics.

66. Fraser, J. P. 1928. DEFECTS IN TIMBER. Timber Trades J. 104: 87-88, 137.
Defines defects referred to in the grading rule book of the National Hardwood Lumber Association.

67. Frost, S. W. 1942. GENERAL ENTOMOLOGY, p. 218, 381, 385. McGraw-Hill, N.Y.
Tunneling habits.

68. Frost, S. W. 1959. INSECT LIFE AND INSECT NATURAL HISTORY, p. 380-385. Dover Publications, N.Y.
Tunneling habits, frass, damage.

69. Garman, H. 1916. THE LOCUST BORER (CYLLENE ROBINIAE) AND OTHER INSECT ENEMIES OF TH BLACK LOCUST, p. 122-123. Ky. Agric. Exp. Stn. Bull. 200.
Carpenterworms were found in the burrows of the locust borer. Habits are briefly described.

70. Gass, R. D. 1967. INSECT AND DISEASE PESTS OF EASTERN COTTONWOOD IN MISSOURI, p. 10-11. Mo. Dep. Conserv., For. Div. Rep.
There is no satisfactory control for the carpenterworm under plantation conditions.

71. Gass, R. D. 1971. For. Div. Mo. Conserv. Comm. For. Pest Rep. 10, p. 3.
Borers, primarily the carpenterworm and red oak borer, Enaphalodes rufulus, *cause an annual loss of $328,000 in Missouri hardwood timber.*

72. Genaux, C. M., and Kuenzel, J. G. 1939. DEFECTS WHICH REDUCE QUALITY AND YIELD OF OAK-HICKORY STANDS IN SOUTHEASTERN IOWA, p. 437-441. Iowa Agric. Exp. Stn. Res. Bull. 269.
Hosts, importance.

73. Gesell, S. G. 1954. INSECT PESTS OF DECIDUOUS SHADE TREES AND THEIR CONTROL, p. 14-15. Pa. Agric. Ext. Serv. Circ. 427.
Biology, injury, control.

74. Gilbertson, G. I. 1915. A SERIOUS TREE PEST. Dakota Farmer 35: 1048.
The insect is a serious pest of South Dakota's shade trees.

75. Gillette, C. P. 1905. INSECTS OF THE YEAR IN COLORADO, p. 59. USDA Bur. Entomol. Bull. 52.
Importance, hosts.

76. Gillette, C. P., and List, G. M. 1918. NINTH ANNUAL REPORT OF THE STATE ENTOMOLOGIST, p. 13. Colo. Circ. 26.
Predicts that black locust will be destroyed in Denver and Boulder Counties by P. robiniae. *Nurserymen in the infested sections have been forbidden to ship black locust.*

77. Girault, A. A. 1913. FRAGMENTS ON NORTH AMERICAN INSECTS—IV. Entomol. News 24: 195.
An incubation period of 15 days was required for eggs deposited by a female moth captured June 2 at a light in Blacksburg, Virginia.

78. Graham, S. A. 1939. PRINCIPLES OF FOREST ENTOMOLOGY, p. 254-256. McGraw-Hill, N.Y.
Biology, damage, control.

79. Graham, S. A., and Knight, F. B. 1965. PRINCIPLES OF FOREST ENTOMOLOGY, p. 356-357. McGraw-Hill, N.Y.
Biology, damage, distribution.

80. Grote, A. R. 1874. LIST OF THE NORTH AMERICAN PLATYPTERICES, ATTACI, HEMILEUCINI, CERATOCAMPADAE, LACHNEIDES, TEREDINES, AND HEPIALI, WITH NOTES. Proc. Am. Philos. Soc. 14: 256-264.
The insect (type species: Cossus robiniae*) is placed in the genus* Xystus. *The genus name* Xyleutes *of Hubner cannot be used, because it was originally applied to none of these species. Range of the insect includes Canada, eastern and middle U.S., and California.*

81. Grote, A. R. 1882. NEW CHECK LIST OF NORTH AM. MOTHS, p. 21. N.Y. Entomol. Club.
Systematics.

82. Grote, A. R. 1896. NOTE ON PRIONOXYSTUS ROBINIAE. Can. Entomol. 18: 98-99.
Systematics, habits.

83. Hamilton, C. C. 1933. THE CONTROL OF INSECTS BORING IN ORNAMENTAL SHRUBS AND TREES, p. 70. *In* Proc. Ninth Natl. Shade Tree Conf.
Control by injecting a fumigant into the burrows.

84. Hampson, G. F. 1892. THE MOTHS OF INDIA. Vol. I, p. 304. Francis & Taylor, London.
Entry not seen, taken from Munro and Fox (1934). Description.

85. Harris, T. W. 1835. A CATALOGUE OF THE ANIMALS AND PLANTS OF MASSACHUSETTS, p. 71-73. Adams & Adams Publishers, Amherst.
Entry not seen, taken from Lintner (1875). Systematics.

86. Harris, T. W. 1841. INSECTS OF MASSACHUSETTS INJURIOUS TO VEGETATION, p. 294-297. Folsom, Welk, and Turston, Printers to Univ. of Cambridge, Mass.
Biology, description, systematics.

87. Haseman, L. 1936. CONTROLLING BORERS OF FRUIT, FOREST, AND SHADE TREES, p. 21-22. Mo. Agric. Exp. Stn. Bull. 373.
The carpenterworm is one of the largest borers in Missouri's timber, but seems to be less important than the cerambycid borers. Notes on biology and control.

88. Hay, C. J. 1968. FRASS OF SOME WOOD-BORING INSECTS IN LIVING OAK (COLEOPTERA: CERAMBYCIDAE: LEPIDOPTERA: COSSIDAE AND AEGERIIDAE). Ann. Entomol. Soc. Am. 61:255-258.
Hand-lens descriptions of extruded dry frass are given for five species. Excrement pellets of the carpenterworm are brown and cylindrical, reaching a maximum length of about 7 mm. When the pellets attain a length of 4-7 mm in fall or spring, emergence can be expected in May, June, or July.

89. Hay, C. J., and Morris, R. C. 1961. (rev. 1970) CARPENTERWORM. USDA For. Serv., For. Pest Leafl. 64, 8 p.
Hosts, evidence of infestation, description, life history, habits, and natural, preventative, and applied control. The 1970 revision omits the recommended use of DDT and chlordane for control.

90. Hay, C. J., and Wootten, J. F. 1955. INSECT DAMAGE IN HARDWOOD SAWLOGS. USDA For. Serv. Cent. States For. Exp. Stn., Tech. Pap. 148, 14 p.
About 88 percent of the oak logs sampled at 19 sawmills in Kentucky had internal insect damage, and 73 percent of the oak boards showed borer injury. Amount of damage increased with size of the tree. Borer tunnels were more numerous in butt than in upper logs.

91. Herbert, F. B. 1919. INSECT PROBLEMS OF WESTERN SHADE TREES. J. Econ. Entomol. 12: 333-337.
Hosts, injury.

92. Herbert, F. B. 1936. INSECT PESTS OF WESTERN OAKS AND THEIR CONTROL. *In* Proc. Third Western Shade Tree Conf., p. 37-38.
The carpenterworm mines in the heart and sapwood of the trunks and larger limbs of coast live oaks and valley oaks, probably causing the death of more oaks than any other insect.

93. Herrick, G. W. 1935. INSECT ENEMIES OF SHADE TREES, p. 165-167, 188, 280. Comstock Publ. Co., Inc., Ithaca, N. Y.
Hosts.

94. Holland, W. J. 1968. THE MOTH BOOK—A GUIDE TO THE MOTHS OF NORTH AMERICA, p. 375-379. Dover Publications, N. Y.
Description.

95. Hollister, W. O. 1920. DISTRIBUTION OF SHADE TREE INSECTS IN 1919. J. Econ. Entomol. 13: 143-147.
Damage, distribution.

96. Hopkins, A. D. 1894. DEFECTS IN WOOD CAUSED BY INSECTS, p. 289-306. West Va. Agric. Exp. Stn. Bull. 35.
Description, damage.

97. Hopkins, A. D. 1910. INSECT INJURIES TO THE WOOD OF LIVING TREES. USDA Bur. Entomol Circ. 126, 4 p.
Damage.

98. Houser, J. S. 1918. DESTRUCTIVE INSECTS AFFECTING OHIO SHADE AND FOREST TREES, p. 329-330. Ohio Agric. Exp. Stn. Bull. 332.
Life history, habits, damage, hosts, distribution, natural enemies, and control.

99. Howard, L. O., and Chittenden, F. H. 1916. THE LEOPARD MOTH: A DANGEROUS IMPORTED INSECT ENEMY OF SHADE TREES, p. 9. USDA Farmers' Bull. 708.
Includes notes on biology and control of P. robiniae.

100. Hutchings, C. B. 1924. A STUDY OF THE PUPAL CASE OF PRIONOXYSTUS MACMURTREI, p. 63-67. Ont. Entomol. Soc. 54th Ann. Rep.
Generic key to the pupae of Cossidae in North America.

101. Imms, A. D. 1957. A GENERAL TEXTBOOK OF ENTOMOLOGY, p. 518, 543. Methuen & Co., Ltd., N. Y.
Systematics.

102. Jaques, H. E. 1947. HOW TO KNOW THE INSECTS, p. 30. W. C. Brown Co. Publishers, Dubuque, Iowa.
Description.

103. Jaynes, R. A. 1969. HANDBOOK OF NORTH AMERICAN NUT TREES, p. 95. W. F. Humphrey Press, Inc., Geneva, N. Y.
Damage, hosts.

104. Johnson, C. W. 1896. THE OAK CARPENTER WORM OR BORER. *In* Pa. Dep. Agric. Ann. Rep. 7, p. 353-355.
Biology, control.

105. Keen, F. P. 1938. (Rev. 1952) INSECT ENEMIES OF WESTERN FORESTS, p. 198-200. USDA Misc. Pub. 273.
Biology, importance.

106. Kellogg, V. L. 1905. AMERICAN INSECTS, p. 385-386, 594. Henry Holt & Co., N. Y.
Description.

107. Kirby, W. F. 1892. A SYNONYMIC CATALOGUE OF LEPIDOPTERA HETEROCERA: Vol. 1. Sphinges and Bombyces, p. 867. Gurney and Jackson, London.
Entry not seen, taken from Barnes and McDonnough (1911). Synonymy.

108. Kotinsky, J. 1921. INSECTS INJURIOUS TO DECIDUOUS SHADE TREES AND THEIR CONTROL, p. 69-70. USDA Farmers' Bull. 1169.
Although carpenterworms rarely kill trees, they cause unsightly deformities. Information on recognition of the insect, damage, seasonal history, prevention, and control.

109. Kowal, R. J., and Ebel, B. H. 1972. INSECTS ATTACKING FOREST TREES IN THE SOUTH. For. Farmer 31 (7): 24-30.
Importance.

110. Lauderdale, J. L. V. 1952. INSECT PESTS OF ORNAMENTALS, p. 17-22. Ariz. State Entomol. Rep. 1950/1951.
Habits, hosts, control.

111. Leonard, M. D. 1926. A LIST OF THE INSECTS OF NEW YORK, p. 570. Cornell Univ. Agric. Exp. Stn. Mem. 101.
Distribution.

112. Levison, J. J. 1908. HOW TO EXTERMINATE TREE BORERS. Gard. Chron. Am. 7 (2): 35-36.
Control.

113. Lintner, J. A. 1875. ON SOME SPECIES OF COSSUS. Rep. N. Y. State Mus. 30: 242-248.
Describes Cossus reticulatus *(a new species),* C. plagiatus *Walker, and* C. crepera *Harris.*

114. Lockard, C. R., Putnam, J. A., and Carpenter, R. D. 1963. GRADE DEFECTS IN HARDWOOD TIMBER AND LOGS. USDA Agr. Handb. 244, 39 p.
Grub holes are grading defects in factory logs because they limit the length of cuttings. They are less important in construction and local-use logs.

115. Lutz, F. E. 1921. FIELD BOOK OF INSECTS, p. 203. G. P. Putnam's Sons, N. Y.
Hosts, systematics.

116. MacAloney, H. J., and Ewan, H. G. 1964. IDENTIFICATION OF HARDWOOD INSECTS BY TYPE OF TREE INJURY, North Central Region, p. 61. USDA For. Serv. Res. Pap. LS-11. Lake States For. Exp. Stn., St. Paul, Minn.
The carpenterworm and its injury to trees are described and hosts are given. The report is designed to help the fieldman without specialized training in entomology to identify the insects causing tree damage.

117. McDaniel, E. I. 1933 (rev. 1936). SOME WOOD BORERS ATTACKING THE TRUNKS AND LIMBS OF DECIDUOUS TREES AND SHRUBS, p. 35-36. Mich. Agric. Exp. Stn. Spec. Bull. 238.
Biology, damage, control.

118. McFarland, N. 1968. A REARING TECHNIQUE FOR SPEEDING UP THE LARVAL STAGES OF SOME ROOT OR STEM BORING LEPIDOPTERA. J. Res. Lepid. 7: 166.
Reared newly hatched carpenterworms to adults on raw potatoes in less than 1 year.

119. McKnight, J. S. 1964. HARDWOOD RESEARCH IN THE SOUTH. J. Soil and Water Conserv. 19(2): 77-78.
Research program.

120. McKnight, M. E., and Tagestad, A. D. 1972. MEGACHILE CENTUNCULARIS IN CARPENTERWORM GALLERY. J. Kans. Entomol. Soc. 45: 51-53.
Carpenterworm galleries provide nesting sites for leafcutter bees.

121. Maisenhelder, L. C. 1951. PLANTING AND GROWING COTTONWOOD ON BOTTOMLANDS, p. 20-21. Miss. Agric. Exp. Stn. Bull. 485.
Carpenterworms deform the tree, weaken small stems, and degrade lumber. Infestations are heaviest on poor sites and in the weaker trees of the stand.

122. Maltais, J. B. 1930. MESURATIONS DE LA CAPSULE CRANIENNE DU VER CHARPENTIER, PRIONOXYSTUS ROBINIAE PECK. Nat. Can. 57: 138-145.
Measurement of a large number of larvae yielded a coefficient of 0.88 mm by Dyar's method. A total of 14 molts were calculated from these data.

123. Matheson, R. 1948. ENTOMOLOGY FOR INTRODUCTORY COURSES, p. 286-287. Comstock Publ. Co., Inc., Ithaca, N. Y.
Life history.

124. Metcalf, C. L., and Flint, W. P. 1932. FUNDAMENTALS OF INSECT LIFE, p. 268. McGraw-Hill, N. Y.
Systematics.

125. Metcalf, C. L., Flint, W. P., and Metcalf, R. L. 1962. DESTRUCTIVE AND USEFUL INSECTS, p. 850-851. McGraw-Hill, N. Y.
Biology, damage, control.

126. Miller, W. E. D. 1967. AN ANNOTATED BIBLIOGRAPHY OF SOUTHERN HARDWOODS. N. C. Agr. Exp. Stn. Tech. Bull. 176, 358 p.
Carpenterworm references.

127. Millers, I. 1971. HARDWOOD BORERS. *In* Forrest Insect Conditions in the United States, 1970, p. 39. USDA For. Serv. Wash., D. C.
A study in Missouri revealed that borers of living hardwood trees cause annual losses of nearly $500,000. Sixty percent of the damage was attributed to the carpenterworm.

128. Milligan, R. H. 1970. OVERSEAS WOOD- AND BARK-BORING INSECTS INTERCEPTED AT NEW ZEALAND PORTS, p. 68. For. Res. Inst. N. Z. For. Serv. Tech. Pap. 57.
Distribution.

129. Mills, H. B. 1941. SHELTER BELT INSECTS, p. 19. Mont. State Ext. Dep. Bull. 194.
Biology, hosts, control, importance.

130. Mitchell, R. T., and Zim, H. S. 1964. BUTTERFLIES AND MOTHS—A GUIDE TO THE MORE COMMON AMERICAN SPECIES, p. 147. Golden Press, N. Y.
Biology, damage.

131. Morris, J. G. 1862. *In* Synopsis of the Described Lepidoptera of North America, p. 123-125. Part I. DIURNAL AND CREPUSCULAR LEPIDOPTERA. Smithsonian Misc. Collect., Smithsonian Inst., Wash., D. C.
Description, hosts, range.

132. Morris, R. C. 1955. INSECT PROBLEMS IN SOUTHERN HARDWOOD FORESTS. South. Lumberman 191(2393): 136-139.
Life stages of the carpenterworm are illustrated, and a table outlines the type of damage, tree species attacked, and economic importance.

133. Morris, R. C. 1957. HARDWOOD INSECT PROBLEMS IN THE DELTA. *In* Proc. La. State Univ. Sixth Annu. For. Symp., p. 100-103.
Carpenterworms belong to 1 of 2 major groups of trunk-boring insects. Notes on the biology and habits.

134. Morris, R. C. 1957. LUMBER DEFECT—WHAT IS THE INSECTS' SHARE? South. Lumberman 195(2341): 26-27.
In oak logs from Mississippi River bottoms, defects caused by carpenterworms and other trunk-boring insects reduced the value of lumber an average of $22 per M BF. Losses averaged $28 per M for overcup oak butt and upper logs, $19 for all Nuttall oak logs, and $18 for all willow oak logs.

135. Morris, R. C. 1959. INSECTS CAUSE DEGRADE IN OZARK OAKS. USDA For. Serv. South. For. Exp. Stn., South. For. Notes 120, p. 2-3.
Potential values of lumber from Ozark red oaks were reduced as much as $19 per M BF by degrade caused from borer attacks on the living trees.

136. Morris, R. C. 1962. CARPENTERWORMS GROW FAST IN MISSISSIPPI. Miss. Farm Res. 25 (4) : 8.
Biology, damage, and control. Shade trees can be protected by spraying the trunks in early June with a residual insecticide.

137. Morris, R. C. 1964. VALUE LOSSES IN SOUTHERN HARDWOOD LUMBER FROM DEGRADE BY INSECTS. USDA For. Serv. Res. Pap. SO-8, 6 p. South. For. Exp. Stn., New Orleans, La.
In mill-scale studies, insect-caused defects in the trunks of living southern oaks resulted in lumber degrade and value loss averaging about $20 per M BF. On this basis, losses would represent a reduction of $60 million in potential value of the 3 billion board feet of oak lumber sawn annually in the South.

138. Morris, R. C. 1965. CONTROLLING INSECT DAMAGE TO SOUTHERN HARDWOOD FORESTS. *In* Proc. La. State Univ. Fourteenth Annu. For. Symp., p. 114-124.
The carpenterworm is the most important pest of oaks in the Midsouth. Insecticides may be used to protect high-value trees during their final growth for veneer logs, especially when drought or other adverse factors make trees susceptible to attack.

139. Morris, R. C. 1970. WHAT ABOUT HARDWOOD INSECTS? *In* Proc. Fifth For. Insect and Dis. Work Conf., p. 197-201. USDA For. Serv., State and Priv. For., Atlanta, Ga.
Importance, research program.

140. Mosher, E. 1969. LEPIDOPTERA PUPAE, p. 28-29, 148. Entomol. Reprint Specialists, East Lansing, Mich.
Description and key.

141. Munns, E. N. 1940. A SELECTED BIBLIOGRAPHY OF NORTH AMERICAN FORESTRY, p. 465-485. USDA Misc. Pub. 364.
References.

142. Munro, J. A. 1931. CARPENTERWORM INJURY TO ASH IN NORTH DAKOTA. J. Econ. Entomol. 24 : 682-685.
The carpenterworm causes serious injury to green ash around Fargo. Includes notes on life habits and control; Arkansas kingbird and the common kingbird are valuable predators.

143. Munro, J. A., and Fox, A. C. 1933. NOTES ON BORERS OF TREES AND SHRUBS. N. and S. Dak. Hortic. 5 (8) : 91-93.
The carpenterworm is a serious borer of ash in North Dakota.

144. Munro, J. A., and Fox, A. C. 1934. CARPENTERWORM BIOLOGY AND CONTROL. N. Dak. Agric. Exp. Stn. Bull. 278, 23 p.
Information on classification, including early descriptions, common names, distribution, and hosts. Detailed review of life history and control.

145. Munro, J. A., and Riddle, H. W. 1930. INSECT PESTS OF TREES AND GARDENS, p. 8. N. Dak. Agric. Exp. Stn., Circ. 42.
Damage and control.

146. Neumoegen, B., and Dyar, H. G. 1894. PRELIMINARY REVISION OF THE BOMBYCIDAE NORTH OF MEXICO. J. N. Y. Entomol. Soc. 2: 160-166.
Systematics.

147. O'Dell, J. H. 1927. INSECT PESTS PREVALENT DURING 1923 AND 1924, p. 61. 15th and 16th Annu. Rep. Ariz. Comm. Agric. and Hortic.
Impact.

148. Osborn, H. 1916. AGRICULTURAL ENTOMOLOGY, p. 210-211. Lea & Febiger, Phila. and N. Y.
Biology, description.

149. Packard, A. S. 1864. SYNOPSIS OF THE BOMBYCIDAE OF THE UNITED STATES. *In* Proc. Am. Entomol. Soc. Phila. III, p. 388-389.
Systematics.

150. Packard, A. S. 1881. INSECTS INJURIOUS TO FOREST AND SHADE TREES, p. 6-12. U.S. Dep. Inter., Entomol. Comm. Bull. 7.
The locust carpenter moth, Xyleutes robiniae *Harris, is common throughout the United States and bores large galleries in the trunks of oaks including pin oak.*

151. Packard, A. S. 1890. INSECTS INJURIOUS TO FOREST AND SHADE TREES, p. 53-58. USDA Fifth Rep. U. S. Entomol. Comm.
From New England southward to Texas, oak lumber and cordwood is commonly honeycombed by the large black burrows of the carpenterworm. Biology, habits, and control.

152. Peck, W. D. 1818. SOME NOTICE OF THE INSECT WHICH DESTROYS THE LOCUST TREE. Mass. Agric. Repos. and J. 5: 67-73.
This is the original description of the carpenterworm. Peck assigns the common name, locust moth, and scientific name, Cossus robiniae.

153. Peirson, H. B. 1927. MANUAL OF FOREST INSECTS, p. 87. Maine For. Serv. (Augusta) Bull. 5.
Hosts.

154. Petch, C. E., and Maltais, J. B. 1932. THE CARPENTER WORM, (PRIONOXYSTUS ROBINIAE) PECK, AND ITS CONTROL, p. 131-136. Que. Agric. Dep., Rep. Que. Soc. Prot. Plants.
Bionomics and control were investigated in an infestation of silver maple at Ste. Anne de Bellevue and St. Laurent, Quebec.

155. Peterson, A. 1962. LARVAE OF INSECTS. I. LEPIDOPTERA AND PLANT INFESTING HYMENOPTERA, p. 132-133. Edwards Brothers, Inc., Ann Arbor, Mich.
Detailed larval description.

156. Peterson, A. 1967. SOME EGGS OF MOTHS FROM SEVERAL FAMILIES OF MICROLEPIDOPTERA. Fla. Entomol. 50: 125-132.
Carpenterworm females deposit eggs singly or in irregular clusters. The egg measures approximately 2.3x1.5 mm. The surface of the chorion is covered with conspicuous irregular indentations.

157. Peterson, L. O. T. 1964. INSECT BORERS IN ASH TREES. Can. Dep. Agric., TN Pam. 2, 10 p.
The carpenterworm is a serious pest of green ash in the prairie region of southeastern Canada. The life cycle is 3 or more years. Moths emerge from early June to early August and deposit 300 or more eggs. Additional information is given on life history and control.

158. Pirone, P. P. 1951. MAINTENANCE OF SHADE AND ORNAMENTAL TREES, p. 255. Oxford Univ. Press, N. Y.
Biology, control.

159. Pirone, P. P., Dodge, B. O., and Rickett, H. W. 1960. DISEASES AND PESTS OF ORNAMENTAL PLANTS, p. 360, 601, 623. Ronald Press Co., N. Y.
Hosts, control.

160. Portman, R. W., and Mannis, H. C. 1958. IDAHO RECOMMENDATIONS FOR INSECT CONTROL, p. 10-11. Idaho Agric. Ext. Serv. Bull. 216.
Description, damage, control.

161. Prentice, R. M. 1965. *In* Forest Lepidoptera of Canada. Vol. 4. Microlepidoptera, p. 740-741. Dep. For. Can. Pub. 1142.
P. robiniae *has been recorded from New Brunswick to interior British Columbia (map shows collection points). Hosts include trembling aspen, black cottonwood, willow, and eastern cottonwood.*

162. Putnam, J. A., Furnival, G. M., and McKnight, J. S. 1960. MANAGEMENT AND INVENTORY OF SOUTHERN HARDWOODS, p. 17-18. USDA Agric. Handb. 181.
Holes, bark pockets, stains, and other blemishes caused by borers and bark scarrers greatly lower the value of hardwoods by limiting the number and size of defect-free pieces that can be cut from lumber.

163. Rivas, A. M. 1964. THE CARPENTERWORM IN MISSOURI. M.S. thesis, Univ. Mo., 76 p.
Life history in Missouri, and economic loss.

164. Rivas, A. M., and Buchanan, W. D. 1958. A NEW TECHNIQUE FOR REARING CARPENTERWORMS. J. Econ. Entomol. 51(3): 406-407.
Describes an artificial diet, container, and procedures for rearing partially grown larvae.

165. Roberts, E. G. 1956. GRUBS IN THE TRUNKS OF LIVE GREEN ASH TREES. J. For. 54(12): 846-847.
Discusses grub damage to green ash near State College, Mississippi, and gives measurements of galleries and size of trees infested.

166. Rohwer, S. A. 1916. DESCRIPTIONS OF NEW SPECIES OF HYMENOPTERA. *In* Proc. U. S. Natl. Mus. 49, p. 224-225.
A primary hymenopterous parasite, Amersibia prionoxysti, *of the carpenterworm is described from Falls Church, Virginia.*

167. Ruggles, A. G. 1941. SOME TREE BORING INSECTS. Minn. Hort. 69: 68-69.
Biology, description, control.

168. Schuder, D. L. 1959. TREE BORERS AND EFFECTIVE CONTROL MEASURES. *In* Proc. Natl. Shade Tree Conf., p. 98-104.
Damage and control.

169. Schuder, D. L. 1962. INSECT PESTS OF SHADE TREES AND SHRUBS, A GUIDE FOR COMMERCIAL NURSERYMEN AND ARBORISTS, p. 8-9. Indiana Ext. Serv., Purdue Univ., Mimeo E-41.
Habits, control.

170. Severin, H. C. 1946. INSECT PESTS OF SHELTER BELTS. *In* Agricultural Research in South Dakota, p. 15-16. S. Dak. Agric. Exp. Stn. Fifty-Ninth Annu. Rep.
P. robiniae *is so destructive in the central portion of South Dakota that ash can hardly be grown.*

171. Shenefelt, R. D., and Benjamin, D. M. 1955. INSECTS OF WISCONSIN FORESTS, p. 91-92. Wis. Agric. Exp. Stn. Circ. 500.
Biology, damage, control.

172. Smith, J. B. 1896. ECONOMIC ENTOMOLOGY, p. 286-287. J. B. Lippincott Co., Phila.
Description, damage.

173. Smith, J. B. 1899. INSECTS OF NEW JERSEY, p. 497. MacCrellish & Quigley, State Printers, Trenton, N. J.
Distribution.

174. Smith, R. C. 1943. INSECTS IN KANSAS, p. 214. Kans. State Board Agric. Rep. 62 (255).
Description, control.

175. Snyder, T. E. 1927. DEFECTS IN TIMBER CAUSED BY INSECTS. USDA Bull. 1490, 47 p.
Classifies defects caused by carpenterworms and other insects.

176. Solomon, J. D. 1966. ARTIFICIAL REARING OF THE CARPENTERWORM, PRIONOXYSTUS ROBINIAE (LEPIDOPTERA: COSSIDAE), AND OBSERVATIONS OF ITS DEVELOPMENT. Ann. Entomol. Soc. Am. 59: 1197-1200.
A diet of oak sawdust, agar, water, and nutrients was developed. Adults emerged in 9 to 23 months, with peaks during the 11th and 19th months. Of the larvae, 59 percent pupated, and 88 percent of the pupae produced adults.

177. Solomon, J. D. 1966. TEPA FOR STERILIZING MALE CARPENTERWORMS. J. Econ. Entomol. 59: 1528-1529.
Males were sterilized by topical application of tepa at dosages that neither affected their mating vigor nor reduced their longevity.

178. Solomon, J. D. 1967. CARPENTERWORM OVIPOSITION. J. Econ. Entomol. 60: 309.
Individual females deposited up to 1,000 eggs in bark crevices on the tree trunk. Moths that re-

quired 2 years to develop from egg to adult were more fecund than 1-year moths. Incubation period in the forest was 10 to 11 days.

179. Solomon, J. D. 1967. REARING THE CARPENTERWORM, PRIONOXYSTUS ROBINIAE, IN THE FOREST (LEPIDOPTERA: COSSIDAE). Ann. Entomol. Soc. Am. 60: 283-285.
Eggs were planted in bark wounds and caged on host trees or young larvae were started on an artificial diet and then transferred to drilled holes. Survival averaged about 60 percent in the oaks and about 1/3 less in green ash and American elm.

180. Solomon, J. D. 1967. REGENERATION OF A MANDIBLE IN A LARVA OF THE CARPENTERWORM, PRIONOXYSTUS ROBINIAE, (LEPIDOPTERA: COSSIDAE). Ann. Entomol. Soc. Am. 60: 481-482.
Loss and almost perfect regeneration of a mandible is reported. Mandible losses occurred in laboratory cultures when molting larvae were unduly disturbed by other larvae.

181. Solomon, J. D. 1968. GALLERY CONSTRUCTION BY THE CARPENTERWORM, PRIONOXYSTUS ROBINIAE, IN OVERCUP OAK (LEPIDOPTERA: COSSIDAE). Ann. Entomol. Soc. Am. 61: 72-74.
Larvae began feeding in the cambium area and then tunnelled 3 inches obliquely upward into the sapwood for about 4 months, when they turned vertically upward for 4.3 inches. Gallery diameters averaged 0.6 in.

182. Solomon, J. D. 1969. WOODPECKER PREDATION ON INSECT BORERS IN LIVING HARDWOODS. Ann. Entomol. Soc. Am. 62: 1214-1215.
Fourteen species of insect borers, including the carpenterworm, were preyed upon by woodpeckers in Mississippi.

183. Solomon, J. D. 1971. EMERGENCE AND REPRODUCTIVE STUDIES OF THE CARPENTERWORM MOTH, PRIONOXYSTUS ROBINIAE PECK (LEPIDOPTERA: COSSIDAE). Ph. D. thesis, Miss. State Univ., 101 p.
Moth emergence usually begins in late April, peaks in late May or early June, and ends during late June or early July. Males emerge mostly during the morning, females almost entirely during the afternoon. Mating and oviposition are discussed in detail.

184. Solomon, J. D., Doolittle, R. E., and Beroza, M. 1972. ISOLATION AND ANALYSIS OF THE CARPENTERWORM SEX PHEROMONE. Ann. Entomol. Soc. Am. 65: 1058-1061.
A sex pheromone was extracted from virgin females and bioassay procedures were developed.

185. Solomon, J. D., and Morris, R. C. 1966. SEX ATTRACTION OF THE CARPENTERWORM MOTH. J. Econ. Entomol. 59: 1534-1535.
Five traps baited with virgin females captured an average of 270 males (range 38-666). Females were most attractive during the first 2 days. From 20 to 25 percent of the males marked and released 1/4 to 3/4 miles from female-baited traps were recaptured. Seven percent of those released 1 mile from the traps were recaptured.

186. Solomon, J. D., and Morris, R. C. 1971. WOODPECKERS IN THE ECOLOGY OF SOUTHERN HARDWOOD BORERS. *In* Tall Timbers Conf. on Ecological Animal Control by Habitat Management Proc. 2 (1970), p. 309-315. Tall Timbers Res. Stn., Tallahassee, Fla.
Woodpeckers significantly reduced populations of several insect borers, including carpenterworms. Predation was greatest during January and February. In a rearing program, 1,424 carpenterworm moths or 20 percent of the total were taken by woodpeckers.

187. Solomon, J. D., and Neel, W. W. 1972. EMERGENCE BEHAVIOR AND RHYTHMS IN THE CARPENTERWORM MOTH, PRIONOXYSTUS ROBINIAE (LEPIDOPTERA: COSSIDAE). Ann. Entomol. Soc. Am. 65: 1296-1299.
In west-central Mississippi, moth emergence began in April, peaked in late May or early June, and ended in late June or early July. Temperature summation provided a good prediction of seasonal patterns. Moths emerged earliest from trees of small diameter. Emergence rhythms were related to sex and generation time.

188. Solomon, J. D., Newsome, L., and Darwin, W. N. 1972. CARPENTERWORM MOTHS AND CERAMBYCID HARDWOOD BORERS CAUGHT IN LIGHT TRAPS. J. Ga. Entomol. Soc. 7: 76-79.
A portable, battery-operated light trap placed in hardwood stands of Mississippi captured 10 species of borers. Carpenterworm moths were taken in the greatest numbers, females more frequently than males.

189. Solomon, J. D., and Toole, E. R. 1968. CARPENTERWORM PUPAE TRAPPED IN GALLERIES BY FUNGUS MYSELIUM. J. Econ. Entomol. 61: 880-881.
Pupae were trapped in their galleries by spongy mycelium of wood-decay fungi. Irpex mollis, *a fast-growing white rot fungus, was the principal species.*

190. Solomon, J. D., and Toole, E. R. 1971. STAIN AND DECAY AROUND CARPENTERWORM GALLERIES IN SOUTHERN HARDWOOD TREES. USDA For. Serv. Res. Note SO-120, 4 p. South. For. Exp. Stn., New Orleans, La.
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