

A NEW SPECIES OF *LITHOPHANE* (LEPIDOPTERA:
NOCTUIDAE: CUCULLIINAE) FROM NORTHEASTERN NORTH AMERICA

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ABSTRACT: A new species of noctuid moth is described and illustrated. *Lithophane thujae*, **new species**, is known from two localities in New Brunswick, Canada, and one locality each in Michigan and Wisconsin, U.S.A. The probable larval host plant is northern white-cedar (arbor vitae), *Thuja occidentalis* L. (Cupressaceae). Notes on its biology are given and the last instar larva is figured.

Additional key words: Winter moths, *Lithophane lemmeri*, New Brunswick, Michigan, Wisconsin.

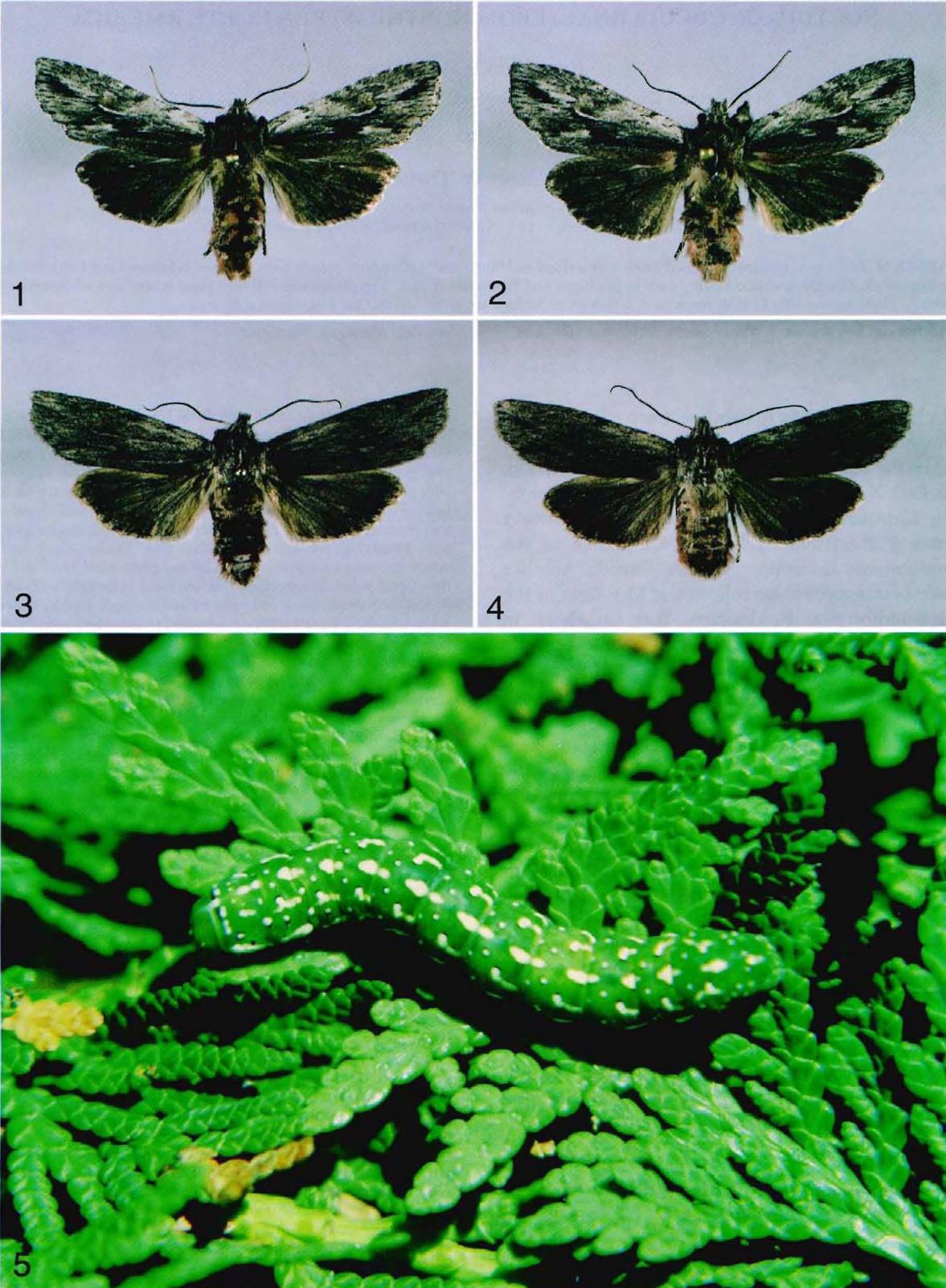
In late April 1990 a female specimen of an unusual *Lithophane* was collected at mercury vapor (M.V.) light by the authors a few km south of Harvey Station, York Co., New Brunswick. This specimen was tentatively identified as *Lithophane* species near *lemmeri* Barnes & Benjamin by Donald Lafontaine of the Biosystematics Laboratory, Ottawa, Canada. Another female of this species was collected at M.V. light by the senior author near Fredericton, York Co., N.B., in early June 1992. Eggs were obtained from this female and neonate larvae were given a choice of 21 species of woody shrubs and trees from the area where the moth was collected. The larvae refused to feed on the foliage of all species except northern white cedar, *Thuja occidentalis* L. (Cupressaceae). Larvae were reared on the foliage of *T. occidentalis*, and adults were produced in late September, 1992. Additional specimens were reared in 1996 from another female collected at the locality near Fredericton in early May at M.V. light. Another two specimens of this species from Michigan and one from Wisconsin were located in the respective collections of Mogens C. Nielsen and James C. Parkinson. These had been identified as *Lithophane* new sp. near *lemmeri* by Dale F. Schweitzer. Comparison of the male genitalia of these moths to those of *L. lemmeri*, which occurs along the Atlantic coast of the U.S.A., demonstrated that this *Lithophane* was not conspecific with *L. lemmeri*. We therefore describe this insect as a new species.

***Lithophane thujae* Webster and Thomas,
new species**
(Figs. 1, 2, 6, 7)

Description (Figs. 1 and 2). Forewing narrow, length 16.0–18.1 mm (mean = 17.2), width at tornus 6.0–7.5 mm (mean = 7.0) (n = 24) in males and length 16.0–18.5 mm (mean = 17.3), width at tornus 6.0–8.0 mm (mean = 7.2) (n = 46) in females. Anterior half of

termen at nearly right angle with distal 1/3 of costa, then angled inwards toward tornus at approximately a 135° angle; lower half of termen slightly emarginated above tornus. Forewing above brownish gray grading to light gray near the anterior margin basally and brown with pinkish hue along posterior margin becoming salmon pink near base of wing. Reniform spot indistinct, dirty salmon pink, basal portion contrasting with lighter gray anterior portion. Orbicular spot absent. Basal dash consists of thin black line. Thicker black median streak between indistinct antemedial and postmedial lines, and well developed subreniform black line outlined anteriorly with white. Apical dash small, black and subterminal line indicated by series of 4 black dashes, most anterior connected to brownish apical streak. Hindwing above darker than forewing and grayish brown with salmon pink hue, discal dot faintly expressed. Fringes of both wings concolorous with adjacent portions of wing. Underside of fore- and hindwings uniformly light gray with strong salmon pink tint except for darker central area of forewing. Discal spot on underside of hindwing well developed. Color and pattern similar in both sexes and uniform among specimens examined. Dorsal side of thorax gray with mid-dorsal brown patch bisected by fine white line extending from collar to base of abdomen. Tegula elongated and gray, margined with black above wing base. Anteriorly, mesothoracic vestiture terminates in V-shaped crest. Patagium concolorous with tegula, but bordered posteriorly towards mid-line by fine black line followed by white line. These lines on adjacent patagia form a V, opening formed by thoracic crest which emerges between arms of V. Head vestiture, dorsally, concolorous with patagia and tegulae. Palpi and ventral thorax gray with definite pinkish hue. Dorsally, abdomen gray with pinkish hue and without tufts; ventrally abdomen approaches dirty salmon pink. Prothoracic legs entirely dirty salmon pink. Outer lateral portions of femur and tibia of meso- and metathoracic legs black, remainder of legs salmon pink.

Male genitalia (Fig. 6). The interpretation of male genitalia was based primarily on Sibatani et al. (1954). Basal part of valve, composed of dorso-proximal costa and ventro-proximal sacculus, well developed. Heavily sclerotized costa forms right angle at junction of its dorso-proximal and proximal margins. Valvula, ventroapical region of valve beyond membranous annelifer, narrower than basal part of valve, but of equal length. Valvula gradually tapers to simple narrowly rounded apex and lacking digitus. Relatively short harpe curved to form open half circle with its opening facing ventro-apically and inner diameter of 0.5 mm. Transtilla curved with its smaller diameter on its mesal surface. Vincula beyond ventral edge of sacculus form V-shaped structure with length longer than width. Two vincula meet at acute angle. Juxta ends in two heavily sclerotized points forming shallow V, with depth of V equal to half width of juxta at level of base of V. Uncus terminates in widened tip with slight bifurcation. Male genitalia is bilaterally asymmetrical, with apical portion of left valvula being broader than right.



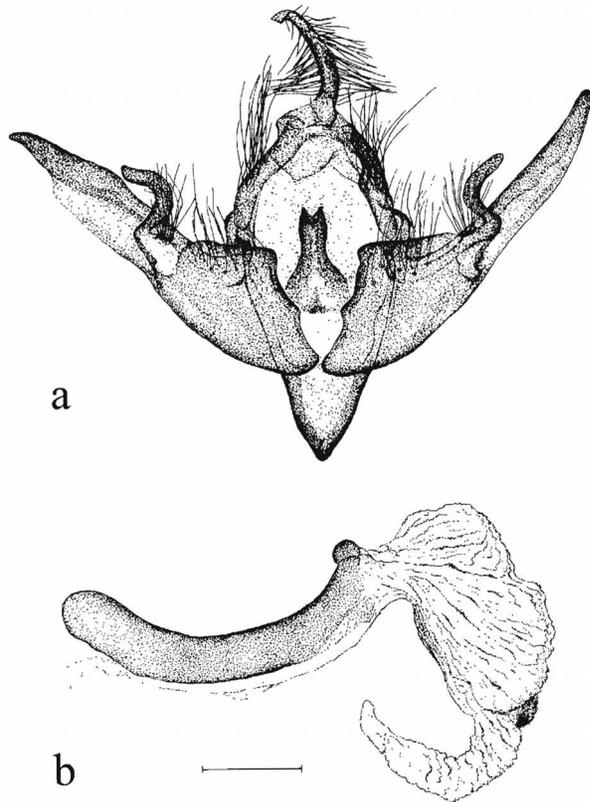


FIG. 6. Male genitalia of *Lithophane thujae*. **a**, Genitalia with aedeagus removed; **b**, Aedeagus. A.W.T. Genitalia vial 95.x.30-#26. Paratype, New Brunswick, York Co., ecl. 22 September 1992, R. P. Webster. Scale bar = 1 mm.

Female genitalia (Fig. 7). Similar to, but smaller than *L. lemmeri* (Fig. 8c). Major structural difference is in ventral edge of ostium. In *L. thujae*, sterigma is non-sclerotized and forms a straight, horizontal, edge. It is totally overshadowed by heavily sclerotized lamella antevaginalis which is deeply invaginated giving ostium an apparent V-shaped opening. In *L. lemmeri*, sterigma is distinct, sclerotized, and has wavy edge.

Diagnosis. The forewing pattern of *L. thujae* (Figs. 1 and 2) is similar to that of *L. lemmeri* (Figs. 3 and 4), but the markings are bolder and more completely developed in *L. thujae*. In *L. lemmeri*, the wings are a uniform dirty brownish gray, the black median streak between the antemedial and postmedial lines is poorly developed, and the subreniform line is less developed and not outlined anteriorly with white. Rubbed specimens may be mis-identified as *L. lemmeri*, but the forewing patterns of fresh specimens of the two species are distinctively different (Figs. 1-4). *L. lemmeri* has longer narrower wings: forewing length 20.0-20.5 mm, width 7.0 mm ($n = 4$). The male genitalia of *L. thujae* and *lemmeri* are also substantially different (Figs. 6 and 8). In *L. lemmeri* (Fig. 8a), valvula has an expanded costal bulge towards its apex to form a rounded protuber-

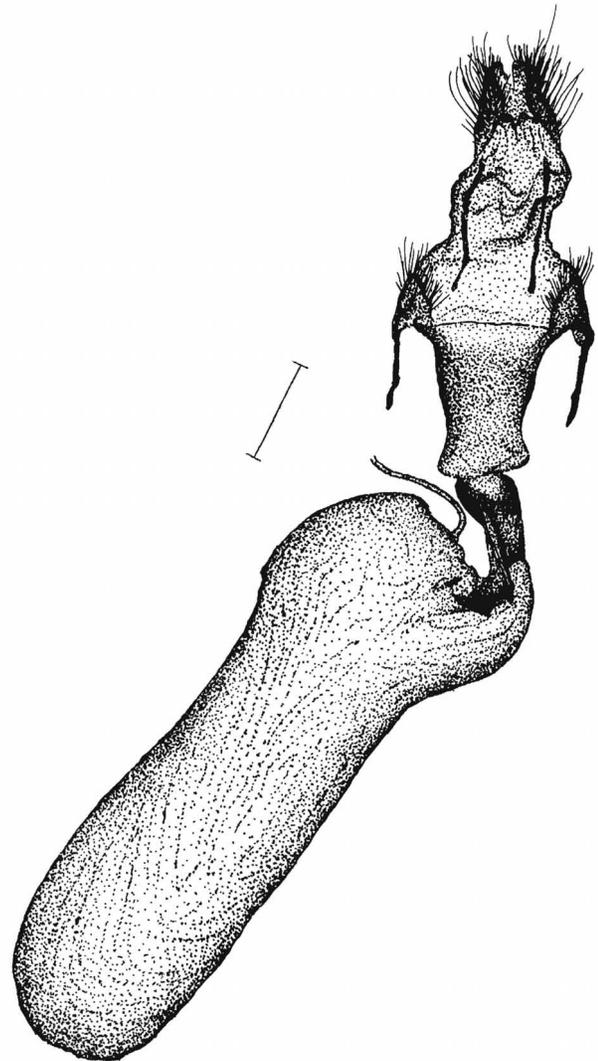


FIG. 7. Female genitalia of *Lithophane thujae*. A.W.T. genitalia vial 95.x30-#25. Paratype, New Brunswick, York Co., ecl. 19 September 1992, R. P. Webster. Scale bar = 1 mm.

ance on its mesal surface and then narrows to form a distinctively bifurcate tip, with the dorsal branch twice as long as the ventral branch (digitus). In *L. thujae* the valvula (Fig. 6a) lacks a costal bulge and gradually tapers to a simple narrowly rounded tip, without a digitus.

Types. *Holotype* male (Fig. 1): CANADA, NEW BRUNSWICK, York Co., 5.3 km SW of Jct. of Hwy. 101 and Charters Settlement Rd. (45°50'38"N, 66°44'31"W), *ex ovum* from female collected at M.V. light 1 June 1992, reared on *T. occidentalis*, emerged 24 September 1992, R. P. Webster. *Allotype* female (Fig. 2): same locality and data as male, emerged 16 September 1992. Paratypes:

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FIGS. 1-5. Adults of *Lithophane thujae*, new species and *Lithophane lemmeri*; and larva of *L. thujae*. **1**, *Lithophane thujae*, holotype male. **2**, *Lithophane thujae*, allotype female. **3**, *Lithophane lemmeri*, male, New Jersey, Atlantic Co., Egg Harbor Twp., *ex ovum* 2 April 1994, reared on *Juniperus virginiana*, ecl. 1-4 Nov. 1994, Dale F. Schweitzer. **4**, *Lithophane lemmeri*, female, same data as male. **5**, Mature larva of *Lithophane thujae* on *Thuja occidentalis*. Length 30 mm. Reared *ex ovum* from a female collected at M.V. light on 3 May 1996 at New Brunswick, York Co., R. P. Webster.

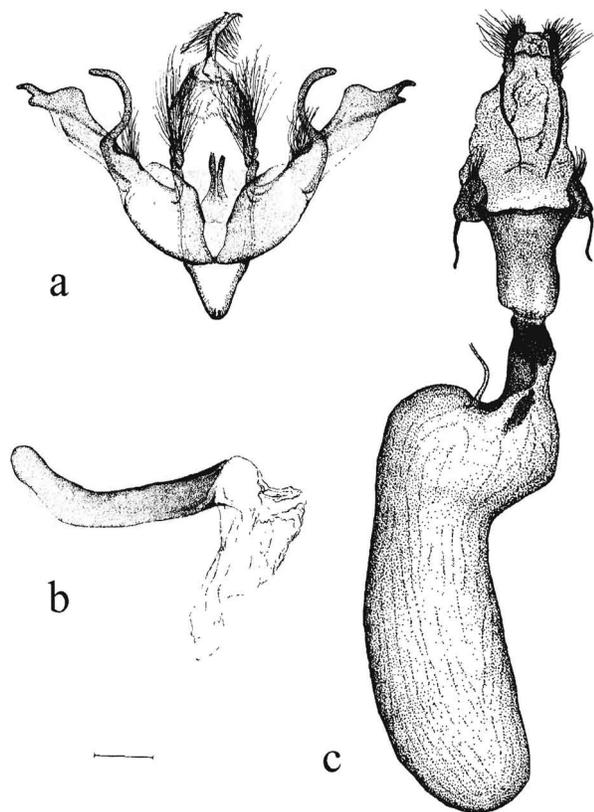


FIG. 8. Male and female genitalia of *Lithophane lemmeri*. **a**, Male genitalia with aedeagus removed; **b**, Aedeagus. A.W.T. genitalia vial 95.x.30-#23. New Jersey, Atlantic Co., Egg Harbor Twp., *ex ovum* 2 April 1994, reared on *Juniperus virginiana*, ecl. 1-4 Nov. 1994, Dale Schweitzer; **c**, Female genitalia. A.W.T. genitalia vial 95.x.30-#24. Same data as male. Scale bar = 1mm.

27 males and 47 females as follows: CANADA, NEW BRUNSWICK: York Co., 3.5 km. S. of Jct. Hwy 3 & 4, Jct. Hwy 3 & Davis Brook, 27 April 1990 (1 female), A. W. Thomas & R. P. Webster; same locality and data as Holotype, emergence dates 16-30 September 1992 (8 males, 14 females), R. P. Webster (2 males and 1 female dissected, A. W. Thomas genitalia vials 95.x.30-#21 (male), 95.x.30-#26 (male), 95.x.30-#25 (female)); same locality as Holotype, 8 October 1994, at M.V. light (1 female), R. P. Webster; same locality as Holotype, *ex ovum* from female collected at M.V. light 3 May 1996, reared on *T. occidentalis*, emergence dates 4-17 September 1996 (17 males, 29 females), R. P. Webster; same locality as Holotype, 13 October 1996, at M.V. light (1 female), R. P. Webster. U.S.A., MICHIGAN: Otsego Co., T29N R2W Section 15, 27 April 1974 (1 male), 13 May 1994 (1 male), both M. C. Nielsen. WISCONSIN: Florence Co., T38N R19E Section 10, 11 October 1980 at light (1 female), J. C. Parkinson.

Disposition of types. Holotype (no. CNC-22575) and allotype in the Canadian National Collection, Ottawa, Ontario; paratypes at the American Museum of Natural History, New York; Canadian National Collection, Ottawa, Ontario; Florida State Collection of Arthropods, Gainesville, Florida; National Museum of Natural History, Washington, D.C.; Los Angeles County Museum of Natural History, Los Angeles, California; The Natural History Museum, London, England; Insect Reference Collection, Natural Resources Canada, Canadian Forest Service - Atlantic Forestry Centre, Fredericton, New Brunswick; and private collections of Henry H.

Hensel, Edmunston, New Brunswick; Mogens C. Nielsen, Lansing, Michigan; James C. Parkinson, Mosinee, Wisconsin; Dale F. Schweitzer, Port Norris, New Jersey; Anthony W. Thomas, Fredericton, New Brunswick; Jim Troubridge, Agassiz, British Columbia; Martin N. Turgeon, St. Basile, New Brunswick; Reginald P. Webster, Charters Settlement, New Brunswick.

Type locality. The type locality is within a small, partially wooded, residential area 5.3 km SW of the Jct. of Hwy. 101 and Charters Settlement Rd, about 8 km SW of Fredericton, New Brunswick, Canada. The forested area where the *L. thujae* specimens were collected is a mature second growth mixed conifer forest with a small brook passing through it. Dominant species of trees are *T. occidentalis*, *Abies balsamea* (L.) Mill. with scattered *Salix* sp., *Betula allegheniensis* Britt., *B. papyrifera* Marsh., *Acer rubrum* L., and *Fraxinus americana* L. *T. occidentalis* is most abundant near the shaded stream. Openings along the stream are dominated by *Alnus incana* (L.) Moench.

Etymology. The specific epithet *thujae* is named after the name of the genus of the probable host plant of this species.

Biology. *Lithophane thujae* was reared on *T. occidentalis* on two occasions. In the initial attempt to rear this species, the larvae were offered 21 species of woody plants from the general area where the adults were collected. The larvae accepted only *T. occidentalis* and completed development on this host. *T. occidentalis* is common at the type locality where most specimens of this species have been collected to date and is present at all other known sites for this species and thus, we feel that *T. occidentalis* is the likely host plant for this species. The related *L. lemmeri* also feeds on a member of the Cupressaceae (*Juniperus virginiana* L.) (Dale F. Schweitzer, pers. comm.).

Lithophane thujae has five larval instars. A mature last instar of *L. thujae* is shown in figure 5. The mature larvae are 33.0 to 35.0 mm in length and range in color from green to dark green with a series of longitudinal rows of white spots as shown in the figure. This pattern makes the larvae very difficult to locate on the foliage of their host plant. The second through fourth instar caterpillars exhibit a similar color pattern.

A female collected on May 3, 1996, and confined to a 2-liter plastic container laid yellowish white eggs (0.89 mm diam., 0.69 mm high) near the tips of the underside of the foliage of *T. occidentalis*. The description that follows is based on observations of larvae maintained on cuttings of *T. occidentalis* between 12° and 18°C. The eggs hatched 12-15 days after they were laid. The tan-colored first instar larvae gradually turned to light green as they fed near the tips of the new growth. The molt to second instar took place about six days later. The second instar larvae developed the color pattern that persisted through the last instar. The duration of the second, third, and fourth instars was each about six days under this temperature regime. The duration of the last instar was nine to eleven days. All larval instars fed near the tips of the new growth and usually consumed between 1 and 2 mm of the tip of the needle before moving to an adjacent needle. Last instar larvae also fed on the previous year's growth. When development was completed (mid June to early July) the last instar larvae formed cocoons in the leaf litter. However, the larvae did not pupate until late August. Adults emerged in mid September under laboratory conditions.

Flight season. *Lithophane thujae* has been collected in October (3 freshly emerged specimens) and during April, May, and early June. Specimens collected in the spring were worn suggesting that *L. thujae*, like other *Lithophane* species, overwinter as adults and will be present in the fall and the following spring.

Geographical distribution. South central New Brunswick, northern Michigan and northern Wisconsin. Probably has a broader distribution and will likely be found in intervening areas where *T. occidentalis* is common.

DISCUSSION

Lithophane thujae is a member of an assemblage of *Lithophane* species which feed during the larval stage

on members of the Cupressaceae. These species include *L. lemmeri* from the Atlantic coastal plain of the U.S.A. from Connecticut southward (Dale F. Schweitzer, pers. comm.); *L. subtilis* Franclemont, *L. tarda* (Barnes and Benjamin), and *L. longior* (Smith) from southwestern North America (Franclemont 1969); and the Palearctic *L. leautieri* Boursin (Bretherton et al. 1983). None of these species has a combination of wing pattern and male genitalia similar to *L. thujae* (Barnes and Benjamin 1929, Boursin 1971, Bretherton et al. 1983, Franclemont 1969). Although the wing pattern of the more northern *L. thujae* and *L. lemmeri* are similar, the genitalia of the two are very different.

Very few field-collected specimens are currently known of *L. thujae*. The reason for this apparent rarity is unclear. Possibly *L. thujae* is less attracted to light or bait than other *Lithophane* species, or has very specific habitat requirements. The current distribution includes only New Brunswick, Michigan, and Wisconsin. However, it is likely that this species will be found in the intervening areas in Maine, northern New Hampshire, Quebec and Ontario once more collecting is done in habitats with *T. occidentalis*.

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plying specimens of *L. lemmeri*, and providing invaluable information on the location of specimens of *L. thujae* in eastern North American institutional and private collections obtained during a survey of the distributional records of *L. lemmeri*. We thank Donald Lafontaine, Biosystematics Laboratory, Ottawa, Canada, for supplying information on the location of possible *L. thujae* specimens in The Canadian National Collection and other Canadian institutions. We thank Martin Honey for supplying information on *L. leautieri* and the location of possible *L. thujae* in The Natural History Museum, London, England. We thank Mogens C. Nielsen, Lansing, Michigan, and James C. Parkinson, Mosinee, Wisconsin, for loaning specimens of *L. thujae*. We thank P. Z. Goldstein and two anonymous reviewers for helpful suggestions on the manuscript.

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