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THE GENUS *PHRAGMATOBIA* IN NORTH AMERICA, WITH THE DESCRIPTION OF A NEW SPECIES (LEPIDOPTERA: ARCTIIDAE)

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This paper, based on the examination of 1,879 specimens, serves to resolve the taxonomic problems involving the three North American species of *Phragmatobia*. The genus *Phragmatobia*, the ruby tiger moths, has had a checkered history since it was described by Stephens in 1829 (type, by monotypy, *Noctua fuliginosa* Linnaeus, 1758). Although many species have been described in or transferred to this genus, in both the Old and New Worlds, most of them have been removed to other genera. By 1902 Dyar recognized only two North American species, a status since then unchanged (McDunnough, 1938; Forbes, 1960). Despite the recent stability of the names, there has been much confusion as to which names to apply to particular specimens. This problem is resolved below, with the description of a third North American species, long confused with the two named species.

North American *Phragmatobia* are rosy, stout, hairy, medium-sized moths, restricted to the Hudsonian, Canadian, Transition, and northern Upper Austral Zones. As with many arctiids, there is considerable variation in color, especially in the hindwings. Females are generally darker than males, and are occasionally difficult to identify with certainty. The males are readily attracted to lights, especially near-ultraviolet ("black") lights, early in the evening, but the females are only rarely collected this way. Of 134 specimens of *P. fuliginosa* collected in Maine by Dirks (1937), only 7, or 5.2%, were females. This disparity is even greater for *P. assimilans* in Michigan, where no females have ever been collected. Ferguson (pers. comm.) similarly reports that he does not recall collecting a single female *P. assimilans* in Nova Scotia, though he has taken about 100 males. Many of the females which we examined in the course of this study were reared specimens.

The highly variable "bear" larvae of all three species have been briefly described, but never adequately illustrated. They usually feed on a variety of low herbaceous plants, but all can be reared on *Taraxacum* (dandelion), *Plantago* (plantain), or *Rumex* (dock).

Phragmatobia is homogeneous and well-defined in North America, but the status of the many Palearctic species, forms, varieties, and aberrations ascribed to this genus is far from clear. The constant and specific differences we have found in the male genitalia may lead to a re-evaluation of the Palearctic representatives.

Several Neotropical moths have been described in or transferred to *Phragmatobia*, but we have made no attempt to evaluate their taxonomic status. These include *P. fervida* (Walker, 1855); *P. modesta* Maassen, 1890; *P. nundar* Dyar, 1907; *P. rubricosta* Dognin, 1889; and *Phragmantobia* [sic] viridis Druce, 1903. We have made no attempt to apply to our North American species the names of "forms" and "aberrations" proposed for Palearctic species. These names include "borea is" Staudinger, "fervida" Staudinger (nec. Walker), "subnigra" Millière, and "pulverulenta" Alpheraky, all of which were catalogued under *P. fuliginosa* by Dyar (1902). A careful check has shown that none of these names applies to the new species described here.

The generic characters have been fairly well enumerated by Forbes (1960), although several characters deserve special mention. The male genitalia (Figs. 1-9, 13-15) follow a simple plan (terminology after Klots, 1956): the uncus, tegumen, vinculum, valvae, aedeagus, juxta, and saccus are well developed and relatively unmodified. Most of these structures exhibit specific differences among the three species. The vesica is ornamented with numerous, stout, thorn-like cornuti, while the distal end of the aedeagus is adorned with carinae of taxonomic importance (Figs. 7-9). The valvae (Figs. 13-15) are long and narrow, with a single spade-shaped projection on the mesal face, or with two lobes, one on the dorsal and one on the ventral margin. The shape of these projections is somewhat variable, but their position and number are constant.

The female genitalia (Figs. 20-25) are fairly uniform, and no striking differences between species have been found, although a few minor differences will be pointed out later. The ductus bursae is strongly sclerotized, dorso-ventrally compressed, and almost as wide as the abdomen. The cervix bursae is large, firm, and somewhat convoluted. The corpus bursae is large, spherical, and adorned with two circular signa composed of small sclerotized dots.

Of special interest in the males are the coremata (Figs. 10-12). These brushes of hairs, white in dissected dried specimens, are located in an invaginated pocket between the seventh and eighth abdominal sterna and are presumably scent-distributing organs, for a liquid is associated with the coremata in live specimens (Lane, 1957). MacNeill (1962) has reported a voluntary display of coremata in *Estigmene acrea* (Drury), but we are unaware of any published accounts of their function. Lane (1957) has reported on the coremata in a live European *P. fuliginosa*, while numerous other observations have been made on other arctiids (see MacNeill, 1962, for a good bibliography, to which may be added Siewers, 1879, and Kershaw, 1953).

All three North American species have a "striated band," a term used by Forbes and Franclemont (1958) and Forbes (1960) for a series of curved, parallel grooves on the anterior edge of each metepisternum, in males and females alike (Figs. 16-18). Blest *et al.* (1963) referred to the swollen, grooved metepisternal sclerite of the arctiid *Melese laodamia* Druce as a "tymbal organ." They found that vertical compression and relaxation of the sclerite caused it to buckle inward and outward, respectively, producing a series of clicks as the 15-20 grooves rubbed against one another. While not precluding the possibil-

ity of a variety of functions in different species, they admitted the possibility that the clicking sounds produced by the tymbal organ could confuse the echolocation system of bats, for the sounds of bats and this moth were similar. Later, Dunning and Roeder (1965), working with the arctiids *Halysidota tessellaris* (Smith & Abbott) and *Pyrrharcia isabella* (S. & A.), found that ultrasonic sounds emitted by the "microtymbal organs" on the metepisterna could provide the moths with some degree of protection from bats.

The venation (Fig. 19) of all three species is subject to much variation, although the general plan follows that of *Spilosoma* or *Estigmene*. Dyar (1891) was correct in pointing out that the origin of R_5 is before that of R_5 in the forewing, and not the converse as figured by Smith (1890: 235, fig. 8)—although Smith may have examined an aberrant specimen. The major sources of variation are the points at which R_1 and R_2 arise (sometimes very close to the apex of the cell, other times not); the point of origin of R_5 when compared to the origins of R_2 and R_{3+4} ; the distances between the points of origin of M_1 , M_2 , and Cu_1 in both wings; and whether R_1 and M_1 of the hindwing both arise from the apex of the cell, or whether they have a common stalk, which may be either short or long. Several interesting venational extremes were noted: R_2 and R_5 of the forewing diverging from the same point (two specimens of *P. fuliginosa*); a forked R_2 vein, resulting in a six-branched radius (one *P. assimilans*); and R_2 arising before the apex of the cell (*i. e.*, before the origins of R_{3-5} ; seen in one specimen of *P. assimilans*).

Because of the sexually dimorphic shape of the forewing, R_5 in females extends slightly behind the end of M_1 (with the inner margin horizontal), while in males R_5 , M_1 , M_2 , and M_3 terminate about equidistant from the base of the wing. "In other" words, the forewing of females is produced at the apex, while the outer margin of the male forewing is nearly perpendicular to the inner margin.

The drawings in this paper were made on No. 2 Rossboard with the aid of a grid eyepiece and graph paper. The scale of the drawings varies, but in all cases similar structures (*e. g.*, valvae) are drawn to the same scale, thus permitting comparisons of size.

The solid black circles on the distribution maps represent the approximate collection sites of specimens examined. Triangles represent either published records we believe to be reliable (Brodie, 1929; Ferguson, 1953; Jones, 1951; Krogerus, 1954) or records obtained from individuals (Richard W. Holzman, Michigan; J. C. E. Riotte, Ontario). The small open circles represent major cities. The distribution maps were prepared on map number 302, North America, published by the Goode Base Maps Series, Department of Geography, The University of Chicago, copyright by The University of Chicago. The maps are reproduced here by permission.

The capitalized color names in the descriptions refer to the standardized color names in Ridgway (1912).

In the list of specimens examined following the discussion of each species, states, counties, and cities are arranged alphabetically. Following each citation is the place of deposition, according to the abbreviations below.

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AMNH	American Museum of Natural History, New York (Frederick H. Rindge).
ANS	Academy of Natural Sciences, Philadelphia (the late Harold J. Grant, Jr.).
BM	British Museum (Natural History), London (Allan Watson).
CAS	California Academy of Sciences, San Francisco (C. Don MacNeill).
CM	Carnegie Museum, Pittsburgh (Harry K. Clench).
CNC	Canadian National Collection, Ottawa (D. F. Hardwick).
CNHM	Chicago Natural History Museum (Alex K. Wyatt).
CU	Cornell University, Ithaca, New York (L. L. Pechuman).
FRLA	Forest Research Laboratory, Calgary, Alberta (H. A. Tripp).
FRLM	Forest Research Laboratory, Winnipeg, Manitoba (K. R. Elliot).
FRLNB	Forest Research Laboratory, Fredericton, New Brunswick (R. S. Forbes).
FRLO	Forest Research Laboratory, Sault Ste. Marie, Ontario (W. L. Sippell).
FRLQ	Forest Research Laboratory, Sillery, Quebec (R. Martineau).
INHS	Illinois Natural History Survey, Urbana (Wallace E. LaBerge).
KU	University of Kansas, Lawrence (George W. Byers).
MASS	University of Massachusetts, Amherst (Marion E. Smith).
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (Howard E. Evans).
MINN	University of Minnesota, St. Paul (Frederick W. Stehr).
MSU	Michigan State University, East Lansing (Roland L. Fischer).
NDSU	North Dakota State University, Fargo (R. L. Post).
ODA	Oregon Department of Agriculture, Salem (Kenneth Goeden).
OSM	Ohio State Museum, Columbus (Edward S. Thomas).
OSU	Oregon State University, Corvallis (Jack Lattin).
PM	Peabody Museum of Natural History, Yale University, New Haven, Connecticut (Douglas C. Ferguson).
UMMZ	University of Michigan Museum of Zoology, Ann Arbor (Thomas E. Moore).
UNH	University of New Hampshire, Durham (J. G. Conklin, Wallace J. Morse).
USNM	United States National Museum, Washington, D. C. (William D. Field).

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KEY TO MALE NORTH AMERICAN *PHRAGMATOBIA*

- 1. Valva with two mesad-directed projections about midway from base to apex, one arising from dorsal margin, the other from the ventral margin (Fig. 15); striated band on metepisternum well-developed (Fig. 18); forewing with no indication of dark antemedial or postmedial lines (Figs. 30-33); coremata well-developed; forewing 14-15mm from base to apex *P. fuliginosa rubricosa* (p. 49)
- Mesal face of valva with a single, central, spade-like projection (Figs. 13, 14); striated band variable; forewing usually with at least traces of antemedial and/or postmedial lines (Figs. 26-29, 34)--if no lines on forewing, then forewing over 17mm and costal margin of hindwing not blackened; coremata variable . . 2

2. Distal end of aedeagus with a sclerotized dorsal "comb" (Fig. 7); striated band on metepisternum well-developed (Fig. 16); hindwing costal margin blackened; wings translucent; coremata well-developed; forewing 15-16mm *P. lineata*, NEW SPECIES (p. 40)

Distal end of aedeagus with at most a few lateral teeth (Fig. 8); striated band poorly-developed, may appear absent (Fig. 17); hindwing costal margin not blackened, concolorous with discal area; wings opaque; coremata small and poorly-developed; forewing usually over 17mm *P. assimilans* (p. 57)

KEY TO FEMALE NORTH AMERICAN PHRAGMATOBIA

1. Striated band on metepisternum poorly-developed, may appear absent (Fig. 17); costal margin of hindwing not suffused with black, concolorous with pink discal area; wings opaque; forewing usually with at least traces of antemedial and/or postmedial lines (Figs. 27, 29); mostly boreal in distribution *P. assimilans* (p. 57)

Striated band well-developed (Figs. 16, 18); costal margin of hindwing suffused with distinct but varying degrees of black, usually invading at least part of the discal cell; wings, especially hindwing, translucent; forewing lines present or absent 2

2. Always a trace of at least one of the forewing lines (antemedial, postmedial, subterminal, adterminal--Fig. 35); striated band usually with more than 9 ridges (Fig. 16); known from southern Alberta and Manitoba, and south of a line drawn from central Maine to northern N.Y., extreme southern Ontario, southern Mich., west to eastern Nebraska (Fig. 38) *P. lineata*, NEW SPECIES (p. 40)

Never a trace of dark lines on the forewing, although an obscure fragmentary subterminal smudge may be visible near the apex of the forewing (Figs. 31, 33); striated band usually with 7 to 9 ridges (Fig. 18); range includes that of former, plus Colo., Cal., Pacific Northwest and throughout Canada and Alaska north to the tundra (Fig. 36) *P. fuliginosa rubricosa* (p. 49)

PHRAGMATOBIA LINEATA Newman and Donahue, NEW SPECIES

(Figs. 1, 4, 7, 10, 13, 16, 20, 23, 34, 35)

DIAGNOSIS: In some cases it is necessary to examine the male genitalia for an infallible identification, but in all except the most badly rubbed specimens the examination of two pattern characters will be adequate for identification: the presence of *any* lines on the forewing, and the continuance of the marginal (or submarginal) black band on the hindwing upperside along the costal margin. The first character separates *P. lineata* from *P. fuliginosa*, the second character separates *P. lineata* from *P. assimilans*.

This species has long been confused with both *P. fuliginosa* and *P. assimilans*, because it has some characters of each. Wherever *P. lineata* occurs, *P. fuliginosa* also occurs, the two being active at the same time. This sympatry and synchrony, and the similarity of size and wing translucency, has led previous workers to assume that *P. lineata* was a "form" of *P. fuliginosa*. On the other hand, *P. lineata* resembles *P. assimilans* in that both have lines on the forewing (absent from *P. fuliginosa*), and both have a single projection on the mesal face of the valva (two projections in *P. fuliginosa*).

Females are more melanic than males, but always have traces of lines on the forewing (separating them from *P. fuliginosa* females). They can be distinguished from similar females of *P. assimilans* by the shiny, translucent hindwing and the dark costal margin on the hindwing upperside. Differences in the female genitalia are slight. Further differences among the three species are emphasized in the key.

HOLOTYPE MALE (Fig. 34)

HEAD: small, antennae ventrally ciliate, dorsally with appressed white scales. Vertex, frons, and palpi with spreading Mahogany Red hairs (appearing Brazil Red under strong light and magnification). Eyes small, hairless.

THORAX: vestiture dense, dorsally Mahogany Red, ventrally Chestnut (English Red under light and magnification). Femora with dorsally appressed Rufous hairs and ventrally spreading Mahogany Red hairs, except for a dorso-distal blackish patch ("knee"). Tibiae with appressed Rufous and Mahogany Red hairs and scales. Tarsi almost entirely Slate. Mid-tibiae with one pair of whitish apical spurs, hind-tibiae with two pairs of whitish spurs. Metepisternum as in Figure 16.

Forewing Upperside: scales sparse and semi-erect which, coupled with transparent membrane, makes wings translucent. Because of this translucency the general color is hard to define, but it is near Kaiser Brown, becoming slightly darker at the base. Blackish markings as follows: an antemedial smudge immediately beneath discal cell, just proximal of origin of vein Cu_2 ; a spot at upper end of discal cell, and a larger one at lower end of discal cell; an irregular postmedial line, about 1mm wide, arising on inner margin $3/4$ of distance between base of wing and distal end of vein $2A$, narrowing to 0.5mm and more or less directed towards apex as far as vein M_2 , then curving proximad and continuing faintly and perpendicularly to a point on the radial sector about one-third the distance between the upper cell spot and the apex; a small, subapical mark between veins R_4 and R_5 ; a straight subapical bar from the apex to vein M_2 , directed to a point about 1mm distad of the origin of the postmedial line; an adterminal line parallel to the outer margin, extending from apex to tornus; and a narrow terminal line (the dark bases of the fringe scales). Fringe Coral Pink, extending from apex to tornus, becoming short dark hairs on inner margin, increasing in length to the base of the wing, where there is a tuft of Coral Pink hairs with Mahogany Red tips. Veins concolorous with scales.

Forewing Underside: shiny Coral Pink; the two cell spots repeated, other dark dorsal markings showing through from upperside; costal margin appearing darker because of denser arrangement of scales; frenulum simple, stout; retinaculum Slate colored; very thinly scaled except for a tuft of appressed Coral Pink hairs arising at base of cell Cu_2 and directed anteriorly to retinaculum; a small ovoid patch devoid of scales at base of anal cell.

Hindwing Upperside: Coral Pink throughout, except: a blackish terminal band beginning 0.7mm posterior of distal end of vein 2A, where it is 1.2mm wide, becoming wider towards the apex, where it is 2.6mm wide, then continuing along costal margin to a point about 1/3 the distance between base and apex; a blackish patch on the M_1-M_2 crossvein at end of discal cell, conjoined to the blackish costal margin; and a small blackish spot at lower end of discal cell. Very thinly scaled and shiny in the discal area, with Coral Pink hairs becoming progressively longer and more dense from the posterior side of the discal cell to the inner margin; a dense patch of Coral Pink scales in basal third of costal margin, coinciding with the bare patch on inner margin of forewing underside; fringe Coral Pink.

Hindwing Underside: very thinly scaled and shiny Coral Pink, except for the two spots at the end of the cell, as on upperside, with the marginal blackish line showing through from upperside. Costal margin more densely scaled.

ABDOMEN: dorsum Coral Red, with a median row of 6 black spots, and a lateral row of 6 black spots on each side; venter, below the lateral rows of spots, Chestnut.

Coremata (Fig. 10), described from a topotypic paratype, 17 Aug. 1964: four well-developed brushes of soft white (in dissected dried specimens) hairs in two contiguous pouches invaginated between the seventh and eighth sterna.

Genitalia (Figs. 1, 4, 7, 13), described from a topotypic paratype, 17 Aug. 1964: Uncus (Fig. 1) long and narrow; valvae (Fig. 13) long, simple, with a single spade-like projection on the mesal face, about midway between base and apex; aedeagus (Fig. 7) stout, with a broad sclerotized dorsal "comb" arising from the right side on the distal end, and a long, toothed, strap-like sclerotized area arising from the left side, the latter extended posteriorly and attached to the vesica; vesica adorned with sclerotized thorn-like cornuti of varying size.

SIZE: forewing 15mm from base to apex (end of vein R_4); 12mm from base to tornus (end of vein 2A); 8mm from apex to tornus (straight line). Hindwing 12mm from base to apex (end of vein R_5); 6mm from base to anal angle (end of vein 3A); 10mm from apex to anal angle (straight line).

ALLOTYPE FEMALE (Fig. 35)

Darker red and more melanic than male.

HEAD: as in holotype.

THORAX: vestiture as in male, except that ventral hairs are darker (Brazil Red), and dorsal appressed hairs on femur are darker (Flame Scarlet). Legs otherwise as in holotype male.

Forewing Upperside: darker and not so translucent as in holotype male, but scales still semi-erect; ground color appears near Carob Brown. The blackish markings, slightly different from those of the holotype male, are as follows: a faint antemedial line, beginning at midpoint of posterior edge of discal cell, continuing obliquely proximad to inner margin; one spot each at upper and lower ends of apex of discal cell, more or less confluent and outlining end of the cell; a postmedial line as in male, but so faint it is represented by slightly darker scales visible only under magnification; a Y-shaped subterminal line, arising from the inner margin near end of vein 2A and proceeding, more or less parallel to the outer margin, to cell M_2 , where it branches, the distal branch extending straight to apex, becoming wider from vein R_5 to apex, the proximal branch extending straight to a point on costa about midway between end of cell and apex of wing, widening from cell R_5 to costa; and a microscopic terminal line, formed by the dark bases of the fringe scales. Fringe Begonia Rose from apex to tornus, then continuing as small hairs, concolorous with ground color, along inner margin to base, where the hairs become longer, more dense, and Rufous.

Forewing Underside: as in holotype, except darker (Begonia Rose), blackish dorsal markings repeated by slightly darker scales; frenulum compound, subcostal retinaculum absent.

Hindwing Upperside: blackish, except for Begonia Rose fringe, basal third of costal margin, and anal area. Marginal black band wide, diffuse, becoming paler and suffusing proximad to cover the entire wing except: the patch of Begonia Rose scales in the basal third of the costal margin (as in male); the Begonia Rose fringe from apex to inner margin; and the Begonia Rose hairs from the basal two-thirds of mid-cell Cu_2 to inner margin, which become progressively longer towards inner margin. Scattered pink scales in the discal area make that area more diffusely black than the marginal area. Distal end of discal cell outlined in black, slightly darker than ground color, but not present as distinct spots as in holotype.

Hindwing Underside: as in holotype male, but darker (Begonia Rose), except for a 2mm-wide submarginal band that repeats the dorsal marginal band. Discal and marginal areas with scattered Begonia Rose scales, becoming more dense at base of costal margin and in space between discal cell and inner margin. Subcostal vein with a row of blackish scales.

ABDOMEN: dorsum spotted as in male, but ground color darker (Rose Red); venter Brazil Red.

Genitalia (Figs. 20, 23), described from a topotypic paratype, 1 July 1965: ductus bursae very wide, inflated, heavily sclerotized;

cervix bursae large, rubbery, somewhat convoluted; corpus bursae large, spherical, membranous, with two round signa of sclerotized dots, one signum on each side. Lamella antevaginalis well-sclerotized, expanded laterally; lamella postvaginalis irregular in shape, with a dense patch of fine hair on the dorsal side. The sclerotized plates to which the apophyses anteriores are attached are broad and rounded. Other structures as illustrated.

SIZE: forewing 15mm from base to apex (end of vein R_4); 10mm from base to tornus (end of vein 2A); 8mm from apex to tornus (straight line). Hindwing 10.5mm from base to apex (end of vein R_s); 6mm from base to anal angle (end of vein 3A); 9.5mm from apex to anal angle (straight line).

VARIATION

As with many species of arctiids, the variation in this species is considerable. In the long series of paratypes the following individual variation has been observed (the individual variation is so great that geographical variation, if any, would be concealed to all but detailed statistical analyses):

MALES: general coloration is fairly constant, although the wings of some specimens may be less densely scaled than others, so that light reflecting from the membrane gives the hindwings a more shiny, rosy appearance. Grease may cause the thorax and abdomen to darken and lose their color.

Forewing Pattern (upperside): at least one line is always distinct (usually the postmedial). Many specimens have more prominent lines than those described in the holotype. The smudge beneath the cell in the holotype is developed in other specimens to a conspicuous, oblique antemedial line, extending from the posterior side of the cell to the inner margin (as described in the allotype). The postmedial line is constant in configuration but variable in intensity. The subterminal line, when well-developed, is Y-shaped, as described in the allotype. There is often an additional, adterminal, line between veins M_1 and Cu_2 . The basic pattern elements, then, are: an oblique antemedial line from the posterior side of the discal cell to the inner margin; a curved postmedial line; a Y-shaped subterminal line; and an adterminal line. Very rarely the antemedial line is bent at the posterior margin of the discal cell, and continues proximad across the cell, as in well-marked specimens of *P. assimilans*. The result is an excurved antemedial line. The variability of forewing markings in this species is a result of the permutations, combinations, and degree of development of these four pattern elements and their parts.

Hindwing Pattern (upperside): the blackish band on the hindwing may be marginal, as in the holotype, or it may be submarginal, with the pink ground color occurring between the band and the fringe. When the band is submarginal it usually touches the apex and anal angle, diverging most from the outer margin between veins M_1 and Cu_2 . This

band is almost always continuous and fairly uniform, but in some specimens it becomes constricted to form a series of confluent maculae, occasionally leaving an isolated spot or two near the anal angle.

FEMALES: the general coloration is fairly constant, although the shade of pink on the hindwing is subject to some variation, perhaps partly due to age of the specimen.

Forewing Pattern (upperside): because the ground color is darker than in males, it is more difficult to distinguish the pattern. But all four pattern elements are present in well-marked specimens, and these elements undergo variation as described for males.

Hindwing Pattern (upperside): the extent of black suffusion varies, but it always extends to the outer margin (not becoming macular or submarginal as in males), and nearly always enters part of the discal cell. Consequently, the extent of pink also varies. The anal area is always conspicuously pink or red.

LIFE HISTORY

Phragmatobia lineata is apparently at least double brooded, and may be triple brooded. Light trap captures at the type locality in 1965 showed three definite flight periods: early May (two males); late June to late July (50 males, five females); and mid-August to mid-September (32 males, one female). Small numbers of specimens have been recorded from other localities from early April to early October.

Although we have not examined any larvae of this species, we do have a good idea of its general appearance. Goodhue (1902) reared this species in Webster, New Hampshire, but thought he was dealing with either *P. assimilans* var. "franconia" or an undescribed species. He described the larva as "... pale yellow, thickly covered with rather long soft light yellow hair" (p. 286), adding that it looked exactly like the larva of *Euchaetias oregonensis*. We have examined two male *P. lineata* from Webster (in coll. Brower and UNH) with pin labels that verify the above description. Although the larval descriptions for *P. fuliginosa* and *P. assimilans* are conflicting, none of them resembles this description of the *P. lineata* larva. Overwintering is in the larval or pupal stages, or perhaps both.

FOODPLANTS: *Eupatorium* (thoroughwort, Joe-Pye weed, etc.) (Goodhue, 1902), and probably on many other low herbs, such as *Solidago* (goldenrod), *Taraxacum* (dandelion), and *Rumex* (dock).

FIGURES: a very good illustration of a *P. lineata* female appears in Beutenmüller (1898: pl. 16, fig. 6, as *P. fuliginosa*), while Hampson (1901: fig. 135, p. 244) depicts a *P. lineata*, probably a female, as *P. fuliginosa* ♂. Although Hampson's figure clearly shows the postmedial line and part of the subterminal line, his description omits mention of them.

DISTRIBUTION

(Fig. 38)

Calgary, Alberta (!) and southern Manitoba; and in the Transition and Upper Austral Zones, usually in deciduous forest areas, from eastern Nebraska, Iowa, and northeastern Missouri east through northern Illinois, southern Michigan, extreme southwestern Ontario, northern New York and central Maine, south to northern Indiana, northern Ohio, Pennsylvania, and central New Jersey. The northern limit of distribution is hard to define, but the known southern limit is near 40° north latitude. The Alberta and Manitoba records are exceptional, in that they are widely disjunct from other populations. Further collecting may prove these populations to be continuous with those in the United States.

TYPES

The holotype male was collected by black light trap in an area surrounded by uncultivated fields one mile east of Galien, Berrien County, Michigan (Township 8 South, Range 19 West, Section 1) on 2 July 1965 by R. E. Thompson. The allotype female was collected by R. E. Thompson at the same locality on 23 June 1965. Both the holotype and allotype are deposited in the Entomology Museum at Michigan State University. Paratypes are as follows (all specimens, except a disintegrated male from Van Buren Co., Mich., are designated as paratypes):

SPECIMENS EXAMINED (526)

CONNECTICUT. HARTFORD: Warehouse Point at Route 5, 28 June 1959, 1♂ (PM). LITCHFIELD: Kent Falls St. Pk., 1 July 1953, C. L. Remington, J. Coutsis, L. & J. Brower, 1♂ (PM). New Preston, 30 June 1951, S. A. Hessel, 2♂ (Hessel). Pleasant Valley, F. C. Pasch, 1♂, and G. P. Engelhardt, 1♂ (CU, Type No. 4325); Aug. 1915, 1♂ (USNM). Washington, 19 April 1959, 6 May 1953, 23 June-23 July 1953, 1955, 1957, 1959-61, 1963-65, 17 Aug. 1965, 10 Sept. 1965, 11 Sept. 1955, S. A. Hessel, 44♂, 2♀ (Hessel), 5♂ (PM).

ILLINOIS. CARROLL: Svanma, 20 July 1927, T. H. Frison, 1♂ (INHS). CHAMPAIGN: Urbana, 12 Aug. 1886, 12 April 1887, C. A. Hart, 2♂, 2♀ (INHS). COOK: Arlington Heights, 18 Sept. 1933, A. L. McElhose, 1♂ (CNHM). Chicago, 1 Sept. 1925, Emil Beer, 1♀ (INHS); 16 July 1951, D. H. Kistner, 1♂ (CNHM); 21 July 1948, Otto Buchholz, 1♂, 1♀ (AMNH); 7 July 1929, 10 Aug. 1949, 24 Aug. 1948, A. K. Wyatt, 2♂, 2♀ (CNHM); 24 & 28 Feb., 17 March 1927 (reared), A. W. Herz, 2♂, 2♀ (CNHM); 17 July 1929, 23 Aug. 1933, A. W. Herz, 1♂, 1♀ (CNHM). Edgebrook, 14 Aug. 1949, D. H. Kistner, 1♂ (CNHM); 4 & 6 Aug. 1947, A. K. Wyatt, 3♂ (PM). Oak Park, 22 April, 29 June, 5 July, 9 July 1946, R. H. Leuschner, 4♂, 3♀ (Leuschner). Morton Grove, 28 June 1949, 19 Aug. 1950, D. H. Kistner, 2♂ (CNHM). KANE: Aurora, 17 July 1927, T. H. Frison & R. D. C., 1♂ (INHS). LEE: Lee Center, 22 Aug. 1929, L. Beer, 1♂ (INHS); 1 Sept. 1940, E. Beer, 1♂ (INHS). MCLEAN: Normal, 1876, 1♂ (INHS). PEORIA: Elmwood, 4 July-28 Aug. 1929, 1930, 1932, 1933, A. W. Herz, 4♂, 2♀ (CNHM).

INDIANA. ELKHART: Bristol, 26 June 1930, E. F. Lustig, 2♂, 1♀ (CNHM). LAKE: Hessville, 5 July 1913, E. Beer, 1♂ (INHS).

IOWA. MUSCATINE: Muscatine, 8 June 1910, "feeding on *Rumex*," K. L. Cockerham, 1♂ (USNM). WOODBURY: Sioux City, 27 July 1917, A. Lindsey, 1♂ (USNM); 24 April 1910, Barnes coll., 1♂ (USNM).

MAINE. no locality, 1 Aug., Otto Buchholz coll., 1♂ (AMNH). PENOBSCOT: Lincoln, W. J. Clayton, 1♂ (Brower). YORK: Kittery Point, 2 July 1912 (?), R. Thaxter, 1♂ (KU).

MASSACHUSETTS. no locality, Strecker coll., 1♂ (CNHM); Thaxter, 1♂ (MCZ); 17 July 1901, 4♂ (CAS). BARNSTABLE: Woods Hole, 26 July 1919, W. T. M. Forbes, 1♂ (CU, Type No. 4325). Barnstable, 14 July 1952, C. P. Kimball, 1♀ (AMNH). BRISTOL: Acoaxet, 15 June 1933, V. H. dos Passos, 1♂ (AMNH). DUKES: Marthas Vineyard Is., 26 July, Frank M. Jones, 1♀ (PM). ESSEX: Magnolia, Aug. 1901, Holland, 1♂ (CM). HAMPSHIRE: Amherst, 4 July 1964, R. W. Koss, 1♂ (MSU); 27 April 1941, J. Kenny, 1♂ (MASS); 30 June 1941, Marion E. Smith, 1♂ (MASS); "Wind-on," 21 Sept. 1911, 1♂ (MASS). MIDDLESEX: Tyngsboro, 12 & 17 July 1915, H. C. Fall, 2♂ (MCZ). Newton, Thaxter coll., 2♂, 1♀ (MCZ); June 1876 (?), 1♂, 1♀ (MCZ). NORFOLK: Cohasset, 4 & 5 July, G. D. Hulst coll., 2♀ (AMNH).

MICHIGAN. ALLEGAN: Allegan St. For., 14 July 1959, R. L. Fischer, 1♂ (MSU). BERRIEN: Galien [type locality], 2 July-3 Sept. 1964, R. E. Thompson, 48♂, 3♀; and 2 & 4 May, 26 June-24 July, 15 Aug.-13 Sept. 1965, R. E. Thompson, 84♂, 6♀ (all MSU). Sodus, 16 July 1960, W. T. Van Velzen, 1♂ (MSU). BRANCH: "vic. Branch Co.," B. D. Stroup, 1♂ (CU, Type No. 4325). 19 July 1964, John H. Newman, 1♂ (MSU). Coldwater, 9 July 1939, P. E. Moody, 1♀ (UMMZ). CALHOUN: Baker Sanctuary, 1 July 1963, J. J. Jackson, 4♂ (MSU); 17 July 1965, R. E. Thompson, 1♂ (MSU); 22 July 1965, R. E. Thompson, J. J. Jackson, 6♂ (MSU). CASS: Wakelee, 10 July 1937, W. S. McAlpine, 2♂ (McAlpine). CLINTON: Rose Lake Exp. Sta., 26 June-24 July 1965, R. E. Thompson, 13♂, 1♀ (MSU). Bath Township, 15 July 1955, R. L. Fischer, 1♂ (MSU); 3 Sept. 1964, 1♂ (MSU); 3 & 17 Sept. 1964, 2♂ (MSU). EATON: Olivet, 10 July 1966, R. C. Fleming, 1♂ (MSU). GRATIOT: St. Louis, 9 July 1964, Del Bierlein, 1♂ (MSU). INGHAM: Dansville Game Area, 14 & 19 July 1961, M. C. Nielsen, 2♂ (Nielsen). East Lansing, June & July 1962, 1♂, 1♀ (MSU). Lansing, 18 July 1948, 1♂ (MSU). IONIA: 12 July 1965, Hecht, 1♂ (MSU). JACKSON: Pleasant Lake, 8, 18, & 22 May 1965, Wm. Stanley, 4♂ (MSU). Waterloo, 10 July 1964, R. W. Holzman, 1♂ (Holzman). KALAMAZOO: 22 July 1960, John H. Newman, 1♂ (MSU). Gull Lake Biol. Sta., 3-29 July 1957-1961, 1965, & 29 Aug. 1964, R. L. Fischer, R. J. Snider, R. W. Koss, 14♂ (MSU). KENT: Harvard, 26 June & 1 Aug. 1964, F. J. Ignatoski, 2♂ (MSU). LAPEER: 27 June 1959, 19 July 1960, R. W. Holzman, 2♂ (Holzman). LENAWE: 14 July 1951, M. C. Nielsen, 1♂ (Nielsen). T8S, R2E, Sec. 31, 3 July 1965, M. C. Nielsen, 1♂ (Nielsen). Morenci-Mulberry Rd., 22 & 23 June, 22 July, 28 Aug. 1960-1962, M. C. Nielsen, 10♂ (Nielsen). T8S, R2E, Sec. 30, 24 July 1965, R. W. Holzman, 1♂ (Holzman). LIVINGSTON: 4-25 July 1959, 1960, 1 & 3 Sept. 1959, John H. Newman, 7♂ (MSU). Green Oak Twp. Farm, 28 July 1951, John H. Newman, 1♂ (MSU). Edwin S. George Reserve, Station 3 light trap, 29 June, 28 & 29 July, 2 Oct. 1951, John H. Newman, 5♂ (MSU). NEWAYGO: Fremont, 16 & 26 July 1965, Mrs. Wm. Zapletal, 2♂ (MSU). OAKLAND: 22 July 1963, John H. Newman, 1♀ (MSU). T4N, R10E, Sec. 24, 22 July 1965, R. W. Holzman, 1♂ (Holzman). ST. JOSEPH: T7S, R12W, Sec. 7, 4 & 8 July 1965, R. W. Holzman, 2♂ (Holzman). SHIAWASSEE: Moon Lake, T5N, R1E, Sec. 21, 13 July 1966, Julian P. Donahue, 3♂ (MSU). VAN BUREN: Bangor, no data, Richard Fleming coll., 1♂, disintegrated, not a paratype. WAYNE: 10 July 1963, R. W. Holzman, 1♂ (Holzman). Belleville, 8 July 1963, Donna Curry, 1♂ (MSU).

MISSOURI. PIKE: Louisiana, 23 Sept. 1905, 1♂ (CAS).

NEBRASKA. DOUGLAS: Florence, 19 July 1903, F. H. Marshall, 1♂, 1♀ (OSM).

NEW HAMPSHIRE. no data, "Bred. Larva dark yellow, thickly covered with short stiff bristles, after the manner of *A. isabella*," 1♀ (UNH); "E. Light," 2♂ (UNH); White Mountains, 2♂ (MSU). MERRIMACK: Webster, W. F. Fiske, 1♀ (UNH);

emerged 10 Aug., "Larva pale light yellow. Long soft hair. Looks like *Euch. oregonensis*," 1♂ (Brower); 16 July, "Bred. Larva pale light yellow, long soft hair, looks like larva of *Euchaetes oregonensis*. 7-16," 1♂ (UNH); 25 July, 1♂ (UNH). ROCKINGHAM: Hampton, 10, 24, & 26 July, 1904, S.A. Shaw, 2♂, 1♀ (Brower). STRAFORD: Durham, 22 June & 19 July 1897, Weed & Fiske, 2♂ (UNH). SULLIVAN: Claremont, 17 July 1901, Barnes coll., 1♀ (USNM); 10 July 1911, 1♂, 1♀ (USNM).

NEW JERSEY. BERGEN: Ramsey, 20 July 1917, 1♂ (AMNH). BURLINGTON: New Lisbon, 8 June 1930, 29 Aug. 1938, E.P. Darlington, 1♂, 1♀ (ANS). ESSEX: Nutley, 2 May 1921, 1♀ (AMNH). Newark, G.D. Hulst coll., 1♂ (AMNH); 9 June, Otto Buchholz coll., 1♀ (AMNH). Short Hills, 2-12 July 1941, 1946, 1950, 14 & 31 August 1949, 1950, Joseph Muller, 5♂, 2♀ (Muller). MERCER: Trenton, 22 June, Sweadner coll., 1♂ (CM). MORRIS: Morristown, 8 July 1948, G.H.H. Tate, 1♂ (AMNH). Mt. Lake, 10 July 1933, V.H. dos Passos, 1♂ (AMNH). Tabor, Aug. 1933, V.H. dos Passos, 1♂ (AMNH). Mendham, 26 June-15 July 1934, 18♂, 1♀ (AMNH), 1♂, 1♀ (Brower). OCEAN: 22 May 1952, 24 June-13 July, 20-30 Aug. 1949, 1951, 1952, 1955, Otto Buchholz, 15♂, 1♀ (AMNH). Lakehurst, Frederick Lerner, 1♀ (AMNH); 25 & 27 June 1951, Joseph Muller, 5♂ (Muller). PASSAIC: Paterson, 10 July, J.A. Grossbeck coll., 2♂, 1♀ (AMNH). UNION: 8 July, A.L. McElhose coll., 1♂ (CNHM). Elizabeth, 12 July, Otto Buchholz coll., 1♀ (AMNH).

NEW YORK. no data, C.V. Riley, 2♂, 1♀ (USNM); Wm. Schaus coll., 1♂, 2♀ (USNM); Barnes coll., 1♂, 1♀ (USNM); Henry Edwards coll., 1♀ (AMNH); 1884, Zeller coll., 2♂ (one without locality, assumed to be N.Y.) (B.M.); 1♀ (CAS); R.H. Stretch coll., 1♂ (CAS); 1♂ (KU). ALBANY: Albany, 4 July 1921, A.C. Frederick, 1♂ (AMNH). CLINTON: Peru, 15-16 Sept. 1917, Mix & Everett, 1♂ (CU, Type No. 4325). KINGS: Dyker Heights, Brooklyn, C. Pasch, 1♀ (CU, Type No. 4325). NEW YORK CITY: S.L. Elliott, 6♂, 3♀ (AMNH). West Farms, J. Angus, 1♂ (AMNH). NASSAU: Glen Head, 28 June 1960, Sutherland, 1♂ (UNH). Long Island, South Shore, Nassau-Suffolk Borer, 12 July 1951, S.A. Hessel, 2♀ (Hessel). QUEENS: Flushing, 1 July, 1♂ (UMMZ). ROCKLAND: Bear Mts., Otto Buchholz coll., 1♂ (AMNH); 17 July 1924, H. J. Elb, 1♂ (AMNH). Valley Cottage, 20 June 1952, 1 July 1953, M. Shulgin, 1♂, 1♀ (PM). SUFFOLK: Long Island, A.T. Slosson, 1♀ (AMNH); Aug. 1908, 1♂ (Plath). ULSTER: Boiceville, 9 July 1936, J.G. Franclemont, 1♂ (CU, Type No. 4325). WEST-CHESTER: Pelham, 30 July 1926, L. Lacey, 1♀ (AMNH).

OHIO. PAULDING: Sec. 15, Benton Township, 8 Sept. 1963, Homer Price, 1♂ (Price).

PENNSYLVANIA. ALLEGHENY: Pittsburgh, 1♂ (CM). BERKS: Adamstown, June 1929, H.C. Moyer, 2♂ (CNC). LANCASTER: Columbia, 1 July 1949, 1♂ (KU). PHILADELPHIA: Homebrook, "L Merion Tp Pa," 18 July 1916, F. Haimbach, 1♀ (ANS). Philadelphia, 14 July, F. Haimbach, 1♀ (ANS). YORK: Picketts, Washington Twp., 27 June 1949, 1♀ (KU). Wrightsville, 27 June 1949, P.J. Spangler, 1♀ (KU).

RHODE ISLAND. PROVIDENCE: Elmwood, 10 July, 7 Aug., Engel coll., 3♂ (CM); 18 July 1906, Edward D. Keith, 1♂ (CM). Oak Lawn, 1907, Grace H. & John L. Sperry, 1♂ (AMNH). WASHINGTON: Westerly, "July," 23 July, 4 Aug., 1926, 1928, Holland, 2♂, 1♀ (CM).

CANADA

ALBERTA: Calgary, Head of Pine Creek, 1 & 7 May 1914, 27 May 1894, F.H. Wolley Dod, 2♂, 1♀ (CNC); Calgary, "at rest in town," 30 May 1907, F.H. Wolley Dod, 1♀ (CNC).

MANITOBA: Aweme (6 mi. N Treesbank), 20 & 22 May 1904, 1910, N. Criddle, 1♂, 1♀ (FRLM). Brandon, 27 April 1952, C. Bird, 1♀ (FRLM).

ONTARIO: HALDIMAND CO: Dunnville, 20 July 1958, W. Plath Sr. & Jr., 1♂ (Plath). KENT CO: Rondeau Prov. Pk., 9 July 1965, J.C. E. Riotte, P. Hebert, 1♂ (ROM).

PHRAGMATOBIA FULIGINOSA RUBRICOSA (Harris)

(Figs. 3, 6, 9, 12, 15, 18, 22, 25, 30-33)

Arctia fuliginosa Linnaeus, 1758: 509.*Phragmatobia fuliginosa*, Stephens, 1829: 74.*Arctia rubricosa* Harris, 1841: 253 (nec. *P. rubricosta* Dognin, 1889: 193, type locality Loja, Ecuador).*Phragmatobia fuliginosa rubricosa*, Rothschild, 1910: 116; McDunnough, 1938: 49.

The infraspecific names proposed for this species in Europe, several of which are listed in the introduction, are not considered by us to be applicable to this subspecies.

Phragmatobia rubricosa was generally accepted as a valid species distinct from *P. fuliginosa* until Dyar (1891) synonymized the two. Allan Watson of the British Museum (Natural History) concurs with us (pers. comm.) in believing that the North American population is at least subspecifically distinct from the named European populations. This judgment is based primarily on color and pattern differences: most European specimens we have seen are much lighter in color, and in most the hindwing band is more or less macular, especially towards the anal angle—a character seldom seen in North American specimens. There are also minor differences in the male genitalia, especially in the vesica, that may prove to be valid criteria for the specific separation of the two populations, but this decision must await further work on the Eurasian species.

Phragmatobia fuliginosa rubricosa is closely allied to *P. lineata*, and has been confused with it for years. Any published references to a "form" with lines on the forewing (as in Forbes, 1960, and Beutenmüller, 1898) refer to *P. lineata* only, for *P. fuliginosa* never has lines on the forewing (with two notable exceptions: a male in the A.E. Brower collection from Dennistown, Somerset Co., Maine, 21 July, and a male in the Hessel collection from Washington, Litchfield Co., Conn., 22 Sept. 1961, but the genitalia proved them to be *P. fuliginosa*—the forewings are marked as in *P. lineata*, the hindwings are dark as in *P. fuliginosa*).

While the absence of forewing lines separates this species from *P. lineata*, the shiny, translucent wings, the smaller size, the dark costal margin of the hindwing upperside, and the flying time (usually later in the season) serve to separate this species from *P. assimilans*. A few unusually small specimens of *P. fuliginosa rubricosa* occur in May and early June (the flying time of *P. assimilans*), but the great majority is collected from late June through September.

Whenever the identity of a specimen is uncertain, an examination of the male genitalia quickly dispels any doubt. A pair of jeweler's forceps, a fine brush, and a dissecting microscope are the only tools needed to remove the anal hairs and examine the exposed valvae. This is the only North American species with two projections on the valva (Fig. 15).

MALES tend to be slightly smaller than males of *P. lineata*. The general appearance is much the same, except that lines on the forewing are absent, and the hindwing is usually more suffused with black. The distal edge of the black band on the hindwing upperside usually extends to the outer margin, while the proximal edge usually suffused inward to the discal area, sometimes (Fig. 32) leaving only the costal patch, fringe, and anal area pink or red, as in females. In those few specimens in which the black band is submarginal (Fig. 30), the band is usually more sharply defined, distally dentate, and tends to be broken up into spots, as in most European specimens. This variation, occurring throughout the North American range of this species, appears to be individual rather than geographic. The coremata (Fig. 12) are well-developed, as in *P. lineata*.

FEMALES are about the same size as *P. fuliginosa* males, but are generally smaller than *P. lineata* females. In general appearance they are much darker than males, with the black on the hindwing always extending to the outer margin (Figs. 31, 33).

GENITALIA: The male genitalia (Figs. 3, 6, 9, 15) are distinctive. In the absence of adequate series of specimens of known parentage, no constant, outstanding differences in female genitalia have been noted at this time. Figures 22 and 25 will, however, give an idea of some potential specific differences.

LIFE HISTORY: The larvae are apparently quite variable in color, judging from published descriptions (Beutenmüller, 1898; Edwards, 1887; Edwards & Elliot, 1883; Goodhue, 1902). The descriptions agree in that the skin of the larva is black or slate, but the color of the setae apparently varies from chestnut to a foxy yellow. Some authors say the larvae have pale yellow dorsal and lateral lines, but we have not seen specimens marked in this manner. According to Goodhue (1902), the thoracic setae are usually darker.

There are probably at least two broods a year. We have seen larvae crawling about in the autumn looking for places to overwinter, in a manner similar to that of the common banded woolly bear (*Pyrrharctia isabella*). On 27 February 1966 Lois Donahue found such an overwintering larva under a log beside an old field in Livingston Co., Michigan. When brought indoors it refused to eat dandelion and pupated in a flimsy cocoon on 2 March 1966, emerging 10 days later.

Specimen labels, and our own observations, show that some larvae pupate in the fall, and overwinter as pupae. The few early spring specimens that have been collected, especially in boreal localities, probably represent pupae or ultimate-instar larvae that overwintered, while most specimens flying later in the spring and in early summer probably are the offspring of the spring brood. Larvae which overwintered in earlier instars may produce moths that fly later, intermingling with the early summer brood. These conjectural statements, based on meager observations and a few notes on specimen labels, only hint at what is actually happening. The dynamics of the various broods can only be determined after further study.

PARASITES: *Zenillia affinis* (Fallén) (Diptera: Tachinidae) has been reared from the larvae of what was identified as *Phragmatobia fuliginosa rubricosa* (Schaffner & Griswold, 1934). The fly referred to is possibly *Hubneria estigmenensis* (Sellers)—a species with which Fallén's species has been confused.

FOODPLANTS: The larvae are general feeders on low herbaceous vegetation. Specific records include *Solidago* (goldenrod), *Eupatorium* (thoroughwort, Joe-Pye weed, etc.), *Symplocarpus* (skunk cabbage), *Vernonia noveboracensis* (ironweed), *Rumex* (dock), *Plantago* (plantain), *Myrica gale* (sweet gale), and *Helianthus* (sunflower) (Beutenmüller, 1898; Dirks, 1937; Edwards & Elliot, 1883; Edwards, 1889; Jones, 1951; and specimen labels).

FIGURES: This species has been correctly figured in Holland (1903: fig. 70; pl. 14, no. 31) and Seitz (1919: pl. 38i, as *rubricosa*). For figures erroneously referring to this species, see the discussion under *P. lineata*.

TYPE LOCALITY: Unknown, but presumed to be somewhere in Massachusetts. The original description does not designate a type locality, but Harris (1841), writing about Massachusetts insects, says "This moth is rare; and it appears here in July and August " (p. 253), the "here" assumed to mean Massachusetts.

TYPE SPECIMEN: Male (genitalia examined), Type No. 26372, in the Harris Collection at the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts.

DISTRIBUTION (Fig. 36): South of the tundra from central Alaska to Newfoundland, south to California (Boisduval, 1852, in addition to the two specimens cited here), Montana, and Colorado, and south to North Dakota, Minnesota, northern Illinois, northern Indiana, southern Michigan, Pennsylvania, and New Jersey. Probably also occurs in central British Columbia, Alberta, at high elevations all along the coastal ranges and Rockies, and in Ohio. The few specimens that have been collected in montane or far-northern areas were caught during the daytime, when the moths were active. Holland (1903) states that this species occurs south along the Appalachians to the Carolinas, and Seitz (1919) says it occurs in "Carolina" (possibly repeating Holland), but we have neither seen nor heard of any specimens from south of Pennsylvania. Rothschild's (1910) record of Florida specimens must be viewed with extreme doubt.

SPECIMENS EXAMINED (991)

ALASKA. Kuskokwim River, A. stecker, 2♂ (CM). Matanuska Exp. Sta., 21 & 24 April 1944, J.C. Chamberlin, 2♂ (USNM). Matanuska, 21 May 1945, "from soil (road)," Allan Linn, 1♂ (USNM). McKinley Park, 5 June 1931, F.W. Morand, 1♂ (USNM). Nushagak, 13 May 1882, McKay, 1♂ (USNM). Palmer, 21 May 1951, 20♂ June 1950, R.H. Washburn, 1♂, 1♀ (USNM). Rampart, 2 June 1900, 16 June 1903, M.E. Koonce, 2♂ (CM).

CALIFORNIA. INYO: near Mono Pass, elev. 12,000 feet, 9 Aug. 1958, C.D. MacNeill, M.R. Lundgren (caught in daytime; very fast flying and hard to catch), 2♀ (CAS).

COLORADO. no data: Smith, 2♂ (BM); strecker coll., 1♂ (CNHM). DENVER: Denver, Engel coll., 2♂ (CM); 8-15 Aug., Barnes coll., 3♂, 1♀ (no date) (USNM). GARFIELD: Glenwood Springs, Barnes coll., 1♂ (USNM). UNKNOWN LOCALITIES: "Colorado, Bruce," 2♂, 1♂ (no date), Edward T. Owen (USNM); Hayden Mts., Oslar, Aug., Barnes coll., 1♂ (USNM) [There is a Hayden Peak somewhere in NW Colorado, while there is an Oslar in Ouray Co.; J. Oslar, however, may have been the collector.]

CONNECTICUT. LITCHFIELD: Beckley Bog, Norfolk, July 1965, S.A. Hessel, 1♂ (Hessel). New Preston, 31 July 1951, S.A. Hessel, 2♂, 1♀ (Hessel). Pleasant Valley, F.C. Pasch, 1♂ (CU). Washington, 10-26 May, 29 June-4 Oct. 1952, 1955, 1958, 1961-1965, S.A. Hessel (a 22 Sept. 1961 ♂ has traces of lines on the forewing, genitalia examined), 65♂, 2♀ (Hessel); 11 Aug. 1965, S.A. Hessel & J.P. Donahue, 8♂ (MSU). WINDHAM: Putnam, 21 Aug. 1951, A.B. Klots, 6-30 July, 21 Aug., 1951, 1960, 1961, 6♂ (AMNH). South Shore, Killingly Pond, Connecticut-Rhode Island Border, 20 July 1930, A.B. Klots, 1♂ (AMNH).

ILLINOIS. no data: Strecker coll., 2♂ (CNHM); Henry Edwards coll., no. 8026, 1♀ (AMNH); 26 June 1904, A. Sala, 2♂, 1♀ (CNHM). COOK: Chicago, 1♂ (USNM); Hm Ramstadt, 1♂ (UMMZ); 30 July 1897, A.K. Wyatt, 1♀ (CNHM); E.B. Chope, 1♂ (CNHM); 5 Aug. 1904, E. Beer, 1♂ (INHS). Edgebrook, 22 June 1925, A.K. Wyatt, 1♂ (CNHM); 19 July 1913, E. Liljeblad, 1♂ (UMMZ); 27 July 1929, E. Beer, 1♀ (INHS). Lincoln Park, 24 July 1899, E. Liljeblad, 1♂ (UMMZ). KANE: Elgin, 11 April 1926, M. Bristol, ex larva, 1♂ (INHS). LAKE: Antioch, 25 Aug. 1925, T.H. Frison, 1♂ (INHS). Ingleside, 30 May 1926, A.K. Wyatt, 1♀ (CNHM). Volo, 2 Aug. 1944, A.K. Wyatt, 2♂ (CNHM), 1♂ (PM). McHENRY: Algonquin, 3-13 Aug. 1907, 1909, Nason, 2♂, 3♀ (INHS). Harvard, Engel coll., 1♂ (CM). OGLE: Oregon, 3 Sept. 1906, E. Liljeblad, 1♂ (UMMZ). PEORIA: Elmwood, 6 May 1934, A.W. Herz coll., 1♀ (CNHM).

INDIANA. LAKE: Clarke, 21 May 1905, A.K. Wyatt, 1♀ (CNHM). Hesselville, 5 July, H. Ramstadt, 1♂ (UMMZ); 17 & 25 July 1908, 1910, E. Liljeblad, 4♂ (UMMZ).

MAINE. no data: 1♂ (USNM). AROOSTOOK: Portage, T17, R13, 28 June 1958, A.E. Brower, "beaten ex fir," 1♂ (Brower). Houlton, 3 Aug., 1♀ (Brower). Woodland, 30 July, 1♂ (Brower). FRANKLIN: Eustis, 7 Aug. 1965, 1♂ (MSU). Kingfield, 12 Aug. 1965, 2♂ (MSU). Rangeley, 31 July, 4 Aug. 1938, V.H. dos Passos, 1♂ (AMNH), 1♂ (FRLNB). KENNEBEC: Augusta, 3 Aug. 1944, A.E. Brower, 1♂ (Brower). Monmouth, 18 & 27 July, 1 Aug. 1957, 3♂ (Brower). KNOX: Hope, 22 July-17 Aug. 1963-1965, S.C. Kleene, 2♂ (Kleene), 5♂ (MSU). PENOBSCOT: Holland coll., labeled "Moth Book Plate XIV, Fig. 31," 1♂ (CM). Lincoln, 28 July 1937, V.H. dos Passos coll., 1♂ (AMNH); 15 June 1937, 18 July, one with no date, 3♂ (Brower). Orono, 1♂ (CU). Shin Pond, 24 July, 1♂ (Brower). PISCATAQUIS: Greenville, 24 July 1965, 1♀ (MSU). SOMERSET: Dennistown, 21 July, 1♂ (forewing with lines as in *P. lineata*, hindwing as in *fuliginosa*; genitalia confirm the latter) (Brower). T8, R19, 8, 9, & 17 Aug. 1965, 4♂ (MSU). Jackman, 6 & 7 Aug., A.E. Brower, 2♂ (Brower). WASHINGTON: Topsfield, 5 Aug. 1965, 1♂ (MSU). YORK: Kittery Point, 2 July 1912, R. Thaxter, 1♂ (USNM); 5 May, R. Thaxter, 1♂ (MCZ). Kennebunkport, 11 & 13 Aug. 1901, G.H. Clapp, 2♂ (CM); July & Aug., G.H. Clapp, 3♂ (CM).

MASSACHUSETTS. no data: 3♂ (INHS); 17 July 1901, J.G. Grundell, 1♂ (CAS); also two males in the Harris collection, MCZ, one of which is type of *Arctia rubricosa*, both presumably from Mass. BARNSTABLE: Barnstable, 20 July 1952, C. F. Kimball, 1♂ (AMNH). BERKSHIRE: Tyringham, 16-27 July 1953, A.E. Treat, 6♂ (AMNH). DUKES: Marthas Vineyard Is., 29 July & 8 Aug., Frank M. Jones, 1♂, 1♀ (PM). HAMPSHIRE: Amherst, 4 & 31 July 1964, R.W. Koss, 1♂, 1♀ (MSU); 27 April 1938, Savage, 1♂ (MASS); 22 May 1948, J. O'Neil, 1♀ (MASS); 27 July 1942, S.K. & A.L., 1♂ (MASS); 23 Aug. 1938, W. Kulash, 1♂ (MASS); 20-31 July 1935, 1944, Marion E. Smith, 4♂ (MASS). MIDDLESEX: Natick, 1♂ (MCZ). Sherborn, 22 July 1900,

H. C. Fall coll., 1♂ (MCZ); 24 July, 1♂ (MCZ). Tyngsboro, 21 & 27 July 1915, 28 July 1925, H. C. Fall coll., 2♂, 1♀ (MCZ). NORFOLK: Cohasset, 6 Aug., G. D. Hulst coll., 1♀ (AMNH). Norfolk, 11 May 1903, A. P. Hall, 1♂ (USNM). PLYMOUTH: Agr. Exp. Sta., East Warehouse, 28 July 1962, 1♂ (AMNH). WORCESTER: Phillipston, 19 July 1919, H. H. Shepard, 1♂ (MASS), 1♂ (Brower). Winchendon, 16 July, Engel coll., 1♂ (CM); 5 Aug. 1899, Engel coll., 1♂ (CM).

MICHIGAN. ALLEGAN: Allegan State Forest, 14 July 1959, R. L. Fischer, 2♂ (MSU). BAY: 5 July 1964, 1♂ (MSU). T15N, R4E, Sec. 36, 16 & 27 May, 13 July, 1962, 1963, V. Warczynski, 3♂ (Warczynski). BERRIEN: Galien, 19 July-3 Sept. 1964, 1965, R. E. Thompson, 14♂, 14♀ (MSU), 1♂ (BM). Sodus, 2-11 Aug. 1960, W. T. Van Velzen, 6♂ (MSU). BRANCH: "vic. Branch Co.," B. D. Stroup, 4♂ (CU). Coldwater, 9 July 1939, P. E. Moody, 1♂ (UMMZ). CALHOUN: Baker Sanctuary, 17 & 22 July 1965, R. E. Thompson, J. J. Jackson, 2♂, 1♀ (MSU). CASS: Wakelee, 10 July 1937, W. W. Newcomb, 1♂ (UMMZ). CHEBOYGAN: Burt Lake, 24 July, 8 Aug. 1937, 1938, Max Peet, 4♂ (UMMZ). Univ. of Mich. Biol. Sta., Douglas Lake, 23 July 1965, G. R. Williams, 1♀ (Voss). T38N, R1W, Sec. 35, 29 Aug. 1961, M. C. Nielsen, 1♂ (Nielsen). CLARE: 23-28 July 1959, R. R. Dreisbach, 1♂ (MSU). CLINTON: Rose Lake Exp. Sta., 26 June-24 July, 12 & 26 Aug. 1965, R. E. Thompson, 4♂, 4♀ (MSU). Bath, 28 May 1956, 28 July 1955, R. L. Fischer, 4♂, 1♀ (MSU); 5 Aug. 1956, H. Niemczyk, 2♂ (MSU). EATON: Olivet, 1♀ (Fleming); 25 Oct. 1964, Paul Hahn, 1♂ (Fleming). INGHAM: Aurelius, 1 Aug. 1938, 1♂ (MSU). East Lansing, June 1962, 8, 24, 28 July, 1941, 1964, July 1962, Aug. 1962, 6 Aug. 1940, 10♂, 1♀ (MSU); 8 May 1965, Gale Jansen, 1♂ (MSU); 20 May 1959, G. C. Eickwort, 1♂ (MSU); 24 May 1959, R. L. Fischer, 1♂ (MSU); 13 July 1956, H. D. Niemczyk, 1♂ (MSU); 3 May 1949, M. C. Nielsen, 1♀ (Nielsen); 19 May 1965, Eric Metzler, 1♂ (Metzler). T2N, R1E, Sec. 34, 9 May 1965, M. C. Nielsen, 1♂ (Nielsen). IOSCO: State Game Refuge, 29 July 1935, A. L. Olson, L. K. Gloyd, 1♂ (UMMZ). JACKSON: Pleasant Lake, 22 May 1965, Wm. Stanley, 1♂ (MSU). KALAMAZOO: Gull Lake Biol. Sta., 3 July-26 Aug. 1957-1960, 1964, 1965, R. L. Fischer, R. J. Snider, B. & T. Hlavac, 104♂, 10♀ (MSU). KENT: Grand Rapids, 25 July 1928, W. F. Lawler, 1♂ (UMMZ). Harvard, 20 July 1963, F. J. Ignatoski, 1♀ (MSU). LAPEER: 3 July 1946, R. R. Dreisbach, 1♂ (MSU). Columbiaville, 28 & 29 July 1960, 8 Aug. 1963, R. W. Holzman, 3♂, 1♀ (Holzman). LENAWE: Morenci, 9 July 1955, M. C. Nielsen, 1♂ (BM); 11 July 1964, R. W. Holzman, 1♀ (Holzman)--this is parent for the following specimens, which emerged as follows: 29 Aug. (2♂, 1♀), 31 Aug. (1♀), 2 Sept. (1♂), 4 Sept. (2♀), 10 Sept. (1♂), 14 Sept. (1♂, 1♀), all 1964, for a total of 5♂, 5♀ (Holzman collection). T8S, R2E, Sec. 32, 4 Aug. 1963, M. C. Nielsen, 1♂ (Nielsen). Morenci-Mulberry Rd., 15 & 22 July 1961, M. C. Nielsen, 1♂, 1♀ (Nielsen). LIVINGSTON: 28 July 1959, John H. Newman, 2♂ (MSU). Edwin S. George Reserve, 2 Aug. 1933, P. F. Hickie, 1♂ (UMMZ); 3 Aug. 1938, I. J. Cantrall, 1♂ (UMMZ); 13 July-12 Sept. 1933, 1934, 1936, 1938, 1941, 1944, Sherman Moore, 13♂, 1♀ (UMMZ); 28 May 1944, R. R. Dreisbach, 1♀ (MSU); 11 & 24 July, 5 Aug. 1934, W. C. Stinson, 3♂ (MSU). Hamburg, 12 Aug. 1934, W. S. McAlpine, 1♂ (McAlpine). MACOMB: 18 & 24 July 1941, John H. Newman, 3♂ (MSU). MARQUETTE: 7 July 1955, W. A. Drew, 1♂ (MSU). MIDLAND: 20-29 July, 1935, 1941, R. R. Dreisbach, 2♂, 2♀ (MSU). MISSAUKEE: Lake City, 1 Aug. 1950, Gordon Guyer, 1♂ (MSU). MONTCALM: Six Lakes, 26 April 1942, W. S. McAlpine, 1♂ (McAlpine). MUSKEGON: 16 May 1945, R. R. Dreisbach, 1♂ (MSU). NEWAYGO: Fremont, 26 July 1965, Mrs. Wm. Zapletal, 1♀ (MSU). OAKLAND: 23 July 1941, 28 May 1942, John H. Newman, 2♂ (MSU). T2N, R8E, Sec. 17, 7 & 14 Aug. 1965, Glenn Buckley, 4♂ (Buckley). Franklin, 12 May 1936, W. S. McAlpine, 1♂ (McAlpine). Rochester, 10 July-11 Aug. 1934, 1935, 1937, Sherman Moore, 4♂ (UMMZ); 21 & 25 July, 7 Aug. 1934, 1935, G. W. Rawson, 3♂ (UMMZ). Watkins Lake, 19 & 22 July 1938, Sherman Moore, 3♂ (UMMZ). OCEANA: Hart, 5 May 1963, Eric Metzler, 2♂ (Metzler). Shelby, 7 May 1964, Elaine Banks, 2♂ (Banks). OSCODA: Comins, 10 Aug. 1937, W. S. McAlpine, 3♂ (McAlpine). OTSEGO: T29N, R2W, Sec. 14, 23 July 1965, 7 Aug. 1961, M. C. Nielsen, 3♂ (Nielsen). T29N, R2W, Sec. 18, 21 July 1963, V. Warczynski, 1♂ (Warczynski); 23 July-15 Aug. 1959, 1960, 1965, M. C. Nielsen, 7♂ (Nielsen). ST. CLAIR: Avoca, 14 July 1944, Philip E. Moody, 1♂ (MSU). Port Huron, 31 July-9 Aug. 1928, 1929, Sherman Moore, 5♂ (UMMZ). SCHOOLCRAFT: T42N, R16 W, Sec. 14, 5 Aug. 1965, M. C. Nielsen, 1♂ (Nielsen). Germfask, 26 & 27 July 1964, R. B. Willson, 3♂ (MSU). SHIAWASSEE: Moon Lake, T5N, R1E, Sec. 21, 13 July 1966, Julian P. Donahue, 7♂, 1♀ (MSU).

WASHTEENAW: Ann Arbor, 7 July-16 Aug. 1922, 1924, F.M. Gaige, 17♂, 3♀ (UMMZ); 30 July, 2 Aug. 1926, 1928, W.W. Newcomb, 3♂ (UMMZ). Base Lake, Webster Twp., 15 July 1920, W.W. Newcomb, 1♂, 1♀ (UMMZ). Sharon, 8 Aug. 1931, Sherman Moore, 1♂ (UMMZ). Willis, 19 July 1931, G.W. Rawson, 1♂ (UMMZ); 18 July 1931, W.C. Stinson, 1♂ (MSU). WAYNE: Detroit, 1♂ (USNM); 20 July, A.W. Andrews, 1♂ (UMMZ); 9 July 1907, W.S. McAlpine, 1♂ (McAlpine). Highland Park, 17 May, 18 & 19 July 1904, 1906, W.W. Newcomb, 4♂ (UMMZ); 17 July 1908, 1♂ (CNC).

MINNESOTA. no data: electric light, 24 May 1926, 1 unsexed (MINN); G. D. Hulst coll., 3♀ (AMNH); Henry Edwards coll., no. 8025, 2♂ (AMNH). ANOKA: Fridley Sand Dunes, 30 July, 1 unsexed (MINN). BECKER: 26 July 1961, Robert Poole, 1♂ (NDSU). BELTRAMI: Blackduck, 1 Aug. 1949, R.H. Leuschner, 1♂ (Leuschner). CASS: Cass Lake, 12, 17, & 21 July, 3 unsexed (MINN). 11 Aug., 1 unsexed (MINN). CLEARWATER: Itaska State Park, 3 Aug. 1910, 1 unsexed (MINN). DOUGLAS: Camp Carlos, Alexandria, 27 June 1940, McDunnough, 2♂, 1♀ (CU). HENNEPIN: St. Anthony Park, 20 July, G.D. Hulst coll., 1♀ (AMNH); 4 July & 30 Aug. 1921, 2 unsexed (MINN). LAKE OF THE WOODS: Baudette, 26 May, 12, 15, & 20 July 1941, George Berggren, 3♂, 1♀ (MINN). LE SUEUR: Fish-Hatch Lights, 19-30 July 1922, 4 unsexed (MINN). OLMSTEAD: July 1896, 1896, 1 unsexed (MINN). POLK: Crookston, 11 & 13 July, 1 Aug. 1935, 1936, D.G. Denning, 1♂, 2♀ (MINN). RAMSEY: Orchard Light, St. Paul, 22 & 26 July 1927, 2 unsexed (MINN). 1 unsexed (MINN). St. Paul, spring 1930, reared from sunflower cane, Fred C. Miller, 1 unsexed (MINN). University Farm, St. Paul, 9 & 19 May, 8-31 July (all 1926?), 9 unsexed (MINN). University Golf Course, St. Paul, 9, 14, & 26 July, 1 Aug., 4 unsexed (MINN). TODD: Long Prairie, 8 July-3 Aug. 1959-1964, Jerome Schrenk, 35♂, 2♀ (Schrenk). WINONA: 20 May, 1 unsexed (MINN).

MONTANA. FLATHEAD: Jewel Lakes, Mt. Aeneas, 18 July 1964, E.E. Remington, 1♀ (PM).

NEW HAMPSHIRE. incomplete data: "So. New Hampshire, bred," 1♀ (Brower); Webster?, 1 May, reared, 1♂ (UNH); G.D. Hulst coll., 3♂ (AMNH); White Mountains, Barnes coll., 1♂ (USNM). COOS: Jefferson, 23-29 May, 21 June, 19 July-2 Aug., 18 Aug., 1935, 1936, 1952, 1963, D.J. Lennox, 12♂, 3♀ (Lennox), 1♂ (UNH); 9 Aug. 1951, S.A. Hessel, 1♂ (Hessel). Randolph, 5 Aug. 1932, Grace H. & John L. Sperry coll., 1♂ (AMNH). GRAFTON: Franconia, A.T. Slosson, 2♂ (AMNH). ROCKINGHAM: Hampton, 28 July-25 Aug. 1915, 1916, S. Albert Shaw, 4♂, 1♀ (Brower). STRAFFORD: Durham, Weed & Fiske, 1♂, 1♀ (UNH). Lee, 3 & 13 Aug. 1960, R.L. Blickle, 2♂ (UNH); 26 May, 11-25 July 1965, 6♂ (UNH). Strafford, 23 July 1965, 4♂ (UNH). SULLIVAN: Newport, 20 July 1895, Barnes coll., 1♂ (USNM).

NEW JERSEY. BERGEN: Strecker coll., 2♂, 1♀ (CNHM). ESSEX: Newark, 12 June, A.L. McElhose, 1♂ (CNHM). MORRIS: Chester, 1 Aug., G.D. Hulst coll., 1♂ (AMNH). Mendham, 15 July, 5 & 10 Aug. 1932, 1934, V.H. dos Passos, 3♂ (AMNH). OCEAN: 27 June 1951, Otto Buchholz, 1♂ (AMNH). SUSSEX: 18 Aug. 1950, Otto Buchholz, 1♂ (AMNH).

NEW YORK. no data: 2♂, 1♀ (USNM); 16-23 May, 1♂ (USNM); 8-15 Sept., 1♂ (USNM); C.J.S. Bethune coll., 1♂, 1♀ (ROM). ALBANY: Albany, 4 July 1921, A.C. Frederick, 1♂ (AMNH); 15 July 1881, Neshe (?), 1♂ (CM). CLINTON: Peru, 5 July-2 Aug. 1915, Mix & Everett, 6♂ (CU). DELAWARE: Stamford, 29 July 1951, S.A. Hessel, 1♂ (Hessel). ERIE: Buffalo, 18 July 1886, W.N. Tallant coll., 2♂ (OSM); 18 July 1905, Barnes coll., 1♂ (USNM); 9 Aug. 1905, Marloff coll., 1♂ (CM). Sardinia, 24 July 1941, A.B. Rupert, 1♂ (CAS). ESSEX: New Russia, 5 Aug. 1906, Frank M. Jones, 1♂ (PM). GENESEE: Batavia, 6 Aug. 1913, H.H. Knight, 2♂ (CU). JEFFERSON: Picton Island, Clayton, 28 July & 11 Aug. 1956, B. Heineman, 2♂ (AMNH). Thousand Islands, A.T. Slosson, 1♂ (AMNH). LIVINGSTON: Nunda, 9 Aug. 1954, C.W. Stafford, 1♂ (CM). MONROE: Rochester, Ferd. Teute, 1♂ (USNM). NEW YORK CITY: West Farms, J. Angus no. 753, 1♂ (AMNH). Central Park, 1♂ (AMNH). ONEIDA: Waterville, 3 Aug. 1911, A.L. McElhose, 2♂ (CNHM). ORANGE: Florida, 8 July 1917, S.W. Frost, 1♂, 1♀ (CU). OSWEGO: Minetto, late May 1939, 2♂ (CU). ROCKLAND: Bear Mts., 5 & 7 Aug., 2♂ (AMNH). TOMPKINS: Ithaca, 23 July 1941,

J.G. Franclemont, 1♂ (CNC); 2 Aug. 1936, 1♂ (AMNH); 7 May 1918, 17 July-3 August 1892-1919, 10♂, 1♀ (CU); 25 July 1884, J.M. Stedman, 2♂ (CU); 17 May 1926, Babig (?), reared, pupa on pin, 1♂ (CU); 1 Aug. 1886, A.M. Shaw, 1♂ (CU). McLean Bogs Reserve, 16 & 25 July 1940, J.G. Franclemont, 1♂ (CNC), 1♂ (CAS); 18 July 1963, C. V. Covell, 1♂ (MSU). ULSTER (and vicinity): Big Indian Valley, Catskill Mts., 14 July 1909, R.F. Pearsall, 1♂ (USNM). Catskill Mts., 18 July & 10 Aug. 1904, R.F. Pearsall, 2♂ (USNM). Boiceville, 9 & 12 July 1936, J.G. Franclemont, 2♂ (CNC).

NORTH DAKOTA. BARNES: 12-13 July 1957, 1♂ (NDSU). Valley City, 10-12 July, 29 July 1957, 2♂ (NDSU). BOTTINEAU: Lake Metigoshe, Turtle Mts., 25 July 1932, L.A. Carruth, 1♂ (CU). BURLEIGH: Bismarck, 6 July 1963, Viola Mader, 1♂ (NDSU). CASS: 1 Aug. 1957, 2♂ (NDSU). 15 July 1963, D.G. Aarhus, 6♂ (NDSU). Fargo, Red River, 22 July 1960, Robert Poole, 1♀ (NDSU). Fargo, 24 July 1941, 1♂ (NDSU). Fargo, USDA UV lt.trap, NDAC, 12 May, 8 June, 13 July-2 Aug. 1956-1958, 10♂, 1♀ (NDSU), 1♂ (Brower). EMMONS: Linton, 5 Aug. 1962, 1♂ (NDSU); 28 July 1963, Ted Miller, 1♀ (NDSU). RANSOM: McLeod, 10 July 1962, 1♂ (NDSU). WARD: Minot, 10 May 1958, 1♂ (NDSU). WELLS: 17, 23, 24 July 1960, Donald Kuske, 3♂, 1♀ (NDSU).

OREGON. HOOD RIVER: 7 July 1938, 1♂ (OSU). KLAMATH: Eagle Ridge, Klamath Lake, 23 May 1924, C.L. Fox, 1♂ (CAS). MARION: Aumsville, 22 July 1963, Kenneth Goeden, 2♂ (ODA). Salem, 20 July 1959, F.P. Larson, 2♂ (ODA). POLK: West Salem, June 1958, F.P. Larson, 1♂ (ODA). UMATILLA: 15 mi. NE Hermiston, 18 Aug. 1965, Kenneth Goeden, 1♂ (ODA).

PENNSYLVANIA. no data: Chas. Palm. coll., 1♂ (AMNH). ALLEGHENY: Pittsburgh, 3 July 1899, Henry Engel, 1♂ (CM); 17 June 1907, 1♂ (CM). BEAVER: New Brighton, 15 Aug. 1903, H.D. Merrick, 1♂ (USNM). BUTLER: Butler, 8 Aug. 1931, Sweadner coll., 1♂, 1♀ (CM). Wolf Creek, near Slippery Rock, Sweadner coll., 1♂ (CM). CLEARFIELD: Shawville, 20 Aug. 1940, John Bauer, 1♂ (CM). CRAWFORD: Pymatunius Swamp, 1-7 July, Sweadner coll., 1♂ (CM). LYCOMING: Barbours, 8 July 1921, J.C. Bradley, 1♂ (CU). SOMERSET: 4 mi.E Somerset, 9 Aug. 1965, Julian P. Donahue, 2♂ (MSU).

RHODE ISLAND. PROVIDENCE: Elmwood, 18 July 1906, Edward D. Keith, 1♂ (CM); 7 & 15 July 1889, Marloff coll., 2♂ (CM); 10, 15, & 18 July, Engel coll., 3♂ (CM). Oak Lawn, 1910, Grace H. & John L. Sperry coll., 2♂ (AMNH). WASHINGTON: Westerly, 5 Aug. 1928, 14 Aug. 1925, Holland coll., 2♂ (CM).

VERMONT. BENNINGTON: West Sandgate, 3 June 1951, Fred H. Rindge, 1♂ (AMNH). FRANKLIN: Swanton, 25 July, 13 & 14 Aug. 1953, A.R. Pierson, 3♂ (AMNH).

WASHINGTON. KINGS: Seattle, 9 Feb. 1944, ex larva, A.W. Herz, 1♂ (CNHM). LEWIS: Chehalis, 15 July 1941, Grace H. & John L. Sperry, 1♂ (AMNH). WHATCOM: Bellingham, 9 May 1917, J.F.G. Clarke, 1♂ (USNM). Slate Peak, elev. 7,000 feet, 19 July 1955, J.F.G. Clarke, 1♂ (USNM). YAKIMA: Yakima, 19 & 23 July 1956, A.I. Good, 1♂, 1♀ (Miller). UNCERTAIN LOCALITY: "Easton, Wash K., (= Easton, Kittitas Co.?), "through C.V. Riley," 1♀ (USNM).

WISCONSIN. no data: May 1881, 1♂ (Brower). COLUMBIA: Arlington, 22 Aug. 1960, W.E. Sieker, 1♂ (Sieker), 1♂ (Holzman). Poynette, 26 July-28 August 1960, W.E. Sieker, 12♂, 1♀ (Sieker). DANE: University Arboretum, Madison, 20 July-24 Aug. 1961, 1962, William E. & Marie A. Sieker, 37♂, 6♀ (Sieker), 2♂ (NDSU). GRANT: Platteville, 17 Aug. 1960, W.E. Sieker, 1♂ (Sieker). SAUK: Sauk City, 18 July & 5 Aug. 1962, Gary Lachmond, 2♀ (Sieker). VILAS: Sayner, 26 July 1963, R.W. Holzman, 1♂ (Holzman). WOOD: Cranmoor, 18 June 1909, C.B. Hardenberg, 1♂ (USNM).

CANADA

BRITISH COLUMBIA. Atlin, elev. 2200 feet, 13 June 1955, H. Huckel, 1♂ (CNC). Garnett Valley, Summerland, 1 May 1933, A.N. Gartrell, 1♀ (CNC).

MANITOBA. Altona, 5 Aug. 1949, 2♂ (FRLM). Aweme (6 mi. N Treesbank), 20 Aug. 1924, R.D. Bird, 1♂ (CNC). Riding Mts., June, Sweadner coll., 1♂ (CM). Whiteshell Forest Reserve, emerged 31 Jan. 1964 from pupa found in moss under tamarack, 1♂ (FRLM). Winnipeg, 16 June 1911, J.B. Wallis, 1♂ (CM).

NEW BRUNSWICK. CHARLOTTE: Waweig (10 mi. E St. Stephen), 20 June 1938, T.N. Freeman, 1♂ (CNC). YORK: Fredericton, 13 July-6 Aug. 1957, 1958, 1960, Forest Insect Survey lt. trap, 8♂ (FRLNB). Nashwaaksis, 16 July 1959, For. Ins. Surv. lt. trap, 1♂ (FRLNB).

NEWFOUNDLAND. Harmon Field (air base, at Stephenville), 16 June 1949, F.G. DiLabio, 1♂ (CNC).

NORTHWEST TERRITORIES. Fort Smith, 26 May 1950, W.G. Helps, 1♂ (CNC). Norman Wells, 23 June 1949, S.D. Hicks, 1♂ (CNC). Yellowknife, 25 May 1953, J.G. Chillcott, 1♀ (CNC).

NOVA SCOTIA. ANNAPOLIS: Lequille, 8 Aug. 1946, D.C. Ferguson, 1♂ (PM). HALIFAX: Halifax Watershed Area, 23-25 June 1954, ex ovo, reared on Plantago, D.C. Ferguson, 4♂, 3♀ (PM). QUEENS: Lake Kejimukujuk, 29 May & 11 Aug. 1958, 1961, D.C. Ferguson, 2♂ (PM). SHELburne: Barrington, 1 July 1941, Marion E. Smith, 1♂ (MASS). VICTORIA: Baddeck, 26 July 1938, T.N. Freeman, 1♂ (CNC); 24 & 27 July 1938, J. McDunnough, 2♂ (CNC).

ONTARIO. CARLETON: Mer Bleue, 19 July 1934, W.J. Brown, 2♂ (CNC); 27 July 1936, F.A. Urquhart, 1♂ (CNC). Ottawa, 30 June, 1 & 2 July 1932, reared on dandelion, 6♂, 2♀ (CNC); 15 Aug. 1904, 1♂ (USNM); 20 July 1908, C.H. Young, 2♂ (USNM); 14 & 25 July 1899, H.S. Saunders, 3♂ (ROM); emerged 7 April 1921, F.P. Ide, 2♀ (ROM). DURHAM: Orono, 10 July 1952, G.B. Wiggins, 1♂ (ROM). Port Hope, 25 July 1898, C.J.S. Bethune coll., 2♂, 1♀ (no date) (ROM). FRONTENAC: Arden, 25 July 1940, F.A. Urquhart, 1♂ (ROM). HALDIMAND: Dunnville, 21 July 1959, W. Plath Sr., 1♀ (Plath); 3 July 1958, 1♂ (ROM); 7 July 1958, R. Plath, 1♂ (AMNH). HASTINGS: Belleville, Engel coll., 1♂ (CM). Trenton, 5, 16, & 20 June 1911, Evans, 3♂ (CM). KENORA: Sioux Lookout, 12 June 1929, J. Russell, 1♂ (CNC). KENT: Rondeau Prov. Pk., 25 May 1965, J.C.E. Riotte, 1♂ (ROM); 6 June 1965, J.C.E. Riotte & I.M. Smith, 1♂ (ROM). LEEDS: Chaffey's Locks, 19 July 1963, J.C.E. Riotte & I.M. Smith, 1♂ (ROM). LINCOLN: Vineland, 18 June 1942, W.E. Hurlburt, 1♂ (ROM). MUSKOKA: Muskoka, William Brodie, 1♂ (ROM). NORFOLK: Normandale, 26 July 1956, Freeman & Lewis, 1♂ (CNC). Simcoe, 27 June 1939, T.N. Freeman, 1♂ (CNC). NORTHUMBERLAND: Cobourg, Aug. 1917, D. Stewart, 1♂ (CM); Aug. 1916, 1♂ (CM); 29 July 1913, Mrs. D. Stewart, 1♂ (CM). ONTARIO: Rouge R., 28 July 1936, T. Irwin, 1♂ (CNC). PEEL: Snelgrove, 17 July 1952, G.B. Wiggins, 1♂ (ROM). RENFREW: Palmer Rapids, 25 July 1935, F.A. Urquhart, 1♂ (CNC). SUDBURY: Sudbury, 23 & 29 July 1959, 29 July 1960, J.C.E. Riotte, 2♂ (AMNH), 1♂ (ROM). THUNDER BAY: Geraldton, 11 June 1956, J.C.E. Riotte, 1♂ (AMNH). WELLAND: Pt. Colborne, 27 July 1933, J.J. de Gryse, 1♂ (CAS). WENTWORTH: Ancaster, 22 July 1946, T.N. Freeman, 1♂ (CNC); 23 July 1955, J.E.H. Martin, 2♂ (CNC). YORK: Cedarvale, Toronto, 25 July & 8 Aug. 1927, C. Hope, 2♂ (ROM). High Park, Toronto, 30 June-6 July 1912, 1913, 5♂ (ROM). Rosedale, Toronto, 23 July 1903, Paul Hahn, 1♂, 1♀ (no date) (ROM). Toronto, 15 July-5 Aug. 1911, 1914, 1933, 7♂ (ROM); 1 Aug. 1904, H.S. Saunders, 1♂ (ROM); William Brodie coll., 1♀ (ROM); J.M. Laing, 1♂ (ROM); D.G. Cox, 3♂ (ROM).

QUEBEC. BERTHIER: Berthierville, 16 July-17 Aug. 1934, 1939, 1952, 10♂ (FRLQ). GATINEAU: Meach Lake (Gatineau Park), April, Barnes coll., 1♂ (USNM). HOUELAGE: Montreal, Charles Palm. coll., 1♂ (AMNH). HUNTINGDON: Hemmingford, 14 May 1963, 1♂ (FRLQ). ST. MAURICE: Lac Mondor, Ste. Flore,

9 Aug. 1951, E.G. Munroe, 1♂ (CNC). TIMISKAMING: Norway Bay, 14 July 1937, F. A. Urquhart, 1♂ (CNC); 23 June 1938, G.A. Hobbs, 2♂ (CNC).

SASKATCHEWAN. Lumsden, 7 Aug. 1954, Brooks-Wallis, 1♂ (CNC). Snowden, 29 Oct. 1948, 1♂ (FRLM).

YUKON TERRITORY. Dawson, June 1917, G.L. Harrington, 1♀ (USNM); 11 June 1916, Kusche, 1♀ (CM); 10 June 1949, W.W. Judd, 1♂ (CNC). Selkirk, 9 June 1928, R.E. Barrett, 1♂ (CAS). Whitehorse, 4 June 1916, "flying among willows in swamp," B.P. Clark, 1♂ (USNM); 28 May 1916, Barnes coll., 1♂ (USNM).

PHRAGMATOBIA ASSIMILANS Walker

(Figs. 2, 5, 8, 11, 14, 17, 21, 24, 26-29)

Phragmatobia assimilans Walker, 1855: 630.

Phragmatobia var. *franconia* Slosson, 1891a: 3.

Phragmatobia assimilans var. *franconia* Slosson, 1891b: 41, pl. 3, fig. 2 (nec. *franconica*, *franconiae*, auctores, in error).

This variable species, our largest *Phragmatobia*, was unknown in United States collections until Annie Slosson (1889, 1890) collected it in northern New Hampshire. Because the taxonomists of the latter half of the nineteenth century had no comparative material of this rarely-collected species, they assumed it to be a synonym of *P. fuliginosa rubricosa*. Even after its rediscovery, Kirby (1892: 245, 911) persisted in retaining *P. assimilans* as a synonym of *P. rubricosa*.

The similarity of this species to *P. lineata* has caused the two to be confused in many collections. Indeed, *P. assimilans* appears to be more closely related to *P. lineata* than to *P. fuliginosa* (based on similarity of forewing pattern and valvae), but *P. assimilans* can be easily separated from *P. lineata* by the following characters: opaque wings, larger size, more boreal distribution (the two being sympatric, so far as is known, only in Calgary, Alberta, southern Manitoba, eastern New York, and New England), absence of a blackened costal margin on the hindwing upperside, the early flight period (May and June), and the absence of the sclerotized "comb" on the distal end of the aedeagus.

P. assimilans can similarly be distinguished from *P. fuliginosa rubricosa* by most of the above characters (opaque wings, larger size, absence of blackened costal margin on the hindwing upperside), and also by the distinctive genitalia.

MALES are robust, "hairy" moths subject to a great deal of variation. Most specimens are strongly marked and have black lines on the forewing (Fig. 28), as in *P. lineata*: an excurved antemedial line directed obliquely distad from the inner margin to the posterior side of the discal cell, then proceeding obliquely proximad to the anterior side of the discal cell (in *P. lineata* this line only rarely crosses the cell); an excurved postmedial line; a curved subterminal line, occasionally Y-shaped, with the distal arm of the Y going to the apex; and an adterm-

inal line. Some (or, rarely, all) of these pattern elements may be absent (Fig. 26), while the intensity of various parts of the elements is extremely variable. Usually, however, the antemedial and postmedial lines are well-developed and conspicuous.

The ground color of the forewing varies from light to dark brown, with variable amounts of black "peppering." The fringe is pink.

The black band on the hindwing upperside is also subject to great variation. In those specimens with a dark forewing the band on the hindwing is broad, uniform, and marginal (Fig. 28). In lighter specimens the band becomes submarginal (Fig. 26), and tends to be macular and broken up into an anterior segment and a posterior segment, or is reduced to one or two irregular black spots near the anal angle, or, very rarely, the hindwing band is completely absent (only one such specimen seen—one of Annie Slosson's from Franconia, N.H., in the American Museum of Natural History, perhaps the one she figured, 1891b, pl. 3, fig. 1).

The hindwing fringe, costa, and discal area are varying shades of bright rosy pink.

The coremata (Fig. 11) are poorly developed.

FEMALES (Figs. 27, 29) are relatively rare in collections—most specimens appear to have been reared. They come to lights only rarely, if at all—a large number of males have been collected in Michigan and Nova Scotia, for example, but no females have ever been collected from these areas. Females tend to be darker than males, and almost always have some part of the forewing pattern well developed. The black band on the hindwing is broad, and extends to the outer margin in all specimens we have examined.

SYNONYMY: The variety "franconia" described by Slosson (1891a; 1891b, pl. 3, fig. 2) is merely a well-marked specimen near one end of a broad range of individual variation, although it is markedly different from the other, immaculate specimen she had before her. Obviously, "franconia" is not a variety at all, and is merely a synonym of *P. assimilans*. The type of "franconia"—a male, not a female as stated in the original description—is deposited in the American Museum of Natural History. The genitalia were examined to eliminate any doubt concerning the identity of the specimen.

GENITALIA: Surprisingly, the male genitalia of this large species are smaller than the genitalia of the other two species. The single projection on the mesal face of the valva (Fig. 14) allies this species to *P. lineata*, but the absence of the "comb" on the distal end of the aedeagus (Fig. 8) identifies *P. assimilans*. The female genitalia (Figs. 21, 24) are patterned after the basic plan of the other species, but are smaller. The lamella antevaginalis is poorly developed, and the sclerotized plate to which the apophysis anteriore is attached is quadrate. As with the other species of *Phragmatobia*, the taxonomic value of the female genitalic structures can only be determined after further work.

LIFE HISTORY: *Phragmatobia assimilans* appears to have only one generation per year. The adults are on the wing from mid-April to mid-June, depending on the locality. The only exceptions to this early flight period are represented by a series of 18 specimens from Constance Bay, Carleton Co., Ontario, collected from 19 July to 2 August 1935 by G. S. Walley; and two females from Edmonton, Alberta, collected on 5 & 6 August 1917. These specimens may represent a second brood, or reared specimens whose normal developmental period was affected, or they may have been mis-labeled.

The larvae overwinter in the last instar, and the following spring they crawl about looking for a place to pupate. The hardiness of these larvae is remarkable—they may be seen crawling about when the ambient temperature is near freezing, and have even been seen crawling on snow (Gibson, 1911). Data on specimen labels indicate that pupation takes place in a flimsy cocoon constructed off the ground in trees or brush.

The larval stages have been described by Gibson (1911), so we will only point out that the larvae would appear similar to larvae of *P. fuliginosa*, but would be darker (mouse gray), without any trace of dorsal or lateral markings. Note that the larval description by Goodhue (1902) applies to *P. lineata*, not *P. assimilans*.

PARASITES: *Exorista cheloniae* (Rondani) (Gibson, 1911)—probably a species of *Carcelia*, for this species is not Nearctic (Diptera: Tachinidae).

FOODPLANTS: *Mertensia*? (bluebells), reared on *Taraxacum* (dandelion) and *Plantago* (plantain) by Gibson (1911); *Betula papyrifera* (white birch) (McGugan, 1958); *Rubus* (raspberry, blackberry), specimen label, Forest Research Laboratory, Manitoba; *Populus balsamifera* (balsam poplar), specimen label, Forest Research Laboratory, Alberta.

FIGURES: *Phragmatobia assimilans* has been properly figured by Ferguson (1953: pl. 3, fig. 8); Hampson (1901: pl. 43, fig. 22); Seitz (1919: pl. 38, row i, as *assimilans* and *franconia*); and Slosson (1891b: pl. 3, fig. 1, as *assimilans*, and fig. 2, as var. *franconia*).

TYPE LOCALITY: The original description (Walker, 1855: 630) says only that the specimens were from the "United States," and were "Presented by E. Doubleday, Esq.," while the undated labels on the two syntypes say "U.S. America" (Allan Watson, pers. comm.).

Although the British Museum (N.H.) has no further records concerning the type locality, Ronald S. Wilkinson, a student of the history of entomology, has done some sleuthing to pinpoint the type locality with a high degree of certainty. Given the information that Edward Doubleday probably collected his specimens in the northern U.S. between mid-April and mid-June, Wilkinson reports:

Edward Doubleday and Robert Foster arrived in New York harbor from England on the evening of 24 April 1837. The weather was cold and the season was delayed, so Doubleday amused himself with bird watching, taking only an occasional trip up the Hudson.

On 7 May he left Foster and traveled by riverboat to Albany. After one or two days in Albany he left on 11 May, taking the train to Utica and arriving there in time for dinner that evening. Foster rejoined him at Utica, and the two proceeded immediately to Trenton, about 14 miles north of Utica. They found suitable collecting territory there and decided to remain, making their headquarters about two miles away at Moore's Tavern in Trenton Falls, near the falls of West Canada Creek.

Here Doubleday began to collect moths in earnest. There were no sugar casks available (see Wilkinson, 1966), and, finding the twilights too brief for the usual English method of "mothing," he resorted to two other methods. The first, roaming the surrounding woods with a lantern, was productive, but the mosquitoes were "very annoying" to him. The second, more productive, method of collecting was to put lights in the open windows of the barroom so that moths came in great swarms. Doubleday bottled moths from twilight to ten at night, went to bed, then arose at five or six to spread his captures. This routine went on for months, and he did not stir from Trenton Falls until long after the flight period of *P. assimilans*. Doubleday was still in the U.S. in the spring of 1838, but he was in Florida, far outside the range of *P. assimilans*.

In the absence of data to the contrary, the type locality of *Phragmatobia assimilans* is hereby fixed as the vicinity of Moore's Tavern, Trenton Falls, Oneida County, New York, where Edward Doubleday collected the types in the spring of 1837.

TYPE SPECIMENS: Two male syntypes in the British Museum (Natural History), kindly examined for us by Allan Watson.

DISTRIBUTION (Fig. 37): In southern parts of the Canadian and northern parts of the Transition Zones, apparently in moist lowlands, from southern British Columbia, central Alberta and central Saskatchewan east through central Ontario to Nova Scotia, south to North Dakota, South Dakota (relict population?), Minnesota, northern Michigan, New York, and New England (except Rhode Island).

Spring collecting with "black" light in suitable localities (marshes or bogs in northern coniferous forest) may extend the known northwestern limit of this species' distribution, and may further result in its discovery in Washington (and perhaps even farther south on the coastal ranges), in the Rockies, and in Wisconsin. It may even occur at high elevations in the Appalachians.

SPECIMENS EXAMINED (362)

CONNECTICUT. LITCHFIELD: Washington, 11-21 May, 1958, 1961, 1964, 1965, S.A. Hessel, 9♂ (Hessel).

MAINE. AROOSTOOK: T11N, R8, 6 July, 3♂ (Brower), 1♂ (CNHM). **FRANKLIN:** Farmington, 19 & 23 May 1964, B. Spies, 2♂ (Brower). **HANCOCK:** Salisbury Cove, 29 May 1937, A.E. Brower, 1♂ (CNHM). **KENNEBEC:** Augusta, 20 May 1955, A.E. Brower, 1♂ (Brower), 1♂ (AMNH). **PENOBSCOT:** Enfield, 7 & 15 June 1953, L.P. Grey, 6♂ (AMNH). Kidney Pond, Norcross, 8 June 1875, F.B. Hyde, 1♂ (USNM). Lincoln, 22 June 1935, 1♂ (Brower). Orono, 20 May 1931, 1♂ (CU). **PISCATAQUIS:** Greenville, 25 June, 1♂ (UNH).

MASSACHUSETTS. no locality: 16 May, Barnes coll., 1♂ (USNM).
BARNSTABLE: Barnstable, 17 May 1952, C.P. Kimball, 1♂ (CNC); 19, 28, & 31 May, 1951, 1952, C.P. Kimball, 3♂ (AMNH). MIDDLESEX: Weston, 22 May 1925, 3 June 1921, 2♂ (MCZ); C.J. Paine, 1♂ (Brower); 30 May 1926, 1♂ (Brower).

MICHIGAN. ALGER: Chatham, 22 May 1901, 1♂ (MSU). BAY: Kawkawlin, 22 & 24 May 1965, J.W. Schmidt, 2♂ (MSU). BENZIE: Benzonia, 19 April 1914, T.H. Hubbell, 1♂ (UMMZ). CHEBOYGAN: T38N, R1E, Sec. 30, 15 May 1964, M.C. Nielsen, 1♂ (Nielsen), 1♂ (MSU). CRAWFORD: T27N, R3W, Sec. 22, 19 & 20 May 1965, R.W. Holzman, 7♂ (Holzman). EMMET: 5 June 1956, John H. Newman, 1♂ (MSU). MACKINAC: T42N, R1W, Sec. 9, 18 May 1964, M.C. Nielsen, 1♂ (Nielsen). MONTMORENCY: Atlanta, 30 May 1935, G.W. Rawson, 2♂ (UMMZ). OGEMAW: West Branch, 20 & 22 May 1965, Dorothy Frosh, 2♂ (MSU). OTSEGO: 26 May 1960, John H. Newman, 1♂ (MSU). T29N, R2W, Sec. 14, 14-22 May 1964, 1965, M.C. Nielsen, 7♂ (Nielsen). T29N, R2W, Sec. 18, 21-29 May, 1957, 1962, 1965, M.C. Nielsen, 12♂ (Nielsen); same, 18 & 25 May 1963, V. Warczynski, 2♂ (Warczynski). SCHOOLCRAFT: 1 June 1963, 4 June 1960, John H. Newman, 5♂ (MSU). Manistique, 29 May 1960, R.L. Fischer, 2♂ (MSU). T42N, R16W, Sec. 11, 1 June 1963, M.C. Nielsen, 1♂ (Nielsen). T42N, R16W, Sec. 13, 15 June 1963, M.C. Nielsen, 1♂ (Nielsen). T42N, R16W, Sec. 14, 7 June 1963, V. Warczynski, 1♂ (Warczynski); same, 31 May 1963, M.C. Nielsen, 1♂ (runt) (Nielsen).

MINNESOTA. AITKEN: Solana State Forest, 4 June 1965, John S. Nordin, 2♂ (MSU). ANOKA: Carlos Avery Wildlife Area, 30 May 1965, John S. Nordin, 3♂ (MSU). LAKE: T57N, R10W, Sec. 31, acid bog, 11 June 1966, John S. Nordin, 1♂ (MSU). OLMSTEAD: no date, 1♂ (MINN).

NEW HAMPSHIRE. COOS: Jefferson, 17 May-6 June 1934-1936, 1964, 1965, Donald J. Lennox, 40♂ (UNH), 4♂, 1♀ (Lennox), 3♂ (Brower), 4♂ (MSU). GRAFTON: Franconia, A.T. Slosson, 4♂ (including type of "franconia") (AMNH). ROCKINGHAM: Hampton, 9 May 1922, S. Albert Shaw, 1♀, ex pupa, pupal case on pine (Brower). STRAFFORD: Durham, 1 & 17 May 1965, 6♂ (UNH). Lee, 31 May 1965, 1 June 1964, 2♂ (UNH). Strafford, 10 May-1 June 1965, 18♂ (UNH).

NEW YORK. CLINTON: Plattsburgh, "E. light," 28 May 1890, 21 May 1891, 3 & 6 June 1893, G.H. Hudson, 4♂ (USNM). COLUMBIA: Hudson, May 1928, Otto Buchholz coll., 1♂ (AMNH); 24 June 1912, Barnes coll., 1♂ (USNM). TOMPKINS: Ithaca, 10 May 1894, 1♂ (CU). ULSTER: Big Indian Valley, Catskill Mts., 23-26 May 1906, R.F. Pearsall, 6♂ (USNM).

NORTH DAKOTA. BOTTINEAU: Turtle Mts., 21 May 1964, J. Oberfoell, 6♂ (PM).

SOUTH DAKOTA. PENNINGTON: Upper Spring Creek, near Hill City, Black Hills, 30 June 1964, D.C. Ferguson, 1♂ (PM).

VERMONT. BENNINGTON: near Beartown, 9 June 1954, A.B. Klots, P. & F. Rindge, 1♂ (AMNH). WINDSOR: Bridgewater, 5 June 1938, V.H. dos Passos coll., 1♂ (AMNH).

C A N A D A

ALBERTA. Calgary, head of Pine Creek, 29 April 1915, F.H. Wolley Dod, 5♂ (CNC), 1♂ (USNM); same, 17 May 1914, F.H. Wolley Dod, 1♂ (CNC). Crimson Lake (8 mi. NW Rocky Mountain House), 6 June 1963, 1♂ (FRLA). Derwent (ex cluster of over 25 eggs found on balsam poplar 6 June 1957. Larvae overwintered. One pupated 22 May 1958, emerged 2 June 1958.), 1♂ (FRLA). Edmonton, 8 & 9 June 1918, D. Mackie, 2♂ (USNM); 5 & 6 Aug. 1917 [date error?], Barnes coll., 2♀ (USNM); 20 May & 4 June 1942, K. Bowman, 2♂ (CNC). Mt. Porcupine, "D. Fir," killed while emerging, 15 May 1952, 1 unsexed (FRLA). Rivercourse, 20 May 1941, Otto Buchholz coll., 1♂

(AMNH). Seebe, 27 May 1958, 1♂ (FRLA). Sunnydale, Lloydminster, 15 & 19 May 1949, 29 May 1943, P. F. Bruggemann, 1♂ (AMNH), 12♂ (CNC).

BRITISH COLUMBIA. Oliver, 5 & 7 May 1923, C. B. Garrett, 2♂ (CNC), 4♂ (AMNH); 14 & 15 May 1953, elev. 1,000 feet, D. F. Hardwick, 5♂ (CNC).

MANITOBA. Brandon, 14 June 1950, W. P. Stephen, R. D. Bird, 2♂ (FRLM). RIDING MT. NATIONAL PARK & VICINITY: Clear Lake, 21 June 1955, C. Remington, R. Pease, 1♂ (PM); Kelwood, 11 June 1927, T. F. May, 2♂ (ROM); Kelwood, 18 May 1928, 11 June 1924, & no date, Sweadner coll., 3♂ (CM); Kelwood, 11 June 1927, Marloff coll., 1♂ (CM); Riding Mountains, June, Sweadner coll., 1♂ (CM); Riding Mts., 1 June 1929, 2♂ (AMNH); Riding Mts. Park, 1 May 1938, J. McDunnough, 2♂ (CNC); Riding Mts. Nat. Park, collected as pupa from white spruce, emerged 12 June 1947, 1♂ (FRLM). McCreary, 19 & 22 May 1928, A. T. Harper, 2♂ (BM). Winnipeg, 7 June 1909, J. B. Wallis, 1♂ (BM).

NEW BRUNSWICK. RESTIGOUCHE: "Gr River" (= Summit Depot), 24 June 1947, C. S. Miller, 1♂ (FRLNB). Matapedia, 25 June 1926, Dr. Sanford, 1♂ (AMNH). "2 Mile Brook, Picea glauca," emerged 10 March 1941 (pupa on pin), 1♀ (FRLNB). YORK: Fredericton, 30 May-24 June 1957-1959, Forest Insect Survey light trap, 5♂ (FRLNB); 29 May 1930, R. P. Gorham, 1♂ (CNC).

NOVA SCOTIA. CUMBERLAND: Lynn Road, 31 May 1954, D. C. Ferguson, 2♂ (PM). HALIFAX: Bog, Prospect Road, 18 June 1952, D. C. Ferguson, 1♂ (CNHM). Boulderwood, 25 & 26 May 1959, D. C. Ferguson, 2♂ (PM). Halifax Watershed Area, 25 May 1952, D. C. Ferguson, 1♂ (PM). Montague Mines, 29 May 1954, D. C. Ferguson, 1♂ (PM). HANTS: Mt. Uniacke, 28 May 1949, D. C. Ferguson, 1♂ (CNHM), 6 June 1951, 1♂ (PM). INVERNESS: Corney Brook, Cape Breton Highlands Nat. Park, 18 June 1955, D. C. Ferguson, 1♂ (PM). QUEENS: Lake Kejimukujik, 27 May, 12 & 13 June 1958, D. C. Ferguson, 2♂ (MSU), 3♂ (PM). VICTORIA: Baddeck, Cape Breton Island, 19 June 1931, 1♂ (MCZ).

ONTARIO. ALGOMA: Galbraith Twp., ex larva coll. 22 March 1946, crawling on bare ground in hardwood stand, 1♂ (FRLA). CARLETON: Constance Bay, 19 July-2 August 1935 [date error?], G. S. Walley, 14♂, 4♀ (CNC). Ottawa, 5 June 1905, C. H. Young, 1♂ (USNM). COCHRANE: Smoky Falls, Kapuskasing, 19 June 1935, R. V. Whelan, 1♀ (ROM). Smoky Falls, Mattagami River, 1935 [date illegible], R. V. Whelan, 1♂ (ROM). PARRY SOUND: Kearney, 22 June 1926, F. P. Ide, 1♀ (CNC). SUDBURY: Sudbury, 1892, Barnes coll., 1♂ (USNM); 31 May 1960, J. C. E. Riotte, 1♂ (AMNH). THUNDER BAY: Black Sturgeon Lake, 31 May-5 June, 1961, 1962, R. E. Fye, 10♂ (Fye); 6 June 1962, 2♂ (FRLA). Geraldton, 5 & 11 June 1956, J. C. E. Riotte, 1♂ (ROM), 15♂, 1♀ (ex larva) (AMNH). Hemlo, emerged 5 June 1961 from pupa found 29 May 1961 on dead balsam fir foliage, 1♂ (FRLA). Hymers, 16 May-15 June 1909, 1910, Horace Dawson, 14♂, 4♀ (USNM), 2♂ (BM). Inwood Lake Provincial Park, Upsala, 7 June 1962, G. B. Wiggins, 1♂ (ROM). Nipigon, 9 June 1956, J. C. E. Riotte, 1♂ (ROM). South Neebing Township, 18 April, 21 & 25 May, 10 & 15 June 1962, W. Hartley & J. C. E. Riotte, 8♂, 1♀ (ROM).

QUEBEC. GATINEAU: Meach Lake, 8-15 May, Barnes coll., 2♂ (USNM). Harrington Lake, Gatineau Park, 3 June 1954, R. McCondochie, 1♂ (CNC). Kirks Ferry, 22 May 1950, B. P. Beirne, 2♂ (CNC). HOCHELAGA: Montreal, 26 May 1941, Guedet coll., 1♂ (CAS). ST. MAURICE: Lac Mondor, Ste. Flore, 15 & 31 May 1951, E. G. Munroe, 2♂ (CNC). TÉMISCAMINGUE: Laniel, 13 June 1936, 3♂ (FRLA).

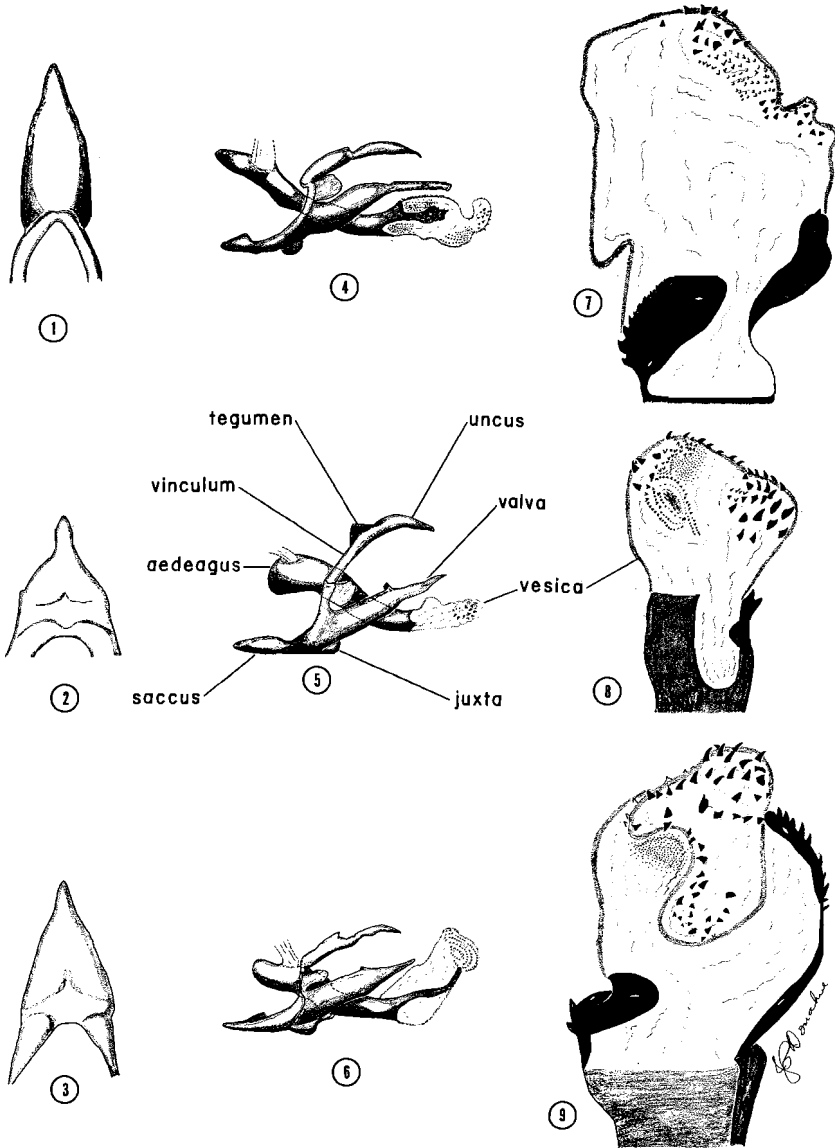
SASKATCHEWAN. Attops Lake, Cut Knife, 29 May 1940, A. R. Brooks, 1♂ (CNC). Green Lake, coll. from white birch as larva, emerged 6 Aug. 1952, pupa & cocoon on pine, 1♀ (FRLM). Grenfell, emerged 12 Nov. 1951, larva reared on raspberry, 1♀ (FRLM). Indian Head, 1 June 1938, K. Stewart, 1♂ (FRLM). Waskesiu, 20 June 1931, R. R. Langford, 1♀ (ROM).

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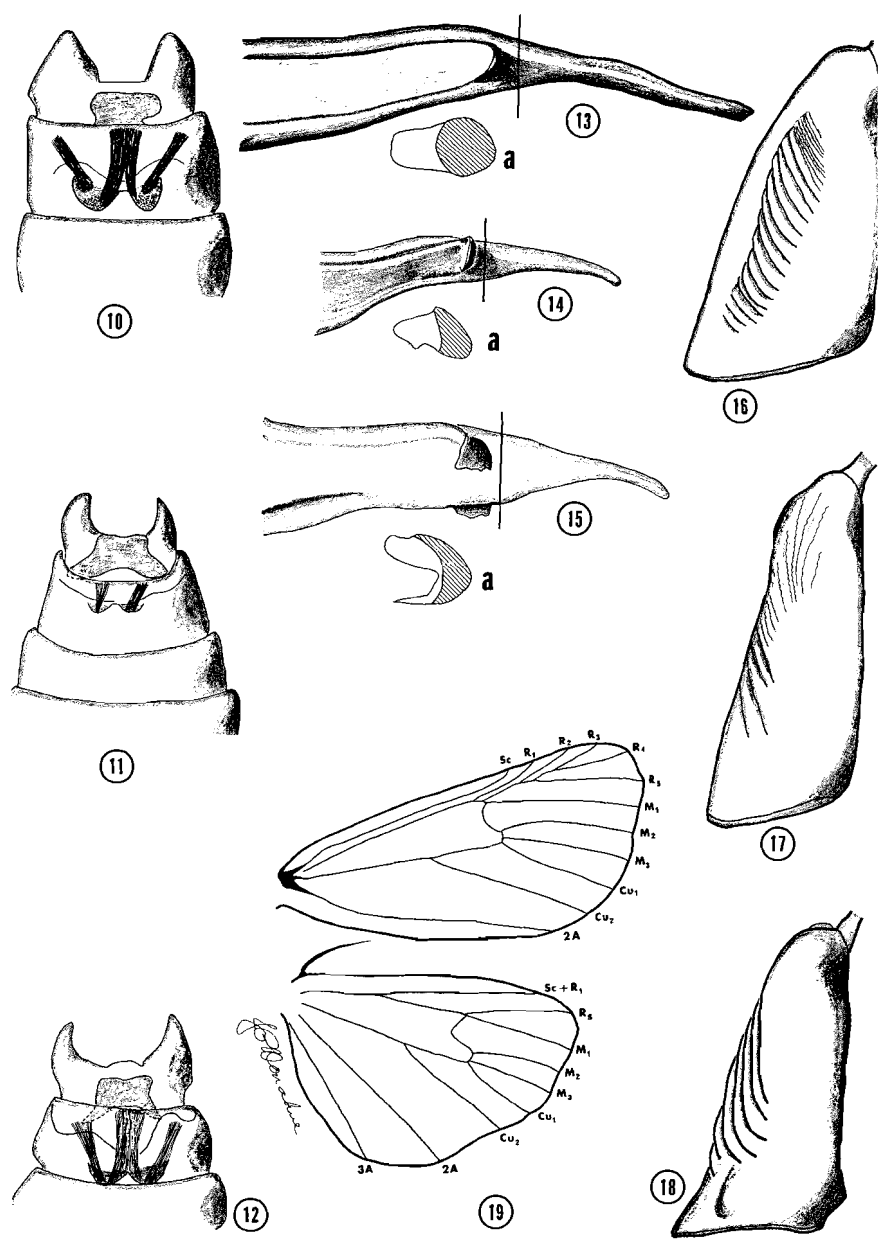
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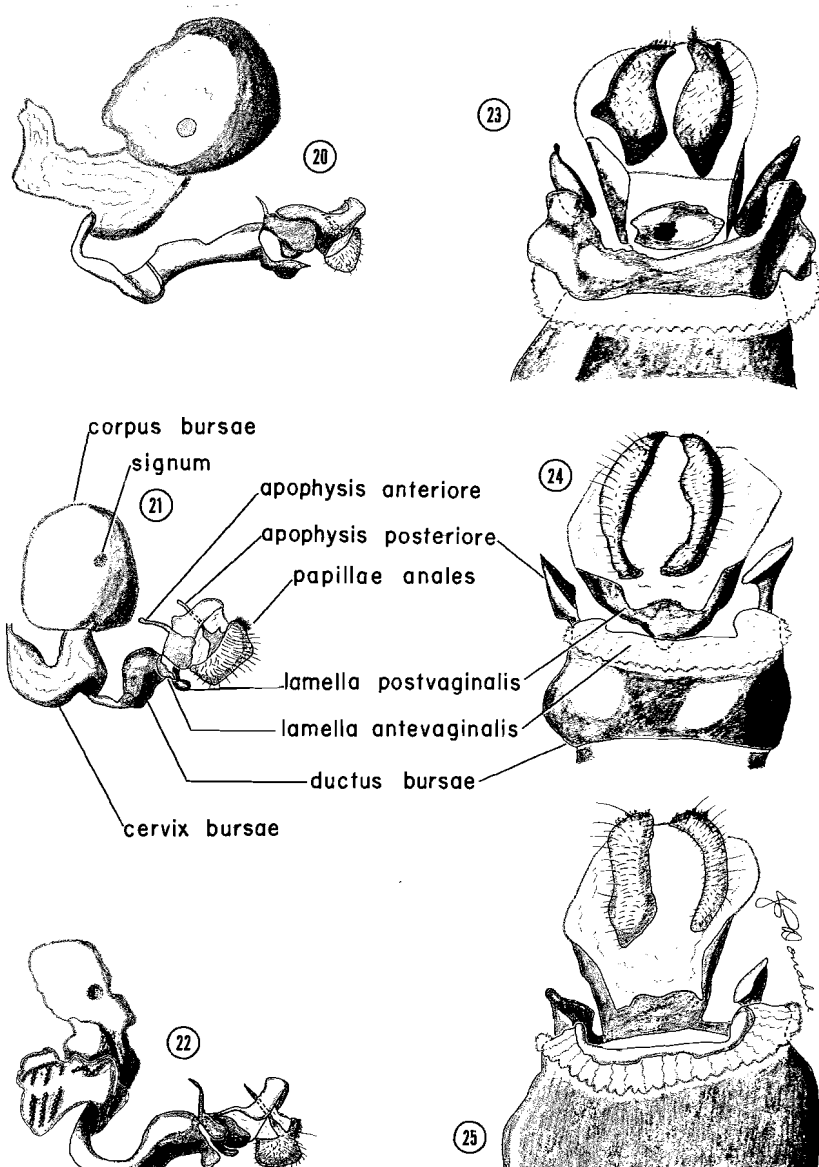
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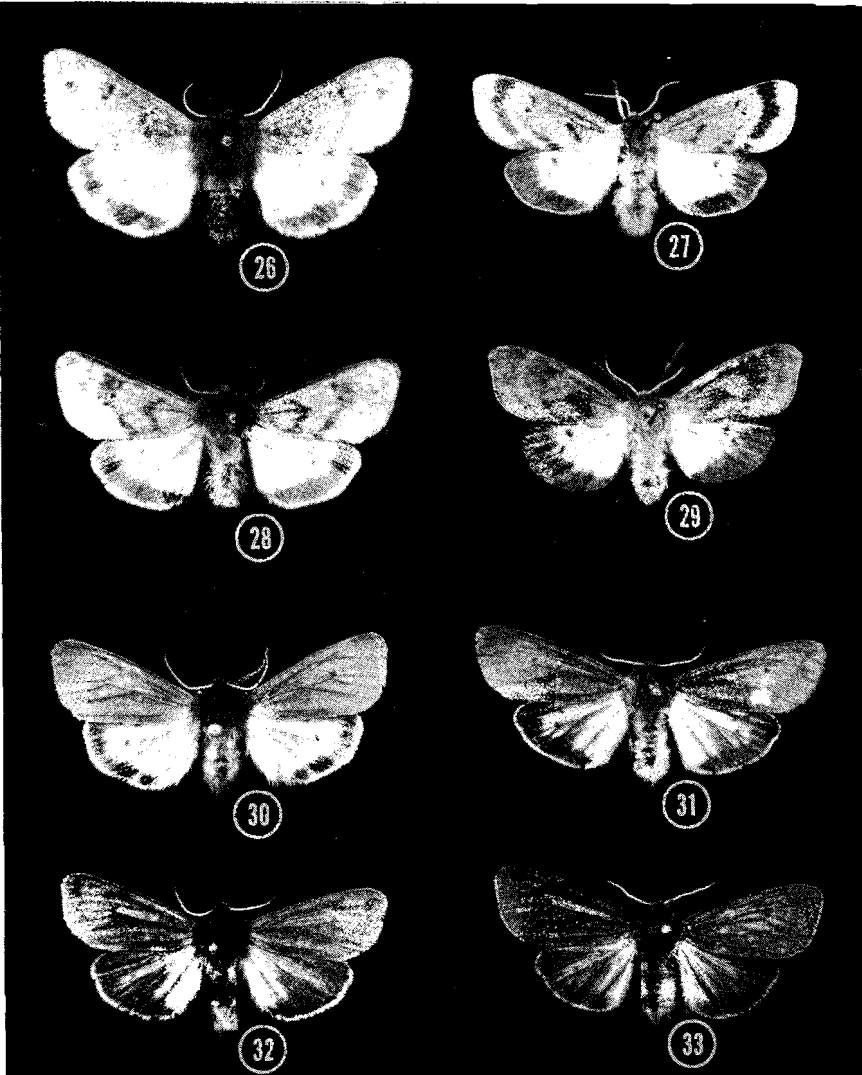
Figures 1-9, male genitalia. Figs. 1-3, dorsal view of uncus, anterior to bottom; Figs. 4-6, lateral view of male genitalia from left side, anterior to left (right valva not shown); Figs. 7-9, dorsal view of distal end of aedeagus, anterior to bottom. TOP ROW: *P. lineata*, topotype, 17 Aug. 1964; MIDDLE ROW: *P. assimilans*, Otsego Co., Mich., T29N, R2W, Sec. 18, 22 May 1962; BOTTOM ROW: *P. fuliginosa rubricosa*, Galien, Berrien Co., Mich., 4 Aug. 1965.

Figures 10-19, coremata, valvae, metepisterna, and venation. Figs. 10-12, ventral view of abdomen, coremata shown *in situ*, anterior to bottom; Figs. 13-15, mesal aspect of right valva, anterior to left, inset *a* showing cross-sectional outline of valva (hatched) and projection as seen from distal end (right side of figure lifted 90° out of the page) at point indicated by line across valva; Figs. 16-18, plane view of left metepisternum, anterior to top left; Fig. 19, venation of *P. fuliginosa rubricosa* ♂, no data. TOP ROW: *P. lineata*, drawn from same male cited on previous plate; MIDDLE ROW: *P. assimilans*, valva and metepisternum drawn from specimen cited on previous plate, coremata drawn from a second specimen, same locality, 19 May 1962; BOTTOM ROW: *P. fuliginosa rubricosa*, drawn from specimen cited on previous plate.

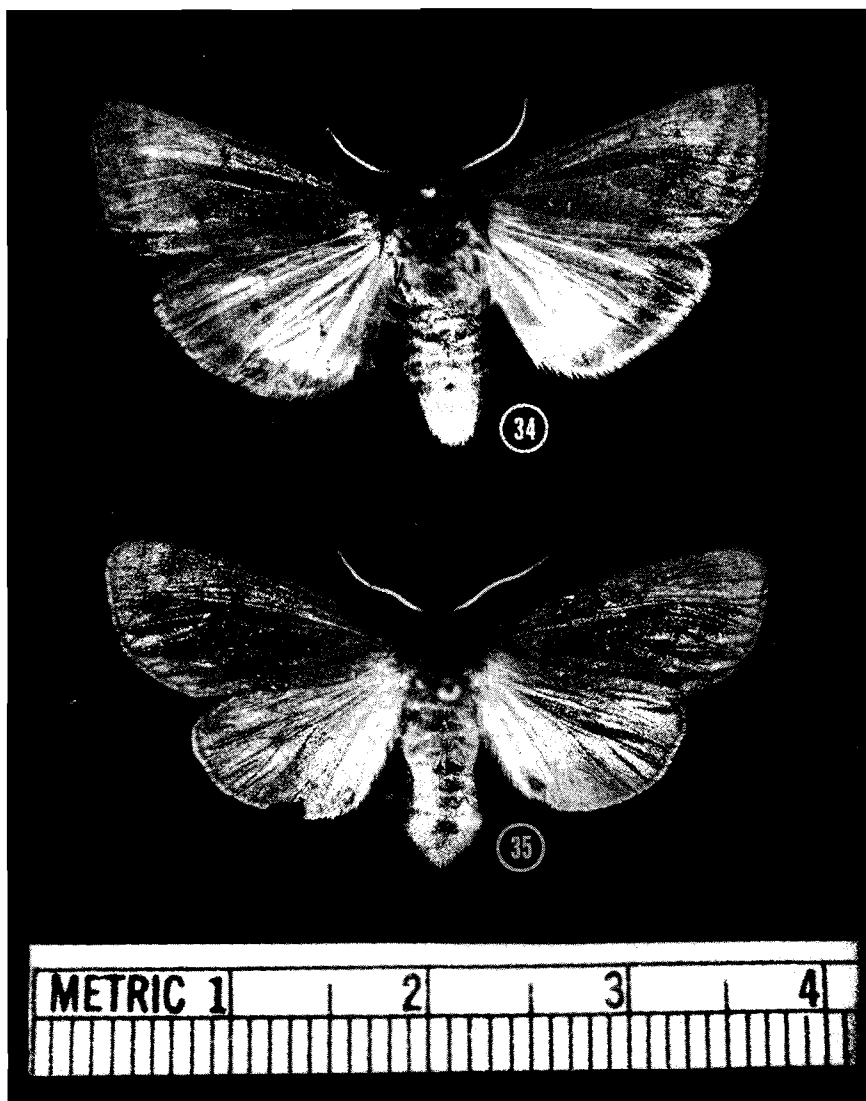




Figures 20-25, female genitalia. Figs. 20-22, lateral view of female genitalia from left side, anterior to left; Figs. 23-25, ventral view of distal end of female genitalia, anterior to bottom. TOP ROW: *P. lineata*, topotype, 1 July 1965; MIDDLE ROW: *P. assimilans*, Kearney, Parry Sound Co., Ontario, 22 June 1926; BOTTOM ROW: *P. fuliginosa rubricosa*, Galien, Berrien Co., Mich., 23 July 1964.



Figures 26-33. Figs. 26-29, *P. assimilans*; Figs. 30-33, *P. fuliginosa rubricosa*. Males in left column, females in right. Fig. 26, Lake Kejimukujik, Queens Co., Nova Scotia, 27 May 1958. Fig. 27, Constance Bay, Carleton Co., Ontario, 19 July 1935. Fig. 28, Geraldton, Thunder Bay Dist., Ontario, 11 June 1956. Fig. 29, Hymers, Thunder Bay Dist., Ontario, 1-7 June. Fig. 30, Morenci-Mulberry Rd., Lenawee Co., Mich., 15 July 1961. Fig. 31, Galien, Berrien Co., Mich., 28 July 1965. Fig. 32, Galien, Berrien Co., Mich., 19 July 1965. Fig. 33, Galien, Berrien Co., Mich., 23 July 1965. Photo by Julian P. Donahue.



Figures 34 & 35. Fig. 34, *P. lineata*, holotype male. Fig. 35, *P. lineata*, allotype female. Photo by Julian P. Donahue

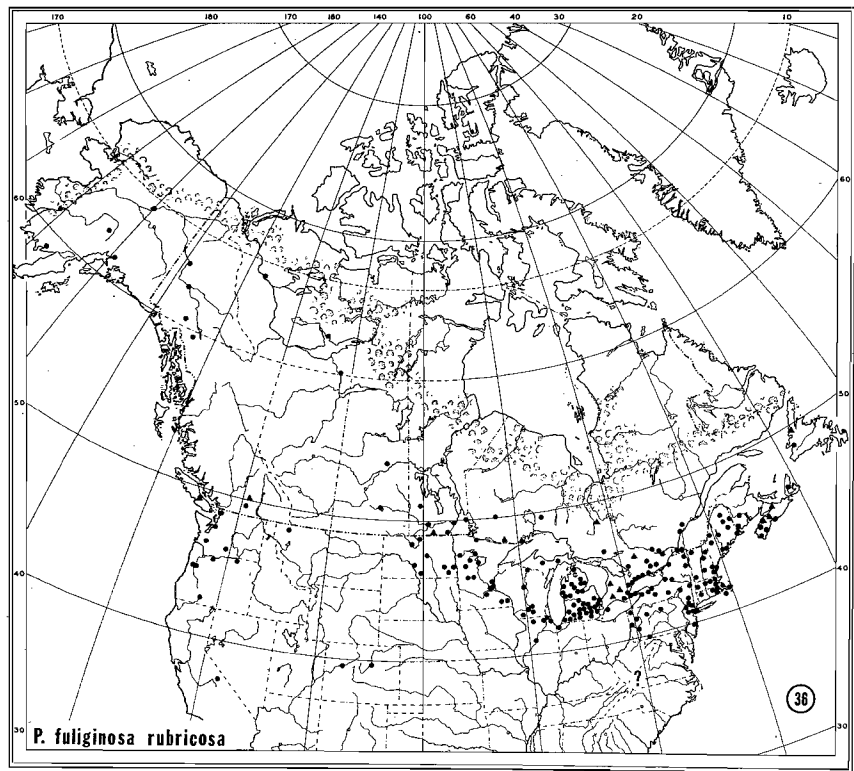


Figure 36, distribution of *P. fuliginosa rubricosa*; black circles represent specimens cited in text, triangles represent authentic records in literature or from individuals; the approximate northern limit of forests (tree line) is represented by the bush pattern; scale as for Fig. 37.

