The Canadian Entomologist

Vol. LXXXII October 1950 No. 10

The Extralimital Distribution of Some Species of Coleoptera[1]

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The following notes report the occurrence in Nova Scotia of *Sthereus ptinoides* (Germ.) and indicate the distribution in North America of 35 species introduced there from the Old World. Of the Old World species, ten are reported from America for the first time; previous records of two others are probably erroneous. Two, which were named and described in *Rhyssemus* Muls. and *Scolytus* Geoff. as species native to America, are considered introduced, and new synonymy is proposed for them. Confusion of introduced with native species is noted in *Stethorus* Weise and *Rhinoncus* Schön. The material recorded from Newfoundland was collected in the Northern Insect Survey, which is a co-operative project of the Canada Department of Agriculture and the Defence Research Board, Canada Department of National Defence.

The following notes supplement a paper[3] published by the writer (6) in 1940. There it was suggested that ships' ballast has been an important source of European insects in Eastern Canada, and that erratic or immature distributional patterns shown by numerous species are evidence that they are introduced, rather than native, in America. Experience during the past decade has supported these opinions. Large quantities of ballast were landed at ports in the Maritime Provinces by ships seeking timber during the Napoleonic Wars, when Baltic sources were closed to British shipping. This seems to be the only historical event that will account for the fact that more European species of Coleoptera occur in that region than in any other part of North America. Nearly all of the European species that are, or were in the past, restricted to the region live on or in the soil or on low-growing plants. They live in habitats created by man and are most abundant in meadows and pastures. They avoid the forests, which are barriers to their spread, and some of the sedentary species are restricted by the forests to very small areas about old ports. For example, at Yarmouth, N.S., the writer collected four species that very rarely or never fly and which were unknown from other parts of America; two of these were very abundant, but only one was found beyond the borders of the town. Some of the species have been introduced into the Maritime Provinces more than once, as is shown by sedentary species restricted to small areas about two or more ports, and some have been introduced also to the Pacific Coast. There is no evidence to suggest that species have been introduced into the Maritime Provinces during recent years.

Parthenogenesis appears to have been an important factor in the establishment of exotic species of Brachyrhininae in Eastern Canada and in other parts of North America. Fifteen species of the group have been collected in Nova Scotia. Three of these are native; of the 12 European species, males have been noted only in *Barypeithes pellucidus* (Boh.).

List of Species

Notiophilus biguttatus (Fab.).—This species, which has not been reported previously from America, was taken at St. John's, Nfld., in 1923 and was found

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[3]This paper should have included Hatch's records (15, p. 117) of *Carabus granulatus* L. and *C. nemoralis* Müll.

abundant there in 1949. Some of its characters have been noted by Fall (11, p. 88); the elytra have the discal striae entire, and each has a large yellow area which is restricted to the apical half.

Clivina fossor (L.).—This species is widely distributed and very abundant on the eastern coasts of Canada. The Canadian National Collection contains specimens, collected since 1924, from St. John's and Harmon Field, Nfld.; the districts about Dartmouth and Yarmouth, N.S.; Tabusintac and Bathurst, N.B.; and Cascapedia and Montreal, Que. The first valid American record of *fossor* is that of Fall (12, p. 162), who in 1922 reported specimens taken at Montreal. According to Hatch (16, p. 118), the species has been taken in western Washington since 1937. The records from other American localities, which are listed by Hatch, refer largely or entirely to *C. collaris* (Hbst.). Most authors consider *fossor* and *collaris* distinct species. *C. fossor* measures from 5 to 6.7 mm.; dorsally it is unicolorous and usually blackish, sometimes reddish. *C. collaris* measures from 4.7 to 5.5 mm.; it is bicoloured above, the reddish elytra being somewhat paler than the pronotum and usually marked with blackish on the suture. Of the specimens seen by the writer, all from Massachusetts are *collaris*, and all from Canada and Washington are *fossor*. According to Lindroth (28, pp. 390-392), *fossor* is widely distributed in Norway, Sweden, and Finland, whereas *collaris* is lacking in this region except in southern Sweden. Jeannel (23, p. 257) failed to find males of *collaris* and concluded that the latter is probably a form of *fossor*. In view of the nature of the American populations, the European distribution, and the possibility of parthenogenesis, *fossor* and *collaris* should be considered distinct species until they have been studied properly in Europe.

Trechus rubens (Fab.).—Dr. P. J. Darlington has informed the writer that this species was taken at Lauzon, near Levis, Que., in 1926. It was taken at Harmon Field and St. John's, Nfld., in 1949. It has been reported from Nova Scotia by Lindroth (27, p. 171) and by the writer (6, p. 69).

Feronia melanaria (Ill.).—Specimens were taken at Pugwash, N.S., in 1926; at Annapolis Royal, N.S., and Campbellton, N.B., in 1947; and at Ottawa, Ont., in 1950. These are the first records for eastern America. The earliest specimen from western America, reported by Hatch (15, p. 119) as *Pterostichus vulgaris* (L.), was taken at Seattle, Wash., in 1927. Using the name *Platysma vulgare* (L.), Hatch (17, p. 148) has reported the species from western Oregon, Washington, and southwestern British Columbia and has given a description of it. The nomenclature used here follows Andrewes (1, p. 184; see note below on *Amara vulgaris*).

Curtonotus aulicus (Panz.).—Two specimens were taken at Harmon Field, Nfld., in 1949. The only earlier American record is that of Fall (13, p. 171), who took a single specimen at Louisburg, N.S., in 1929. The species is strongly characterized, for the impressed marginal line on each side of the pronotum is interrupted before the posterior angle, and the middle tibiae of the male are trituberculate on their inner margins.

Bradytus fulvus (Deg.).—This species was taken at Harmon Field and Gander, Nfld., in 1949. It has been reported from coastal localities in Quebec and New Brunswick by the writer (6, p. 69) and doubtfully from Newfoundland by Leng (26, p. 60).

Celia bifrons (Gyll.).—This species, not reported previously from America, was taken at Dartmouth, N.S., in 1947 and at St. John's and Gander, Nfld., in 1949. It falls with *C. musculus* (Say) in Horn's key (21, p. 35), but has the body more elongate, the posterior pronotal angles more prominent, and the pronotum punctured at its base from side to side. It measures from 5.5 to 6.5 mm.

Amara vulgaris (L.) [= *A. lunicollis* Schiödte].—Three specimens of this species, which has not been reported previously from America, were taken at Eastern Passage, near Dartmouth, N.S., in 1947. The species falls with *A. cupreolata* Putz. in Hayward's key (18, p. 49) and resembles the latter in most of its characters. In *vulgaris*, however, the prosternum of the male has at the middle a large, very feebly impressed but distinct fovea; only the two basal segments of each antenna are reddish; and the apex of each front tibia, near the spur, is produced and angulate. The species measures from 6.7 to 7.5 mm. The nomenclature here follows Andrewes (1, p. 184), who identifies *Carabus vulgaris* L. with the species described subsequently by Schiödte as *Amara lunicollis* and not with *Feronia melanaria* (Ill.), which is listed above.

Amara aenea (Deg.).—Specimens were taken at Port Maitland, Yarmouth, and Dartmouth, N.S., in 1947 and at Ottawa, Ont., since 1948. Darlington (8) has reported the species from Massachusetts, New York, and Connecticut.

Amara familiaris (Dufts.).—This species was taken at Agassiz, B.C., in 1919 and has been found since 1928 at Harmon Field, Stephenville Crossing, and St. John's, Nfld.; Yarmouth, Dartmouth, and Annapolis Royal, N.S.; Shediac and Tabusintac, N.B.; and St. Pascal, Que. According to Hatch (17, p. 150), who has summarized its American distribution and history, the species occurs from southern British Columbia to Oregon and from New York and New Hampshire to Rhode Island. Malkin (30, p. 285) has reported it from New Jersey.

Agonum mülleri (Hbst.).—This species, not reported previously from America, is very abundant in Newfoundland and Nova Scotia. It has been taken at St. John's, Heart's Content, Harmon Field, and Stephenville Crossing, Nfld.; and in Nova Scotia in the Halifax district, at Yarmouth, and at Annapolis Royal. Some specimens from Halifax were taken in 1897, all the others since 1947. In *mülleri* the head and the pronotum are dark green; the elytra are bronze or coppery; the first segment of each antenna, the tibiae in large part, and sometimes the femora are pale; and the third interval of each elytron bears three or four punctures. The species resembles very closely *A. seminitidum* Kby., in which the antennae and legs are blackish throughout and the pronotum is slightly less strongly transverse.

Agonum ruficorne (Goeze).—This species was very abundant at St. John's, Nfld., in 1949. It has been known in America since 1863, but only four specimens, from Maine, New Brunswick, and Nova Scotia, have been reported (6, p. 70).

Pseudophonus rufipes (Deg.).—This species was very abundant in southwestern Newfoundland at Harmon Field and Stephenville Crossing in 1949 but was not found at Gander or St. John's in the eastern part of the island. It has been reported (31) from Prince Edward Island, Nova Scotia, and New Brunswick, but it is not generally distributed in the Maritime Provinces. The earliest American specimens were taken in 1937.

Phosphaenus hemipterus (Goeze).—A single male of this lampyrid was swept from a meadow in Yarmouth, N.S., in 1947. The species, not reported previously from America, is blackish and subopaque, and has the elytra in the male dehiscent and abbreviated so that much of the abdomen is exposed. The male is said to measure from 5.5 to 7.5 mm., and the female, which lacks elytra and wings, from 7 to 10 mm.

Cantharis rufa L.—This species has been reported from Maine and Nova Scotia by McKey-Fender (29, p. 75). It is very abundant and generally distributed in the meadows of Newfoundland, Nova Scotia, and eastern New Brunswick and occurs westward along the St. Lawrence and Ottawa rivers to Montreal, Que., and Ottawa, Ont. It was not found at Ottawa until 1950. The species

has each third tarsal segment emarginate and measures from 7.5 to 9.5 mm. It is reddish-yellow, with stramineous elytra. The head sometimes has a dark area behind each eye. The pronotal disk sometimes has on each side two or three dark spots, which may unite to form an M-shaped mark. The metasternum is blackish; the abdomen is bicoloured; and the femora and tibiae are often streaked with black. The species resembles *C. livida* L., but the latter is usually larger and has the posterior tibiae, and usually the apices of the posterior femora, blackish.

Cantharis fulva Scop.—This species was very abundant in meadows at Abbotsford, B.C., in 1948. It has been reported doubtfully from Texas by Green (14, p. 211). It is not closely allied to native species and is placed in *Rhagonycha* Esch. by recent European authors. It measures from 7.5 to 9 mm. and is reddish-yellow, with the antennae, palpi, elytral apices, and tarsi blackish. The pronotal sides are straight and converge rather strongly from base to apex; the length of the pronotum equals nine-tenths of the width in both sexes.

Stephostethus lardarius (Deg.).—The only American record of this species seems to be that of Belon (2, p. 171), who recorded it from the Queen Charlotte Islands. Six specimens were swept from meadows at St. John's, Nfld., in 1949.

Stethorus punctillum Weise.—This species, not reported previously from America, occurs at Framingham, Mass., and at Vineland Station and Leamington, Ont. It is confused in collections with *S. punctum* (Lec.), from which it is separable only by characters of the genitalia. These species and *S. picipes* Csy. may be compared as follows:—

1. Labrum, palpi, tibiae, and parts of the anterior femora pale yellow 2
   Mouth parts and legs entirely brown or blackish; not separable otherwise from *punctum*. British Columbia to California ..... *picipes* Csy.
2. Genitalia as figured by Kapur (24, p. 303). Male: paramera very slender, attenuated, almost attaining the apex of the penis; spicule straight to somewhat sinuous but never strongly bent near the free end; first of the modified tergites, to which the spicule is attached, strongly sclerotized except for a very narrow posterior margin. Female: receptaculum seminis not evident, apex of each half of ninth sternite narrowed to a blunt point. Massachusetts, Ontario ..... *punctillum* Weise
   Male: paramera ligulate, very much wider in dorsal or ventral than in lateral aspect, extending only to the apical fourth of the penis; spicule strongly bent near the free end; first of the modified tergites, to which the spicule is attached, strongly sclerotized anteriorly, the transparent posterior margin almost as wide as the sclerotized portion; other genital structures as in *punctillum*, the siphonal capsule and trab varying much as in that species. Female: receptaculum seminis quite evident; halves of the ninth sternite, apically, very broadly rounded. Nova Scotia to Manitoba, Iowa, and Kansas ..... *punctum* (Lec.)

Tribolium destructor Uyttenb.—This name was validated (34) in 1933, and the species was described and reported (35, pp. 21, 26) from Germany and the Netherlands in 1934. The species has been reported from "Canada" by Cotton (7, p. 18); from Abyssinia by Hinton (19, p. 16), who believes it to be native to Africa; and, as *Aphanotus destructor* (Uyttenb.), from Hayward, Calif., by Blaisdell (4, p. 146). Cotton's record is based on numerous specimens found in a seed house in Montreal, Que., in 1937. This is the earliest American record. The species has been taken since 1945 at Edmonton, Calgary, and Hussar, Alta., and at Toronto, Ont.

Onthophagus nuchicornis (L.).—This species, which occurs (6, p. 72) from Nova Scotia to New Jersey and eastern Ontario, has been found at Creston, B.C.

Aphodius prodromus (Brahm).—This species, which has been reported (6, p. 74) from New York and northward, was taken at Lexington, Ky., in 1937.

Rhyssemus germanus (L.) [= *R. puncticollis* Brown (5, p. 91), *New Synonymy*].—This species has not been reported previously from America under the name *germanus*, but comparison of the types of *puncticollis* with European specimens shows the names to be synonymous. These types were taken at Toronto, Ont., in 1925 and 1927, and the species was found abundant at Ottawa, Ont., in 1949.

Chrysolina staphylaea (L.).—This flightless species has been known (6, p. 74) since 1897 from a few specimens taken at "Halifax", N.S., and on McNab Island, Halifax Harbour. Collecting in 1947 failed to produce specimens at Halifax, but the species was common across the harbour at Dartmouth, where it occurred in meadows over an area six miles long and up to five miles wide. It appeared to be restricted by the forests to this small area. The Museum of Comparative Zoology and the U.S. National Museum have specimens of *staphlyaea* from Queens County, N.S.

Mantura chrysanthemi (Koch).—For several years Mr. C. A. Frost has been taking this species at Framingham, Mass., from its food-plant, *Rumex Acetosella* L. The species has not been reported previously from America. It resembles *M. floridana* Crotch. In the latter, which feeds on several large species of *Rumex*, the colour is usually paler, the pronotum and elytra are more continuous in outline, and the pronotal impressions are deeper.

Tropiphorus obtusus (Bonsd.).—This species has been known (6, p. 74) in America from two specimens, tentatively identified, that were collected at Yarmouth, N.S., in 1933. The identification has been verified. In 1947 the species was found common in meadows at Yarmouth and six miles to the north at South Ohio. It is undoubtedly restricted to a very small area.

Barynotus schönherri (Zett.) and *B. obscurus* (Fab.).—The writer (6, p. 75) confused these species under the name *obscurus*. A specimen from Newfoundland, which was reported as *schönherri* in 1876, remains in the LeConte collection and belongs to that species. The writer's specimens from Cape George, N.S., and Tabusintac, N.B., also represent *schönherri;* his other records from Nova Scotia and New Brunswick refer to *obscurus*, which is common on grassland in those provinces. *B. obscurus* has been reported from Newfoundland by Hustache (22, p. 252), and *schönherri* is abundant at St. John's and Stephenville Crossing, Nfld. Authors have treated *schönherri* and *illaesirostris* Fairm. as varieties of *squamosus* Germ., and the three forms have been compared by Hustache (22, p. 253) and by Holdhaus and Lindroth (20, p. 225). The writings of these authors, however, suggest that *schönherri* is more likely a distinct species, or a well-defined subspecies as is suggested by Hustache, and that *illaesirostris* and *squamosus* are synonymous. *B. schönherri* is said to have a long sulcus on the rostrum, to be restricted in Europe to the North, and to lack males. The others are said to have the rostral sulcus lacking or short (*illaesirostris*), or rarely long (*squamosus*), and to be known only from the Pyrenees and the mountains of south-central France, where males are numerous.

Barynotus moerens (Fab.).—Six specimens of *moerens*, which has not been reported from America, were swept from a meadow at Yarmouth, N.S., in 1947. The three species of *Barynotus* may be separated by the following key.

1. Rostrum with two longitudinal furrows on each side of the median sulcus. Second and third elytral intervals without setae. Yarmouth, N.S. ..... *moerens* (Fab.)

Rostrum with no more than a trace of a single furrow on each side of the

median sulcus. All elytral intervals with setae, at least on the apical declivity 2

2. Scales of head and rostrum numerous and conspicuous; scales of pronotal disk numerous, concealing about half of the integument. Basal angles of elytra right, the elytral sides oblique just before the angles. New Brunswick to Newfoundland ..... *obscurus* (Fab.)

Head, except at extreme base, and rostrum with very few scales; scales of pronotal disk sparse, concealing much less than half of the integument. Basal angles of elytra acute, the elytral sides sinuate immediately before the angles. New Brunswick to Newfoundland ..... *schönherri* (Zett.)

Philopedon plagiatus (Schall.).—This species was taken at Dalvay and Brackley Beach, P.E.I., in 1940 and 1941. It has been recorded (6, p. 76) from eastern New Brunswick and the Magdalen Islands.

Brachyrhinus rugifrons (Gyll.).—This species is abundant at St. John's, Nfld. It has been reported (6, p. 76) in America only from Sydney, N.S.

Trachyphloeus bifoveolatus (Beck).—A single specimen was taken at Fernie, B.C., in 1934. The species was found abundant at Montague, P.E.I., in 1948 and at Ottawa, Ont., in 1949. It has been reported (6, p. 77) previously from Nova Scotia and New Brunswick, where it is very abundant, and from central New York.

Sthereus ptinoides (Germ.).—A single worn but living specimen of *ptinoides* was found beneath a log on the beach at Kelly Cove, Yarmouth, N.S., in June, 1947. The species is native to the coasts of Alaska and northern British Columbia, where it is said to live beneath driftwood. As it has not been taken in other regions, it cannot be native to Nova Scotia but is evidently introduced and established there.

Ceutorhynchus erysimi (Fab.).—This species, not known previously from America, was taken at St. Catharines, Ont., in 1948 and at Uxbridge, Ont., in 1950. The specimens from Uxbridge were said to be destroying seedling turnips. The species measures about 2 mm. in length. It is entirely black except for the elytra, which are green or blue-green. It differs from American species that resemble it in colour in having the middle and hind femora mutic and in being slightly smaller. In *erysimi* the tarsal claws are not toothed, the antennal funicle consists of seven segments, and white scales are not condensed on the median line of the pronotum or behind the scutellum. The species is said to feed on various crucifers.

Rhinoncus castor (Fab.) and *R. pericarpius* (L.).—Except for *longulus* Lec., the species of *Rhinoncus* occurring in America have been confused. The Palaearctic *castor*, evidently introduced to both the eastern and western coasts of America, is very abundant and has been confused with the native *pyrrhopus* Boh. The species commonly identified in America as *pericarpius* (Fab.) 1801 [= *pericarpius* (L.) 1758] is native and should be known as *triangularis* (Say). The Palaearctic *pericarpius* is abundant at St. John's, Nfld., and is represented in the U.S. National Museum by a single specimen taken in 1948 at Orient, Long Island, according to Mr. L. L. Buchanan, who has supplied the writer with records from that collection for the other species. The earliest specimens of *castor* were taken at Clementon, N.J., in 1895 and in Hastings County, Ont., in 1901. The five species of *Rhinoncus* now known in America are compared in the following key.

1. Body elongate, its length subequal to twice its width. Eyes separated by a distance not quite as great as the diameter of an eye, their inner margins not elevated above the level of the front, their outer margins not covered in repose by the prothorax. Pronotum without trace of tubercles. Elytra

roughened but not tuberculate. Black or black and red above. Males with the middle tibiae unguiculate, the other tibiae mutic. Length 2.2 to 3.3 mm. Quebec to Alberta; said to extend to Florida and California and to feed on *Polygonum* ..... *longulus* Lec.

Body stout, its length distinctly less than twice its width. Eyes separated by a distance at least as great as the diameter of an eye, their inner margins elevated above the level of the front, their outer margins covered in repose by the prothorax. Pronotum usually with a small tubercle on each side. Elytra with very small, acute tubercles, at least on the apical umbones, except in *pericarpius*. Males with at least two pairs of tibiae unguiculate 2

2. Pronotal tubercles obsolete. Elytra roughened but lacking acute tubercles even on the apical umbones. Pronotum and elytra entirely black. Males with the anterior tibiae mutic, the middle and hind tibiae strongly unguiculate. Length 2.6 to 3 mm. (Pronotum more strongly transverse and the legs slightly less elongate than in *triangularis*). On *Rumex*. St. John's, Nfld., and Orient (Long Island), N.Y. ..... *pericarpius* (L.)

Pronotal tubercles distinct except in *triangularis*. Elytra with acute tubercles . 3

3. Length 3 to 4 mm. Elytra with acute tubercles only on the apical umbones. Elytra and sometimes the anterior margin of pronotum red or reddish-brown, the elytra always at least slightly paler than the black pronotal disk. Males with the anterior and middle tibiae rather strongly, the hind tibiae feebly, unguiculate. On *Polygonum*. Quebec to Alberta, Texas, and Virginia ..... *triangularis* (Say)

Length 2.1 to 3 mm. Elytra with acute tubercles throughout. Males with the anterior tibiae mutic; the middle tibiae strongly, the hind tibiae less strongly, unguiculate 4

4. Fully coloured specimens entirely black above. Elytral intervals with the tubercles a little larger and the scales a trifle wider. Median line of the pronotum less deeply impressed. On *Rumex*. Newfoundland to Ontario, Illinois, and Virginia; British Columbia to Oregon ..... *castor* (Fab.)

Elytra and anterior margin of pronotum nearly always partly or wholly reddish and paler than the black pronotal disk. Southern Ontario and Massachusetts to Alabama, California, and British Columbia ... *pyrrhopus* Boh.

Scolytus mali (Bechst.) [= *S. sulcatus* Lec. (25, p. 167), *New Synonymy*].—All specimens of *sulcatus* that have been reported except the type, which was described from New York in 1868, have been taken since 1933. In 1933 and 1934 *sulcatus* was taken (3, p. 12) at Chatham, Maplewood, and East Orange, N.J., at Stamford and Greenwich, Conn., and at Yonkers and Staten Island, N.Y., from elm, plum, and apple. Dietrich (9, 10) reported that in 1935 *sulcatus* was common in dying apple trees in New York State and that it occurred north to Rensselaer County and west to Onondaga and Oswego counties; he stated that it was not found in the apple-growing sections of Lake Champlain and western New York. Between 1936 and 1941, *sulcatus* was taken (36, p. 540) at several other points in western and central Connecticut, and cherry and pear were noted as additional hosts. In 1938 Pechuman (32) reported that *sulcatus* occurred in New York north to Willsboro, on the southern shore of Lake Champlain, and west to Ithaca and Oswego. He noted that *sulcatus* was especially common in southeastern New York and suggested the possibility that it was an introduced species spreading north and west from the region about New York City. He noted also that *sulcatus* was considered identical with the European *mali* by Dr. K. G. Blair, and he mentioned peach and mountain ash as additional hosts. Although Pechuman was unable to find *sulcatus* in the region in 1938, he reported

(33) conspicuous damage by it in 1940 and subsequently to sweet cherry in the fruit area of western New York. In 1945 the writer found *sulcatus* abundant in apple in Quebec up to 20 miles north, and 15 miles northeast, of Lake Champlain; it could not be found northward even in the Richelieu Valley. The species was found in apple at Vineland Station, near Niagara Falls, Ont., in 1949. The writer is unable to distinguish specimens of *sulcatus* and *mali*, and their food-plants are the same. The history and distribution of *sulcatus* are strongly suggestive, as was noted by Pechuman. It seems necessary to conclude that *sulcatus* and *mali* are one species.

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Descriptions of Larvae of Forest Insects. *Plagodis, Anagoga, Hyperetis* (Lepidoptera: Geometridae)[1]

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In his recent revision Rupert (1949) has focused attention on the geometrid genus *Plagodis.* In the present paper the writer presents descriptions of larvae of three of the four Canadian species in this genus and of the larvae of *Anagoga occiduaria* (Wlk.) and *Hyperetis amicaria* (H.-S.). Forbes (1948) notes that these three genera make a neat subgroup in the tribe *Anagogini* and indicates that there are differences in the larvae. From studies during the summer of 1949 it was determined that there are differences in these larvae; and the differences, along with the similarities, are set forth in this paper.

Plagodis phlogosaria approximaria Dyar

(Description of one larva, Forest Insect Survey, record no. '49 Alberta 806E, collected by R. R. Stanley from alder at Cameron Falls, Waterton Lakes National Park, Alberta, on July 26, 1949. This larva pupated September 29 and emerged as a female moth on February 2, after 19 days of artificial incubation at approximately 68°F.).

Penultimate Instar.—Head width 1.45 mm.

Ultimate Instar.—Head width 2.0 mm. Body 25 mm. in length and 2.3 mm. in width. Integument of body smooth. Dorsal humps or ridges present on the mesothorax and fifth and eighth abdominal segments, the largest being on the fifth and the smallest on the eighth. Ground colour of body grey; middorsal line poorly defined. Dorsum on abdominal segment 1 striped as follows: greyish-red to setae beta, then a broad white line, remainder of side greyish-red. Thorax greyish-red, with a pair of white patches in front of the hump on the mesothorax. Except segment 1, abdominal segments reddish; the areas anterior and posterior to the hump on segment 5 paler than the remainder of the dorsum. This hump dark brown on the crest, bordered anteriorly by a grey crescent. Contiguous to the hump a pale-brown crescent, which becomes dark brown at the anterior edge. Spiracles and surrounding setae of abdominal segments 2 to 4 inclusive in grey patches. On each of abdominal segments 1 to 5 a fine white line in the subventral area. Midventral line pale with a fine dark line running throughout its length. Integument of head rugulose. Head grey with much dark-grey marking in patches on apices, and to a limited extent, on the frons. Epicranial index 1.67. Prothoracic shield greyish-red. Anal shield grey with brown pits. Setigerous tubercles of dark-brown papillae set on small, brown, convex pinacula; setae of moderate length, brown, pointed. Tubercles bearing setae sigma appearing to

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