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VARIATION IN NEMEOPHILA PETROSA AT LAGGAN IN WESTERN ALBERTA.

BY THOMAS E. BEAN.

At 5,000 feet altitude, in the vicinity of Laggan, *Nemeophila petrosa* flies during July. This is one of our commoner moths, and appears to be the only bombycid of common occurrence in the district. Although occasionally found near timber line, it is rare at that elevation. Under natural conditions only one flight occurs in the season, and larvæ from eggs of that flight hibernate principally at an early stage. In the house, with a warmer night temperature, larvæ resultant from the July flight will go to imago late in October instead of hibernating. In the wild environment, a second flight is prevented by the low night temperature. *Petrosa* frequents moist banks, ditches, margins of old roads, and open ground well supplied with plants. A great majority of the individuals seen in flight are males, the disparity in relative number of males and females observed resulting from the quieter disposition of the females. The males are very restless and readily take flight, thereby attracting observation. The females, less demonstrative, fly but little and are seldom noticed. Males, the physiologists kindly inform us, are katabolic, and females anabolic; we may discover, unaided, that the terminology is diabolic. Results obtained by bringing to imago a large number of wild larvæ and pupæ indicate that the females of *Petrosa* somewhat outnumber the males. The larva is a general feeder, thriving on aster, strawberry, or grass, and extremely partial to the newly formed pupa of *Nemeophila petrosa*.

The plate which this notice is intended to explain and supplement has been prepared under the skillful supervision of Mr. H. H. Lyman. Selection of specimens for the purpose proved a difficult matter, on account of the necessary limitation to a single plate of twenty figures. Complete illumination of the subject would require at least five plates. Were such ample resources of illustration available, three of the plates would serve to present effectively the principal sequence of pattern

evolution, by displaying a progressive series of minute gradations of pattern; a fourth plate might be devoted to an accessory suite of specimens illustrating subordinate lines of variation; and on the final plate an interesting series of aberrant examples could be presented in an order suggestive of their systematic relationship. Five plates, so managed, would furnish a pictorial analysis of the pattern-building method of *Petrosa* more instructive than a laborious essay.

Limited to twenty figures, I found it advisable to select a set of examples suitable for a merely synthetic plate, indicating the leading results of the pattern development rather than its progressive details. The plate contains figures of eleven *Petrosa* males, and seven females. A somewhat fuller series of variations could have been shown by figuring only males. By selecting partly females, however, a distinct advantage was gained, as I have included four appropriate examples bred from one lot of eggs, and incidentally a direct proof is thereby supplied that the plate represents in its local specimens a single valid species. Numbers 1 to 9, inclusive, also 11 and 16, are males. Numbers 12, 13, 14, and 17 to 20, inclusive, are females. For comparison, two instances of *Nemeophila plantaginis* are included, numbers 10 and 15. The former is a male, form *Hospita*, from northern Finland; the latter a female, from the Amour region in eastern Siberia.

My analysis of *Petrosa* is based on examination of 199 males and 160 females. The series is as complete as can be desired, comprising all specialties and stages of pattern caught or bred during seven collecting seasons. The entire material was first assorted in an order expressing the gradual modification of pattern, beginning with initial "*Scudderi*," and progressing to ultimate "*Petrosa*." In order to estimate in numerical terms the prevailing tendency or present attitude of the moth as to pattern, the extended column of variation has been sectioned into separate masses, thus distributing into convenient sections the pattern-distance between the two extremes of variation.

One hundred and seven flown males are first considered. Section 1 contains 14 of these specimens, which, as to upper surface at least, are formal *Scudderi*. Fig. 1 of the plate differs from the specimens of section 1 merely in having the light coloured spur (which extends from base of f. w. and is a rudiment of the longitudinal stripe of *Petrosa)* extended to greater length; in other respects it is *Scudderi*. Fig. 7 has this basal spur as in *Scudderi*.

Section 2 contains 16 intergrades very close to *Scudderi*. Some are like fig. 1 of the plate, some have the longitudinal stripe of f. w. prolonged nearly to a junction with the oblique bar, a few have slightly developed light markings on hind wing. In several examples the oblique bar on f. w. is largely produced, and on basal side projects a branch backward toward the systematic point of junction with the longitudinal stripe, although this stripe is only developed to the extent of a short basal spur. In section 3 are 20 intergrades near to *Scudderi*, but having usually a well defined light pattern on h. w., as in figures 3 and 7 of the plate. Section 4 comprises 7 very characteristic intergrades nearer to *Scudderi* than to *Petrosa*. Fig. 5 stands for this section, and is nearer than the rest of section 4 to the character shown in section 3. The other 6 specimens in section 4 appear to form a progression in pattern of h. w. away from fig. 5 in the direction of *Petrosa* (fig. 16). This progress, however, does not consist of sharply defined gradations like the h. w. pattern steps seen in figures 8 and 4, which figures so normally lead toward fig. 16. In the progression formed by these 7 specimens, the h. w. black area, extending in fig. 5 from the central white band to the base of the wing, becomes in the other specimens increasingly indefinite and finally nebulous, as if the black were eliminated atom by atom without any definite pattern evolution. In the 7th term of this progression, the h. w. is practically like that of fig. 2, except that the basal part of the wing, in addition to the two black streaks seen in fig. 2, has also a slight haze of black scales. This 7th term, however, is not as to f. w. a typical *Petrosa*, for the longitudinal stripe is extremely tenuous at its end next the oblique bar. In the other 5 specimens the longitudinal stripe is scarcely more developed than in fig. 5 of the plate. Section 5 has 10 intergrades, very uniform, decidedly nearer to *Petrosa* than to *Scudderi*. They come between fig. 11 and fig. 8, but nearer the latter. Section 6 is formal *Petrosa*, consisting of 41 specimens. Figures 2, 6 and 16 exemplify this section, fig. 16 being the dominant local form. In section 6 variation is subordinate to a general equality or maturity of pattern.

Sections 1, 2 and 3 are not in the slightest degree distinct in a systematic sense. Together they number 50 individuals, constituting the form *Scudderi* with its inseparable variations. Section 4 agrees in system with the previous section, but between the two masses there is an appearance of discontinuity. In case fig. 5 and another specimen were

lacking, a rather broad gap between sections 4 and 3 would result. Even in that case, the systematic unity of pattern would remain evident. Section 5 accords entirely in system with section 6, yet it happens that actual intergrades between them are extremely scarce, so that these two bodies of variation are also nearly isolated from each other. The only intermediates between sections 5 and 6 are figures 8 and 4 and a single additional specimen; all three are bred specimens—"missing links" are not always so easily obtained.

Sections 5 and 4 are not visibly harmonic. Between them exists a break of continuity by lack of intergrades, and this break resembles a systematic partition, from the fact that the methods of pattern growth in the two series appear discordant. Although the section 5 pattern is more like formal *Petrosa* than is the pattern of section 4, yet a higher stage of the method of section 4 reaches practically the *Petrosa* pattern without in transit assuming the section 5 pattern, or so it seems. It is a fact that section 5 shows more plainly its alliance with sections 2 and 3 than with section 4, while section 4 more clearly manifests its alliance with section 6 than with section 5. Yet sections 4 and 5 undoubtedly belong in the relative positions mentioned. Study of the males alone does not relieve this apparent discord. The males matured indoor from estray pupæ, or from larvæ found wild and fed up, have not supplied any examples reconciling this lack of harmony. I have bred two considerable families from eggs, but it has singularly occurred in each instance that all the resulting males belong on the "*Petrosa*" side of this gap. Figs. 11 and 16 were from one lot of eggs, and although they are a good distance apart as to pattern advancement, yet they are plainly identical in method, fig. 11 being intergraded with fig. 16 by figs. 8 and 4, as also by section 5 and by some other specimens. Study of the females supplies convincing evidence that this apparent lack of harmony at one point in the series of flown males is not due to a systematic partition. In the series of females no corresponding discord is found. Also, we have in figures 12 and 17 direct evidence uniting the extremes of the general series. These two females were bred from the same lot of eggs which produced figs. 11 and 16. Fig. 12 is almost normal *Petrosa*. Fig. 17 may safely be considered a very moderate divergence from formal *Scudderi*. These two females efficiently unite the extreme terms of the series. The lack of unity between sections 4 and 5 is due mainly to the fact that there is a meagerness of representation at that part of the series of males. The

principal masses of individuals occur near the extremes of the pattern-distance, and the intermediate position is in comparison thinly occupied. A divisive attitude is manifested.

Additional to the flown males, my series contains 74 males matured in the house from estray pupæ or wild larvæ. Of these, 13 are *Scudderi;* 11 are intergrades very near *Scudderi;* 15 are somewhat more divergent, yet pretty near to *Scudderi.* One is a stage agreeing with section 4 of the flown males; 6 are nearer to *Petrosa* than to *Scudderi,* and intergrade closely with fig. 11 of the plate and with section 5 of the caught males, 5 of them being intermediate between fig. 11 and section 5, and the other 1 between section 5 and fig. 8 of the plate. Twenty-eighty are formal *Petrosa.* These 74, then, distribute as to pattern development in about the same numerical proportions as the caught males, and with a similarly feeble representation at the centre of the pattern-progress as compared with the extremes.

The caught females are but 25, all told. Of females matured in the house from wild larvæ and estray pupæ, there are 111. Total number of females, not including those bred from the egg, 136. Of these, 16 are *Scudderi,* 20 are intergrades very near *Scudderi,* 26 are more divergent, yet all pretty near to *Scudderi;* 9 are of composite pattern, combining in the same individual a considerable degree of *Petrosa* character, as to some parts of the pattern, with a predominant *Scudderi* tendency in other pattern elements; 9 are well-balanced intermediates between *Petrosa* and *Scudderi;* 18 are gradations near to *Petrosa;* 38 are formal *Petrosa.*

The females display a pattern sequence more even and harmonic than that of the males, with less tendency to break into divisions by lack of intergrades, and more fully sustained in the central part of the chain of variation. At the same time, the females vary as extensively as the males, and they exhibit at least an equal amount of aberration and as great a degree of inequality or oscillation in the progress of the several pattern constituents.

All through the range of variation, in both sexes, it is conspicuously evident that *Petrosa* is exceedingly unstable in regard to the relative development of the various elements of pattern. This is sufficiently illustrated in figures 3 and 5, also by figs. 9 and 11. The oblique bar of primary is the only element which approaches fixedness. The f. w. cell-

spot may be very small or very large, and may be isolated, joined to the oblique bar, or connected with the longitudinal stripe. The longitudinal stripe of f. w. is peculiarly vacillating. Sometimes it shows large development in an otherwise very dark wing, as seen in figs. 3 and 9; on the contrary, in some patterns it is but a mere basal spur, although the other light elements are highly conspicuous, as in fig. 5.

In the summer of 1888 three families were bred from eggs.

Progeny in family A.:

Males.—5 formal *Petrosa;* fig. 16 of the plate is one of them. One intergrade, somewhat nearer to *Petrosa* than to *Scudderi* in the method of its pattern, but at least as near to *Scudderi* as to *Petrosa* in degree of development of pattern; this is fig. 11 of the plate.

Females.—3 nearly formal *Petrosa;* fig. 12 is one. Ten intergrades, all nearer to *Scudderi* than to *Petrosa*, of which the one nearest to *Scudderi* is fig. 17 of plate.

Progeny in family B.:

Males.—One, formal *Petrosa*. Two, near *Petrosa*. Six, a little nearer to *Petrosa* than to *Scudderi*, and all much alike.

Females.—One, nearly formal *Petrosa*. Seven, a little nearer to *Scudderi* than to *Petrosa*, and all much alike. Three, nearly *Scudderi*.

Family C.—Eggs from a female of extreme *Petrosa* characters. Resulting progeny, 3 composite males, *Scudderi* as to hind wing, but with f. w. approximating *Petrosa* nearly in equal degree to the f. w. of fig. 11. Two of them are precisely the form "*Geometrica*," as figured in Plate 2, Proc. Ent. Soc., Phil., Vol. 4, 1865. The third specimen differs by having a single small white dot on each hind wing.

A question has been raised whether *Nemeophila plantaginis* occurs in North America. At Laggan, *Plantaginis* is not found. The local *Petrosa*, throughout its immense range of variation, is at no point of its pattern-sequence coincident with *Plantaginis*. Of the latter I have compared a small but broadly geographical series. The typical *Plantaginis* from Saxony is a larger form than our moth of the Bow Valley, and is besides a far more gorgeous affair, with hind wing black and red in the ♀, black and saffron in the ♂. The type form from polar Norway is smaller, but retains nearly the same pattern, and in my examples the colours are but little toned down. From northern Finland I have a pair,

representing still the typical form, but with the brilliancy of the colours greatly reduced; these are smaller than most local *Petrosa*, and the ♀ is not more brightly coloured, but the ♂ has the tawny yellow ground of hind wing, never found here in male *Petrosa*. From Saxony, from polar Norway, and from northern Finland, I have the male form *Hospita*, in which the saffron or tawny yellow ground of h. w. is replaced by white; this form approaches the local ♂ *Petrosa* by a practical concord of colours. Fig. 10 of the plate represents *Hospita* male from northern Finland. *Hospita* is the nearest phase of *Plantaginis* to the Bow Valley *Petrosa* male. Fig. 15 represents my only Asian instance of *Plantaginis*, a ♀ from eastern Siberia, an example nearer of kin to the Laggan *Petrosa* ♀ than any other *Plantaginis* I have seen. One local female corresponds so closely to this Amour *Plantaginis* that they are separable by a single character only. This final point of distinction is the apical element of the light pattern of primary, the light coloured marking near apex of f. w., exterior to the oblique bar. The apical element seems to be persistent in *Plantaginis*, but in the local *Petrosa* it is only occasionally seen, and even when present is in most cases rudimentary in degree. Fig. 14 illustrates an extreme development of *Petrosa*, in which the apical inscription is blended with the oblique bar. Even in extreme stages of the *Petrosa* pattern the apical element is usually absent. It appears sometimes in intergrades very near to "*Scudderi*." Occurrence or lack of this character, and the degree of its development when present, appear not to be correlated to the degree of advancement of the general pattern. The extensive material before me strongly supports the view that *Petrosa* and *Plantaginis* are distinct species.

Aside from the two *Plantaginis* figures, the plate represents a single species. This conclusion is derived from examination of the caught series, and independently proved in the families bred from eggs.

NOTE.—As the Entomological Society of Ontario supplied the plate, Mr. Bean generously presented the specimens from which it was made to the Society's collection. H. H. L.

PREPTOS, TAMPHANA, AND AROTROS.

In the February number of the CANADIAN ENTOMOLOGIST, Mr. Dyar very justly complains of the inadequacy of my descriptions of the above genera in the Proceedings of the Zoological Society of London, for 1892. Both Preptos and Tamphana belong to the Eupterotidæ. Preptos is most closely allied to the Eastern genus Tagora, Walk., and differs in the following particulars:—Primaries with veins 5 and 6 from upper angle of cell, discocellulars angled outwardly and then inwardly close below vein 5; secondaries with discocellulars very obiique. No allied forms of *Preptos oropus* have as yet been discovered in America, although the species has been redescribed as *Tagora corax*. Druce, Proc. Zool. Soc., London, 1893.

Tamphana is allied to Tarchon, Druce and Apatelodes, Packard, but the wing shape and lateral abdominal tufts distinguish the genus at once, and I shall give full details of the neuration in a paper I am preparing on Walker's American types at Oxford. Arotros belongs to the Bombycidæ; the neuration only differs from Bombyx, Hubn., in having vein 8 of the secondaries rise from the cell at a third of its length from the base, but the shape of the wings is quite different. In locating the above genera I follow the arrangement of Mr. Hampson, as Messrs. Neumoegen and Dyar place the Bombycidæ under the group of families with a frenulum, whereas Bombyx, the typical genus, has no frenulum.

W. SCHAUS, Twickenham, England.

THECLA ONTARIO, EDW.

In a small collection of butterflies sent to me for identification, I find a good example of this very rare Hair-Streak, which was taken by Mr. William Metcalfe, of Toronto, at Grimsby, on 24th of June, 1894. This record is important, as it is the first one of an exact date and locality. Mr. Metcalfe states that the exact spot was along the Grand Trunk Railway track, near Grimsby Park, at the back of Mr. Harry Griffith's farm. The specimen in question is a male in good condition, although slightly stained with cyanide on the upper side. The figure given by Mr. W. H. Edwards (in his Butt. N. America, I., pl. 2, *Thecla)* represents this specimen admirably, although slightly larger. Mr. Metcalfe's specimen expands 22 mm., and has the orange spot on secondaries above only faintly indicated by a few rusty scales. J. FLETCHER.

ON THE TERM CYDOSIINÆ.

BY A. RADCLIFFE GROTE, A. M., BREMEN, GERMANY.

In my check list, New York, May, 1882, I first proposed the collective term *Cydosiinæ*, having for its sub-family type the well-known *Cydosia nobilitella*. I associated with it *Penthetria*, Hy. Ed., not from any study of this genus, unknown to me in nature, but merely on the strength of certain of Mr. Edwards's remarks. This latter genus, under the name *Tantura*, Kirby, is now referred to the *Lithosiidæ* by Neumoegen and Dyar, and probably correctly. I excluded the genus *Oeta*, previously referred here, as I believed it to belong to the *Tineidæ*, as indicated by Zeller. To this sub-family *Cydosiinæ*, Grote, the genus *Cerathosia* is also referred by Neumoegen and Dyar, following Smith's more recent opinion. In 1882, I regarded *Cydosia*, then, as the type of a sub-family of arctiiform *Zygænidæ*. In 1893, Dyar regards it as the type of a sub-family of zygæniform *Arctiidæ*. This is the amount of the difference; but, in any event, I may point out that the term *Cydosiinæ* belongs to me. And I do not expect that the last word as to its family position has been said. In his Preliminary Catalogue, CAN. ENT., XXI., 169, Mr. Smith refers the genus *Gnophaela* to the *Arctiinæ*, p. 172. This genus, according to Neumoegen and Dyar, belongs to the *Pericopidæ*. The genera, previously regarded by me as arctiiform *Zygænidæ*, following Dr. Packard, under the term *Glaucopes*, are now divided into two families: *Zygænidæ* and *Pericopidæ*, excluding the *Cydosiinæ*. For the genera, referred by me to the *Castniares*, the distinct family *Agaristidæ* is retained. This seems to be the amount of the difference. In any event, I point out the fact that, up to quite recently, Dr. Packard had not abandoned his view of the family solidarity of his family *Zygænidæ*, and that this certainly was not the case in 1882; hence any criticism of my list, based on more recent discoveries, is totally irrelevant. On the contrary, my list offers a term *Cydosiinæ*, of which the most recent classification (1893-4) avails itself. Further, Mr. Smith refers, in 1889, *Melanchroia* to the *Arctiinæ*. No one else, I believe, has ever placed it there, nor has it stayed there long. This placing of *Gnophaela* and *Melanchroia* among the *Arctiinæ* might indeed provoke an unfriendly criticism, but a little reflection shows that all such mistakes are in due course corrected as we add to our knowledge of structure. Already in 1891 the two genera suddenly

disappear from the *Arctiinæ*, to appear in the *Pericopidæ* of the Philadelphia List. In the next List to be published it seems likely that *Melanchroia* will submit, with similar celerity, to a third *changement de place.*

As to the position of *Cerathosia*, Dr. Packard says: "The occurrence of such [glandular] hairs in this genus [*Cerathosia*] is interesting, from the fact that they have not yet been observed in the Arctians, to which this moth has been referred, nor in the *Noctuidæ*, among which it should be placed, since no Arctians have, when hatched, smooth glandular hairs." Proc. Bost. S. N., Hist., xxv., 109, 1890. The citation of this genus in a synoptic table does not of itself constitute a proof that it is correctly classified.

SOME NEW ATTIDÆ.

BY NATHAN BANKS, SEA CLIFF, N.Y.

Phidippus borealis, nov. sp.

Length, 13. mm.: ceph., 4.2 mm. long, 3 mm. wide. Cephalothorax very dark brown, covered with black hairs, clypeus with white hairs, and some white scales on the lower sides: a bunch of stiff hairs behind the eyes of second row; mandibles red-brown, iridescent greenish near tip: sternum brown with black hairs. Abdomen black, a narrow basal line of white, and broad side stripes of white which do not quite reach to the tip; just beyond the middle the side stripes indent the central black area; sides black and venter blackish; legs black, bases of metatarsi reddish. The cephalothorax is moderately high, narrower than in the allied species, the quadrangle wider behind, the anterior row much curved, the S. E. small and well separated from the M.E., the eyes of second row almost twice as near to the lateral as to the dorsal. The posterior metatarsi are more slender than usual, and spined only at tip. The region of the epigynum is nearly circular in outline, with a deep rounded excision behind, and two quite widely separated openings in the anterior portion. Two females; Crawford Notch, White Mts., N.H. (Mrs. Slosson). Differs from allied species (*rufus*, *mystaceus*) in the narrower cephalothorax, markings of abdomen, etc.

Dendryphantes bifida, nov. sp.

Length, ♂, 4 mm.; ceph., 1.8 mm. long, 1.2 mm. wide; ♀, 4.2 to 5 mm. long. Cephalothorax reddish, black around eyes, some long white hairs on clypeus: mandibles red-brown: sternum dark brown or black: legs yel-

lowish, femora mostly black in the male, anterior legs of female reddish, patellæ and tibiæ of other legs reddish or with red bands. Abdomen red-brown, in male with four black spots each side near tip, in female a black stripe each side with three pale spots, as in *D. flavus*, sometimes a pair of pale spots near base; venter pale with three dark brown or black stripes. In structure similar to *D. flavus* and *D. montanus*, but the mandibles are not enlarged as in those species, and the size is much smaller. The male palpus is similar to *D. montanus*, but with a smaller tibial hook, a smaller striate upper portion of bulb, and with a tube yet stouter and deeply bifid at tip. The epigynum has a triangular excision behind, and a deeply lunate dark patch in front. Several specimens: Olympia, Washington (T. Kincaid).

Attus dorsatus, nov. sp.

Length, 3.5 mm.: ceph., 1.5 mm. long, .95 mm. wide. Cephalothorax red brown, eye-region blackish, a narrow median light stripe extending from the dark of eye-region to the hind margin of the cephalothorax, also a light stripe each side from just below the dorsal eyes to the hind margin, a few whitish hairs around anterior eyes, abdomen above and below a uniform gray, sternum and legs brownish yellow, latter with ends of the joints darker, mandibles reddish. Cephalothorax but little shorter and narrower than the abdomen, barely wider behind the eye-region than in front, eye-region as wide behind as in front, eyes of second row a little nearer dorsal than lateral eyes. Fourth pair of legs much the longest, first the next; tibia IV. twice as long as III., anterior coxæ separated by more than width of lip; metatarsi IV. spined throughout. The epigynum consists of a depressed area, broadly rounded in front and longer than broad, at the anterior end there are two square holes, and from them extend behind on each side a clavate body, enclosing between their tips two elongate holes. One specimen: Southern California.

Attus morosus, nov. sp.

Length, 4.5 mm.; ceph., 2 mm. long, 1.4 mm. wide. Eye-region blackish, thoracic part reddish, a median white line; dorsum of abdomen brown, a pair of large black spots on anterior part, on the anterior edge of each is a small white dot, behind them there is a broad, triangular, transverse area of white with three brown chevrons, a large black spot each side terminating the two posterior chevrons, behind them is a white band and a narrow black band just above the spinnerets: sides lineated

with brown and white; venter pale, with a large light brown spot; sternum blackish, pale on the margins; legs brownish, paler at tips, posterior pair indistinctly ringed. Cephalothorax as usual, quadrangle of eyes equally wide in front and behind, eyes of second row half-way between dorsal and lateral eyes. Fourth pair of legs much longer than third; anterior coxæ separated by more than width of lip; metatarsi IV. spined throughout. The epigynum consists of a circular depressed area, divided by a broad septum, much broader behind than in front, where on each side there is a small dark spot. One female; Olympia, Washington (T. Kincaid).

Icius obliquus, nov. sp.

Length, 2.8 mm.; ceph., 1.2 mm. long, .8 mm. wide. Cephalothorax yellowish-brown, eyes connected by a black band, extending behind and enclosing the dorsal eyes, a few of the radial furrows partly black, margin black; abdomen yellowish, a few brownish chevrons near the tip, sides with oblique blackish lines, venter suffused with black, two rows of yellow spots; sternum yellowish, black on edge; legs yellowish-brown, anterior pair stoutest and darkest, with a few black patches, palpi similar, mandibles yellowish, black near base. Sides of cephalothorax almost straight, slightly narrowed behind; eye-region wider in front than behind; eyes of second row about half-way between dorsal and lateral eyes. Anterior coxæ separated by more than width of lip; fourth pair of legs longest, third nearly as long as first; the three pairs of spines on tibia I. are very long, metatarsus IV. spined only at tip. The tibia of palpus has no projection, the lower part of palpal organ is large, the upper portion is cut off from that below by a transverse furrow and is twice as wide as long; the tube is slender, but slightly curved and projects into a large circular cavity in the upper portion of the tarsus. One male and one young female; Olympia, Washington (T. Kincaid).

Icius monticola, nov. sp.

Length, 4 mm. ♂. Cephalothorax red-brown, black on margin and in eye-region, clothed with white scales; a median row of stiff bristles just above anterior eyes. Legs yellow-brown, the femora darker; on posterior pairs a black ring at base of tibia, metartarsus and tarsus; clothed with long black hairs and shorter white scales; palpi red-brown, clothed with white scales; sternum dark red-brown; abdomen blackish (but somewhat discoloured), clothed above with white scales, and below with fine hairs. Cephalothorax moderately long, low and flat, broadest in

middle, eye-region one and one-half times as wide as long, equally wide in front and behind; the A. M. E. large, nearly touching, the eyes of second row a little nearer to A. S. E. than to dorsal eyes. Mandibles small and weak; sternum narrow: anterior coxæ separated by more than width of labium; leg I. barely longer than leg IV.; femora, patella, and tibia enlarged: metatarsus IV. spined only at tip. Palpi short, the tarsus truncate at tip, tibia with a short straight-pointed projection on outside, lower part of palpal organ very much swollen, almost pointed, upper part short, tube short, bent upon itself. A male: near Livermore, Colo. (C. F. Baker.)

Icius minutus, nov. sp.

Length, 2.5 mm.; ceph., 1.1 mm. long, .75 wide. Cephalothorax red-brown, eye-region black, abdomen dark gray, with a few narrow light chevrons on the posterior part; legs white, annulate with black, the femora partly suffused with fuscous, sternum dark gray, venter pale, a median and two broader lateral gray stripes, palpi white, distal joints a little enlarged, mandibles yellowish. Cephalothorax widest behind the middle, eye-region a trifle narrower behind than in front, legs short, fourth pair wanting, third as long as the first, second shorter, anterior coxæ separated by more than width of labium. Abdomen one and one-half times as long as the cephalothorax. A quite prominent bristle arising from between anterior median eyes. The epigynum has, in the posterior portion, two very large contiguous circular depressions: and two very much smaller holes, slightly separated, in the anterior portion. One female; Olympia, Washington (T. Kincaid).

Icius floridanus, nov. sp.

Length, 3 mm. Cephalothorax dark yellow-brown, darker in eye-region, clothed with yellowish or golden scales, especially near eyes: mandibles yellowish: sternum blackish. Legs pale yellowish with a black stripe on anterior and one on posterior sides of patella, tibia and metatarsus, anterior femur blackish, rest of anterior leg reddish, with the usual black stripes. Abdomen black, with a band of white scales at base, above with dark, somewhat coppery scales, below with white hairs. Cephalothorax quite short and broad, sides but little rounded, low and nearly flat, eye-region nearly twice as wide as long, a little wider behind than in front; eyes of second row closer to lateral than to dorsal eyes. Mandibles quite large, with a black tooth behind fang: sternum short, triangular; anterior

coxæ separated by width of lip; leg I. longest and stoutest, but not much longer than leg IV., metatarsus IV. spined only at tip. The palpus is long and slender, a short curved spine at tip of tibia, the tarsus fully twice as long as broad, palpal organ but little convex, divided transversely and the upper part bilobed, behind one of these lobes arises the long and slender tube, which curves toward the middle and extends into a furrow in the upper part of tarsus. One male from Punta Gorda, Florida (Mrs. A. T. Slosson).

Icius similis, nov. sp.

Length, 4.1 mm.; ceph., 1.6 mm. long, 1.1 mm. wide. Cephalothorax with sides and thoracic part reddish, with a few white scales and a marginal stripe of white: eye-region black, posterior part iridescent; clypeus with white hairs; a ridge of white or yellowish hairs above the first row of eyes: mandibles, legs and sternum reddish, the latter darker than the other parts; the legs have a black stripe above and one on each side of patella, tibia and metatarsus; the posterior metatarsi are almost wholly black. Abdomen black, covered with pale scales, not or but slightly iridescent.

In structure and coloration this is similar to *I. elegans*, Hentz, but the scales are not as iridescent, there is no pale line around the abdomen of the ♀, the legs are more reddish, the ♂ has no brush to tibia I., the tube of palpus much stouter; the ♀ is but little larger than the ♂. The epigynum has a small median rounded excision in the posterior margin; and two oval holes, about their diameter apart, in front. Several specimens from Olympia, Washington, and from Ft. Collins, Colo. Prof. Emerton, in his N. Eng. Attidæ, mentions what is probably this species as a variety of *Icius elegans*.

Icius sexmaculatus, nov. sp.

Length, 3.5 mm.; ceph., 1.4 mm. long, .85 mm. wide. Thoracic part black, with some golden hairs on the anterior edge; sides and thoracic part reddish, mandibles reddish brown; sternum yellowish; dorsum of abdomen red-brown with blackish patches, and with six white spots, two transverse basal ones, two larger, median, more circular ones, and two small preapical ones; beyond the middle pair a few indistinct pale chevrons; legs pale yellowish, anterior pair more reddish, especially femora and bands on patellæ and tibiæ; palpi pale; sides of abdomen red-brown; venter pale, with a brown line each side. This species is similar to *I.*

lineatus; the cephalothorax is the same, though perhaps a trifle higher and the dorsal eyes slightly farther apart; otherwise the structure is like that species. The tibia of the palpus has a short black spine at tip, the tarsus is much narrower than in *I. lineatus* and the palpal organ quite simple, the lower part is large and projecting, the upper part striate and with a short, stout apical tube; there is on the outer side the outline of a curved tube pointing down toward the tibial spine. One male; Washington, D.C.

Saitis parvulus, nov. sp.

Length, 3 mm.; ceph., 1.4 mm. long, 1.05 mm. wide. The eye-region black; the thoracic part reddish, with two black spots on the posterior margin; the palpi and first legs black, the second legs mostly black; other pairs yellowish, no black spots as in *S. pulex*; the mandibles red-brown; the sternum yellowish-brown; the abdomen black above, with a broad white stripe, broadest at the middle, beginning just before the middle it contains five broad black chevrons; venter yellowish, with a median black spot and two black stripes. Similar to *S. pulex*, but the cephalothorax is shorter and the eye-region is proportionately broader, the quadrangle being a little narrower behind; the palpus is much smaller, the tibia has not the long, thin projection, nor a broad lobe below, but a moderate, curved black process; the bulb of palpus has a swollen part not seen in *S. pulex*. One male from a deep and cold swamp near Ithaca, N. Y.

Habrocestum borealis, nov. sp.

Length, 5.5 mm.; ceph., 3. mm. long, 2. mm. wide. Cephalothorax black, in a strong light the thoracic part showing slightly reddish; the sides with white scales, which on the margin form a distinct white line; above anterior row of eyes is a crest of long black hairs; sternum black, sometimes pale in the centre; coxæ mostly black, sometimes posterior ones pale at base; palpi black, except the tibia and tarsus, which are pale; anterior pairs of legs mostly pale, with a few black patches on femora and tibiæ; posterior legs mostly black, the tarsi pale, and the patellæ, tibiæ and metatarsi are lineated with pale. The palpi have many white hairs or scales, and on the tarsi they are interspersed with long black hairs; there are white scales on the black parts of the legs. The abdomen is jet black, sides white, above with a white basal band and a band crossing the dorsum just before the middle and curving to meet the white sides; just above the spinnerets is a pair of white dots, and in front of these a median white spot, sometimes elongate. The structure

is similar to the other species of the genus; there is a horny spot on the base of the abdomen. The palpus is similar to *H. cæcatum*, but is not so broad; the tibial projection is much longer and the tube is not so stout. There is no projection at the tip of patella III. Several males, from Franconia, N. H. (Mrs. A. T. Slosson).

Habrocestum clypeatum, nov. sp.

Length, ♂, 4.7 mm. Cephalothorax yellowish in front, black on sides and a short median stripe from behind; clothed with tawny scales; a curved band of white scales just above first row of eyes, surrounding the eyes of second row and passing below the dorsal eyes and extending behind toward the posterior margin; a stripe of white scales near each lower margin; clypeus black, a few white hairs in centre and on mandibles, and a prominent elongate vertical spot of white scales under each side eye. Leg I. black, except metatarsus and tarsus which are pure white, clothed with white scales, those under the tibia extremely long and pedicellate; basal joints of leg II. blackish, with white scales; legs III. and IV. brownish-yellow, femora blackish at base. with white scales and black hairs: sternum pale. Abdomen black above, a basal band of white and a white median stripe behind; sides and venter pale, the latter with two black stripes. Of the usual structure of the genus, leg III. simple. Palpus broad, much like that of *H. agilis*, Bks. (*auratum*, Peck., not Hentz.), but the tibial projection is much stouter, and the long tube starts nearer to the tip of bulb. One male: Dixon's Canon, Colo. (C. F. Baker).

Zygoballus iridescens, nov. sp.

Length, 4.1 mm.; ceph., 1.8 mm. long, 1.4 mm. wide. Eye-region black, thoracic part reddish, both with whitish hairs and scales. Anterior femora black, black stripe above and on inner side of patella and tibia I., rest of legs pale yellowish, without any spots. Mandibles and mouth parts red-brown; sternum black. Abdomen black, clothed above and on sides with iridescent scales and long hairs; venter black, hairy, and with two indistinct rows of pale spots. Structure in general similar to *Z. bettini*, but the mandibles are not quite so large; and the sternum is much broader, not narrowed in front, so that the anterior coxæ, which are not as long as in *Z. bettini*, are more widely separated. The region of the epigynum is red-brown, and is semicircular in outline; showing four pale spots, two in front close together, and one in each posterior corner. Franconia, N. H. (Mrs. Annie T. Slosson).

SYNOPSIS OF THE DIPTEROUS GENUS PHORA.

BY D. W. COQUILLETT, WASHINGTON, D. C.

In Osten Sacken's well-known Catalogue of Diptera ten species of Phora are credited to our fauna. Of these I have been unable to find any Phorid described by Fabricius under the name of *atra*. The author who first used this name appears to have been Meigen; in his Klass. Besch. Eur. Zwei. Insect (1804), this author describes a *Trineura atra*, but in his later work (Syst. Besch. Eur. Zwei. Insect, 1830) this name is relegated as a synonym of *Musca aterrima*, Fabr. (Ent. Syst., 1798). In the recent revision of the Austrian Phoridæ, by Strobl (Wiener Ent. Zeitung, 1892, pp. 193-204), no mention is made of a *Phora atra*, Fabr. The reference in the Catalogue should therefore be credited to Meigen, and transferred as a synonym of *Trineura aterrima*, Fabr.

Phora fuscipes, Macq., has been credited to our fauna by Walker, but from Macquart's three-line description it is quite impossible to identify the species, and the name should therefore disappear from our list. The form doubtfully referred to this species by Zetterstedt does not occur in our fauna so far as I am aware.

Since the publication of the above mentioned Catalogue, descriptions of five supposed new species of Phora from our fauna have been published, viz.: *aletiæ*, Comstock (Cotton Insects, 1879, pp. 208-211), and four other species by Prof. Aldrich, in the CANADIAN ENTOMOLOGIST, Vol. XXIV., pages 142-146. Although I have not seen an undoubted type of *Phora aletiæ*, Comst., still there is every reason for believing that it is identical with the common *Phora nigriceps*, Loew. The described female was evidently immature, which would account for the darker markings on the abdomen mentioned in the description; in the male, however, it is stated that the "dorsal portion of the abdomen is entirely blackish," and this accords perfectly with the colouring of this part of the body in normally coloured specimens of *nigriceps*. Moreover, this latter species has been repeatedly reared from larvæ feeding upon the decomposing chrysalides of Aletia, thus having similar habits to the form described by Prof. Comstock.

So far as at present known, the larvæ of all the different species of Phora feed upon animal or vegetable substances in a more or less state of decay. In Prof. Aldrich's paper mentioned above the statement is made that several of the species were reared from Cimbex cocoons, but in a recent letter the author states his conviction that these cocoons contained only dead larvæ and pupæ at the time they were attacked by the Phorids.

Four European species, not heretofore known to occur in our fauna, have recently been recognized by the writer, viz: *femorata*, Meig., *interrupta*, Zett., *mordellaria*, Fall., and *fasciata*, Fall. There are also four apparently undescribed species occuring in this country, and these will be found duly characterized below. Our species may be tabulated as follows:

Second heavy vein of wings simple, not forked near the apex; head and body black.

Frontal setæ next the antennæ pointing downwards; tibiæ destitute of setæ on the outer side; palpi and halteres yellowish..... *cocciphila*, n. sp.

Frontal setæ pointing upward; front and hind tibiæ each bearing one, the middle tibiæ two setæ on the outer side near the base; halteres black.

Palpi and antennæ black..... *femorata*, Meig.

Palpi yellowish.

Antennæ black..... *mordellaria*, Fall.

Antennæ yellowish-red..... *clavata*, Loew.

Second heavy vein forked near the apex.

Middle tibiæ each bearing two or three setæ on the outer side near the base; frontal setæ pointing upward; head and thorax black.

Halteres, palpi and abdomen black; front tibiæ each bearing a single seta on the outer side near the base.

Hind tibiæ each bearing a seta on the outer side near the base and three smaller ones before the tip..... *cimbicis*, Ald.

Hind tibiæ destitute of setæ on the outer side... *pachyneuron*, Loew.

Halteres yellowish.

Palpi and abdomen black, front and hind tibiæ each bearing a single seta on the outer side near the base..... *microcephala*, Loew.

Palpi yellowish.

Hind tibiæ each bearing seven, the front ones three setæ on the outer side; abdomen black..... *spinipes*, n. sp.

Hind tibiæ each bearing two, the front ones each one seta on the outer side near the base; abdomen black.. *Luggeri*, Ald.

Hind and front tibiæ each bearing a single seta on the outer side near the base; abdomen velvet-black, the bases of the segments partly or wholly yellow..... *venusta*, n. sp.

Hind tibiæ destitute of stout setæ on the outer side, the front ones each with three or four; abdomen black, the apices of the segments sometimes narrowly yellow...*incisuralis*, Loew.

Middle and other tibiæ destitute of stout setæ on the outer side, at most bearing short bristly hairs; frontal setæ next the antennæ pointing downward.

Thorax, palpi and halteres yellowish.

Head, antennæ and dorsum of abdomen largely or wholly black.....*nigriceps*, Loew.

Head and antennæ yellowish.

Abdomen yellow, a black fascia or pair of spots on the second and sometimes also on the third segment.....*fasciata*, Fall.

Abdomen yellow, the sides and a fascia near the hind margin of each segment, black.....*scalaris*, Loew.

Abdomen yellow, an interrupted black fascia on the base of each segment.....*interrupta*, Zett.

Thorax, head and abdomen black.

Halteres black, palpi yellowish.....*fungicola*, n. sp.

Halteres yellowish.

Palpi black.....*minuta*, Ald.

Palpi yellowish.

Tip of first heavy vein near the last fourth of the distance between the humeral cross-vein and the tip of the first branch of the second heavy vein; abdomen of male bristly.....*rufipes*, Meig.

Tip of first heavy vein nearly midway between the humeral cross-vein and the apex of the first branch of the second heavy vein; abdomen of male destitute of bristles.....*setacea*, Ald.

Phora cornuta, Bigot, from Cuba, is too imperfectly described to admit of giving it a place in this table.

Phora spinipes, n. sp.—Black, sub-shining, the palpi, halteres, front and middle tibiæ and a large portion of their femora, also the knees of the hind legs, yellowish; all frontal setæ pointing upward. Front tibiæ each bearing three setæ on the outer side of its basal three-fourths, middle tibiæ each bearing three setæ in a curved row on the outer side of its basal half, hind tibiæ each with seven setæ in an irregular row extending

nearly the entire length of the outer side. Wings hyaline, costal vein extending three-fourths the length of the wing, ciliate with rather short bristles; second heavy vein forked near its apex, tip of first heavy vein slightly beyond the middle between the humeral cross-vein and apex of the first branch of the second heavy vein; first slender vein curved near its base, then nearly straight, the cell in front of it scarcely wider than the narrowest part of the cell behind it; fourth slender vein distinct. Length, 4 mm. Hartford, Conn. A single specimen in my collection, taken April 30, 1893, by Mr. Stewart N. Dunning.

Phora coccíphila, n. sp.—Black, sub-shining, the under side of the third antennal joint and the palpi, yellowish; halteres whitish; front legs, including the coxæ, light yellow, the others brown. The four frontal setæ above the antennæ pointing downward, the others upward. Tibiæ destitute of stout setæ on the outer side. Wings whitish hyaline, costal vein not extending to the middle of the wing; ciliate with very short bristles, second heavy vein simple, not forked near the tip, apex of first heavy vein near the last fifth of the distance between the humeral cross-vein and the tip of the second vein; first slender vein nearly straight, the cell in front of it nearly twice as wide as the narrowest part of the one behind it. Abdomen bare in both sexes. Length, .75 to 1.25 mm. Twenty-five specimens in the collection of the Department of Agriculture, bred in October and November, 1894, from larvæ infesting dead adults of *Icerya purchasi*, collected by Mr. C. H. T. Townsend at Magdalena, Victoria, and Tamaulipas, Mexico.

Phora fungícola, n. sp.—Black, sub-shining, antennæ and halteres concolorous, the palpi and legs, including the front coxæ, yellowish. The four frontal setæ above the antennæ pointing downward, the others upward. Tibiæ destitute of stout setæ on the outer side. Wings hyaline, costal vein extending to the middle of the wing, ciliate with short bristles, second heavy vein forked near the apex, tip of the first heavy vein near the last third of the distance between the humeral cross-vein and apex of the first branch of the second vein, first slender vein gently curved its whole length, the cell in front of it scarcely wider than the narrowest part of the one behind it. Abdomen bare in both sexes. Length, 1 to 1.5 mm. Ten specimens in the collection of the Department of Agriculture, bred by T. D. A. Cockerell, Las Cruces, New Mexico, from larvæ infesting a tree-fungus, *Trametes Pecki*, which was inhabited by Coleopterous insects belonging to the genus *Cis*.

Phora venusta, n. sp.— ♀ Head and thorax black, sub-shining; antennæ yellowish-brown; palpi, halteres and legs, including the coxæ, yellow. Abdomen opaque velvet-black, the broad bases of the second and sixth segments and a triangular dorsal spot at the base of the third, fourth and fifth segments, yellow; venter also yellow. Frontal setæ pointing upward. Front tibiæ on the outer side each bearing one, the middle tibiæ with two stout setæ near the base, hind tibiæ destitute of setæ on the outer side. Wings hyaline, costal vein extending to the middle of the wing, ciliate with minute bristles, second heavy vein forked near the apex, the tip of the first heavy vein near the last fourth of the distance between the humeral cross-vein and the tip of the first branch of the second vein; first slender vein nearly straight, the cell in front of it sub-equal in width to the one behind it. Length, 1 mm. Boston, Mass., Sept., 1868. A single specimen in the National Museum. I am indebted to the Curator for the privilege of studying the fine series of specimens contained in the collection of that institution.

PREPARATORY STAGES OF EUCLIDIA CUSPIDEA, Hubn.

BY JOHN B. LEMBERT, YOSEMITE, CAL.

Egg.—Pea-green colour; round, with deep longitudinal lines from the top to the bottom. Deposited in twos and threes up to as many as eight or nine at one laying before flying away. The eggs change next day to a mottled gray colour, resembling the dried plant stalks on which they are laid. They are not deposited directly on the food plants, which are lupin and clover. They hatch out in nine days.

Larva, first stage.—A slender looper. Head quite large and bilobed. Light green from the head to the first segment back of the thoracic legs, which are six in number; thence dark green to the segment joining the four abdominal legs, lighter beneath; remainder of body light green. Length, about 6 mm.

The second change escaped my notice, as the larvæ were always moving and must have taken but a short time to effect it; the whole surface of the body became concolorous and of a light green. On the twelfth day they were very quiet; fine white and black lines could be seen along the sides. After this they would raise themselves up, put their heads between the thoracical legs, then twist around, open their mouth parts as if in the act of biting or covering their bodies with a fluid; suddenly they disappeared. Seven days afterwards I examined the leaves of the food plants and found one curled up in a web; taking it for granted that it was prepared to hibernate, I put the jar away for the season.

Subsequently I found that I was mistaken on this point, and that I had introduced with some clover a Hemipterous enemy which destroyed my larva.

PRELIMINARY STUDIES IN SIPHONAPTERA.--III.

BY CARL F. BAKER, FORT COLLINS, COLO.

Genus Pulex (continued.)

DIVISION II.

Mandibles short, not reaching ends of anterior coxæ; spines in pronotal comb, 14 to 26. Group 1.

Mandibles long, reaching to or beyond ends of anterior coxæ; spines in pronotal comb, 16 to 20. Group 2.

TABLE OF SPECIES OF GROUP 1.

Spines in pronotal comb, 14 to 20.....A.

Spines in pronotal comb, 24 to 26: hind femora with a row of minute bristles on side; first two or three abdominal segments with minute teeth on disc above; first claspers of male without short black teeth; bristles on second antennal joint shorter than third joint; length, 3–3.5 mm.; colour dark brown .....*avium.*

A. Abdominal segments each with one row of bristles; eyes very large, longer than third antennal joint, the upper edge extending above middle of head; bristle on second antennal joint reaching to end of or beyond third joint; maxillary palpi with joint 2 shorter than 4 in male, as long as 4 or longer in female; head in female evenly rounded from occiput to mouth, in male flat on top, rounded in front; pronotal comb of 14 spines; first two or three abdominal segments without minute teeth on disc above; in anterior tarsi joint 5 is as long or longer than 1 and 2 together and longer than 3 and 4 together; in middle tarsi joint 5 is three times 4 and as long as 2 or longer, while 2 is longer than 1 and as long or longer than 3 and 4 together; in posterior tarsi last three joints are very slender, 5 about equal to or shorter than 3 and 4 together, 2 equals three times 4, as long or longer than 5 and longer than 3 and 4 together, while 1 is much longer than 5 and nearly three times as wide; hind femora with a row of minute bristles on side; colour dark brown; length: male, 2 mm.; female, 2.25–2.5 mm.*glacialis.*

AA. Abdominal segments each with two rows of bristles; spines in pronotal comb, 16 to 20.....B.

B. Hind femora with a row of minute bristles on side; eyes small, near lower edge of head; antennal groove in anterior half of head; in anterior tarsi joint 5 is shorter than 1 and 2 together and shorter

than 2 and 3 together, but as long or longer than 3 and 4 together; in middle tarsi joint 5 equals twice 4, equals or is slightly shorter than 2, which is shorter than 1 and shorter than 3 and 4 together; in posterior tarsi joint 2 is less than three times 4, much longer than 5, and nearly as long as 3 and 4 together. . . . . F.

BB. Hind femora without a row of minute bristles on the side; eyes small, near lower edge of head; antennal groove in anterior half of head; maxillary palpi in female with joint 2 more than three-fourths of 4; head in female evenly rounded from occiput to mouth; pronotal comb of 18 spines; colour light brown, sometimes darker dorsally . . . . . C.

C. Abdomen more convex above than below, and without teeth on discs of first two or three segments above; bristles on second antennal joint shorter than third joint; bristles on abdomen as follows: first row on each side of dorsal segments with 4 or 5 bristles, second row with 6, ventral segments with 4 on each side; in anterior tarsi joint 5 is longer than 3 and 4 together; in middle tarsi joint 5 equals twice 4 and equals 1; in posterior tarsi joint 5 equals two-thirds of 2, is less than twice 4, and equals 3, 2 is slightly less than 3 and 4 together, while 1 is more than twice 5; colour light brown; length: female, 3 mm . . . . . *Wickhami*, n. sp.

CC. Abdomen concave or very slightly convex above; with minute teeth on discs of first two or three abdominal segments above. . . . . D.

D. Bristles on second antennal joint nearly as long as third joint; bristles on abdomen as follows: first row on each side of dorsal segments with 6 bristles, second row with 7, ventral segments with 4 or 5 on each side; in anterior tarsi joint 5 nearly as long as 3 and 4 together; in middle tarsi joint 5 is less than 1, about as long as 2 or shorter, and less than 3 and 4 together; in posterior tarsi joint 5 equals two-thirds of 2, equals 3, and is less than twice 4, 2 is less than three times 4, and 1 is more than twice 5; colour light brown; length: female, 2.5–3 mm. . . *Gillettei*, n. sp.

DD. Bristles of second antennal joint short; comparative lengths of tarsal joints not as above . . . . . E.

E. Male claspers unarmed; head evenly rounded; first and second rows of bristles on dorsum of abdominal segments each with 7 bristles; in anterior tarsi joint 5 equals 3 and 4 together; in middle tarsi joint 1 equals 2, equals 5, and equals 3 and 4 together;

in posterior tarsi joint 5 equals 2, equals twice 4, and equals one-half of 1; colour light brown; length: female, 2–2.5 mm.; male, 3 mm..... *fasciatus.*

EE. Male claspers armed with short black teeth; head evenly rounded in female, flat above, rounded in front in male; first row of bristles on each side of dorsum of abdominal segments with 5 bristles, second row with 6, ventral segments on each side with 3 or 4; in anterior tarsi joint 5 as long or longer than 3 and 4 together; in middle tarsi joint 5 equals 1 or less, equals 2 or more, and equals 3 and 4 together or less; on hind tarsi joint 5 equals two-thirds to three-fourths of 2, equals twice 4, and equals 3 or more, 2 is less than three times 4, while 1 equals twice 5 or more; light brown, more or less dark dorsally on abdomen; length: male, 1.75–2 mm.; female, 2.25–2.5 mm..... *Howardii*, n. sp.

F. Bristles on second antennal joint shorter than joint 3; maxillary palpi in male with joint 2 nearly as long as 4; head in male flat on top, rounded in front; pronotal comb of 18 spines; first two or three abdominal segments without minute teeth on discs above; first and second dorsal rows of bristles on segments of the abdomen each with about 7 bristles on either side, ventral rows with about 4 on either side; first claspers in male with long heavy bristles, but without short black teeth; in posterior tarsi joint 5 about equals 3, while 1 is longer than 2, longer than 3 and 4 together and more than three and a-half times the length of 5; head, thorax and legs light brown, abdomen reddish brown; length: male, 3 mm..... *coloradensis*, n. sp.

FF. Bristles on second antennal joint longer than joint 3; eye very small, almost obsolete; maxillary palpi in female with joint 2 as long as 4; head in female evenly rounded from occiput to mouth: pronotal comb of 20 spines; first two or three abdominal segments with several short minute teeth on discs above; bristles on abdomen as follows: first row on dorsum of each segment with 12 to 14 on either side, second row with 11 to 12 on either side, each ventral row with about 6 on either side; in posterior tarsi joint 5 is shorter than 3, 1 nearly as long as 2 and 3 together and less than 3 and 5 together; uniform light brown: length: female, 2.5 mm..... *ignotus*, n. sp.

Pulex avium, Tschb.

1880. Taschenberg, Die Flohe, p. 70.

This species has quite an appalling synonymy. Dr. Taschenberg records it from a great variety of birds, including the domestic fowl. I have four specimens from Dr. Taschenberg, taken on *Sturnus vulgaris* in Germany, and a single specimen taken at Ames, Iowa, by Prof. Herbert Osborn—the host not given. It is recorded in Bull. 30 of the Texas Exp. Sta. as "common; very troublesome last summer at Bryan, Tex., on chickens." This determination was undoubtedly an erroneous one, the record probably referring to *Sarcopsylla gallinacea*.

Pulex glacialis, Tschb.

1880. Taschenberg, Die Flohe, p. 76.

I have received specimens of this species from Mr. A. B. Cordley, who took them on "cotton-tail rabbit," near the Grand Canon, in Arizona. The type specimens were from *Lepus glacialis*, "collected at the North Pole."

Pulex Wickhami, n. sp.

This species differs very widely in general appearance from any other Pulex I have seen. The abdomen in the two females before me is somewhat swollen and suddenly and strongly rounded back of the thorax. The swelling is not due to pregnancy, as the abdominal plates retain their normal relative position. My specimens are from *Sciuropterus volans*, and were collected at Iowa City, Iowa, by Mr. H. F. Wickham.

Pulex Gillettei, n. sp.

Closely related to *fasciatus*, though readily separated from it. Prof. C. P. Gillette took three specimens from Red Squirrel (*Sciurus canadensis*) at Portland, Mich.

Pulex fasciatus, Bosc.

1801. Bosc d'Antic, Bull. des Sci. par la Soc. Philomat. II., p. 156, No. 44.

I have seen nothing among the specimens examined that I could refer to this species as it is described and figured by Taschenberg. It was originally described from *Myoxus nitela* and *Talpa europea*. Kolenati found it on *Cricetus frumentarius*. Taschenberg records it from *Myoxus*, *Mus musculus*, *Mus decumans*, and *Canis lagopus*, in Europe, and without giving host, from Mammoth Cave, in Kentucky.

Pulex Howardii, n. sp.

I have received specimens of this species as follows: On Red Squirrel, at Ithaca, N. Y., from Mr. R. H. Pettit; on Squirrel, at Tallula Falls, Ga., from Mr. L. O. Howard (No. 5435); on "Gray or Fox" Squirrel, and in nest of field mouse, at Lincoln, Nebraska, from Prof. Lawrence Bruner; also several specimens from Prof. Herbert Osborn, at Ames, Iowa, the host not given.

Pulex coloradensis, n. sp.

The nearly parallel upper and lower borders of the abdomen in the single male before me, give it a somewhat peculiar appearance. It was taken from Fremont's Chickaree, at Georgetown, Colo., by Professor Lawrence Bruner.

Pulex ignotus, n. sp.

I have received two specimens of this species from Prof. Herbert Osborn, of Ames, Iowa. The host is not given.

[TO BE CONTINUED.]

MOUNTING INSECTS WITHOUT PRESSURE.*

BY R. W. RENNIE, LONDON, ONTARIO.

The mounting of insects (which are naturally semi-transparent) without pressure has always appeared to me to be a far more satisfactory method than the process so generally in use, viz., the soaking the specimen in liquor potassæ until clear, and then pressing it flat between two glass slips. The liquid partially, or wholly, destroys the internal organs, and the flattening process completes what the liquid failed to accomplish; that is, in so distorting the insect that the flattened skin on the slip but very remotely resembles the natural insect.

In mounting without pressure, some kind of a cell is necessary, and it can be obtained in various materials, such as ebonite, hard rubber, brass, tin, etc., but my own experience with cells of any depth cemented to the slip has been anything but satisfactory, for very often a fall, or even a slight jar, will separate the cell from the glass slip.

The cells that I use are the same that I described some three years ago at a meeting of this section, and up to the present time I have not found anything that answers all requirements so well, and yet is so easy to construct.

* Read before the Microscopical Section of the Entomological Society of Ontario.

For the benefit of those who were not present at that meeting, I will again describe the process of making:

The material used is beeswax, with a small quantity of resin added to increase the hardness and to raise the melting point. This mixture of beeswax and resin is kept heated almost to the boiling point; if the temperature falls much lower you will not be able to form a smooth cell. Place your slip on the turntable and set in rapid motion, then with a moderately thick brush apply a drop of the hot wax to the slip, which, being cold, cools the wax rapidly, rendering the cell visible at once; apply the wax drop by drop until the cell is a little deeper than is required for your material; allow it to cool thoroughly, and before removing from the turntable, take a sharp knife and trim it down to the proper thickness. You may also taper the outside of the cell towards the centre and the inside towards the circumference, leaving the base of your cell wider than the top, but always have your cell wide enough at the top, so that your cover glass will not come quite to the edge, leaving a small margin for the cement; a shallow depression may also be turned in the top to receive the cover glass. This cell answers for such mounting media as Canada balsam, or any glycerine jelly: but for media containing oil, it will be necessary to varnish the cell inside with some material that will not be acted upon by the mounting medium. These cells answer for almost any kind of material, if treated in the manner described, but when the mounting medium is of a very thin or watery nature, it is advisable to slightly heat the slip after you have your cell made and before turning it down, in order to make a perfect contact between the wax and glass.

For mounting transparent aquatic insects, take a cell of proper depth, transfer your insect to it with a small quantity of water, and add a drop of Pyroligneous acid; as soon as the acid reaches the insect it dies at once; place the cover glass in position, and after carefully absorbing any water that may have run over, cement down the cover.

Semi-transparent insects should be placed in a solution of Carbolic acid and Turpentine (one part of the former to three of the latter) and allowed to remain until clear. Ordinary crystallized Carbolic acid may be used in preparing this clearing solution, but I think the best results are obtained by using the C. P. acid; the crystals of pure Carbolic acid are needle-shaped and colourless, while the ordinary commercial acid comes in white flaky crystals. The Turpentine will also require some attention, for, as ordinarily sold, it is hardly suitable for this purpose.

Take one pint of Turpentine, and add to it about two ounces of 95% alcohol, shake thoroughly, and set aside until the liquids separate (the alcohol will be the upper liquid), remove the turpentine to another bottle (which should be quite clean), and add to it about one pint of distilled water, give another good shake, and set aside until separation takes place; the turpentine will now be on top; pour it off carefully, and add about one ounce of finely ground starch, and filter through paper; you will now have a pure and sparkling turpentine. The alcohol used need not be wasted, as it will do for cleaning slips, brushes, etc., also for burning.

After your insect has become clear in the carbolic acid and turpentine solution, remove it to a cell of proper depth, and drain off superfluous solution, arrange the wings, legs, and antennæ, add one or two drops of Canada balsam dissolved in turpentine, and apply the cover glass, remove any balsam that may have run over, and cement down the cover. If the directions given are carefully followed, you will have a mount that you can spend hours in examining, and one that will show better the internal organs, than can be done by following any other method of preparation with which I am acquainted. In this method of preparing insects, for microscopical examination, as in a great many other processes, the longest part of the process is the description.

BOOK NOTICES.

Canadian Spiders. by J. H. Emerton. Transactions of the Connecticut Academy, Vol. IX., July, 1894; 30 pp.; 4 plates.

This interesting and valuable paper treats of spiders collected in various parts of Canada, from the Rocky Mountains to the Gulf of St. Lawrence. The author states at the outset that the species differ little from those of the New England States. "Out of 61 species, from Labrador to Manitoba, 56 species live in New England; and 27 out of 48 species from the Rocky Mountains." Of the latter, no less than 40 of the species mentioned were collected by Mr. Bean at Laggan, and of these sixteen are described as new to science. Mr. Tyrrell, of the Geological Survey of Canada, supplied other species from the Rocky Mountain region, Alberta Territory, and Ottawa, and other collectors from the various localities mentioned in the paper. The plates illustrating the new species are admirably drawn by the author, the excellence of whose work in scientific illustration has long been well-known and highly appreciated.

Report of Observations of Injurious Insects and Common Farm Pests during the year 1894, with Methods of Prevention and Remedy. Eighteenth Report. By Eleanor A. Ormerod, F. R. Met. Soc., etc., etc., London: Simpkin, Marshall, Hamilton, Kent & Co., Limited. 1895, pp. 122, lxii., plate.

In this the author has given us another of her most excellent Annual Reports, if anything, better than those that have preceded it. There are 29 species, besides the two groups, Julidæ and Vespidæ, fully treated in the Report, which is illustrated by 45 figures and one excellent plate, the latter devoted to the Stem Eelworm, *Tylenchus devastatrix*, in connection with its recent discovery as injurious to hops. We congratulate the author on being able to give us so much information on Eelworms, Warble Fly, and Carabid enemies of the strawberry. In fact, she has, throughout her Report, strictly adhered to the plan expressed in the preface, viz: "not to enter again on such of our common infestations as have been repeatedly noticed in my preceding Reports, excepting where there was some new information to be given or (sometimes) needed." This renders the Report of unusual value. To do the publication justice is simply out of the question in an ordinary book notice, but suffice it to say that it is in every way a credit to its author.

The writer well remembers an evening spent with the late Fraser S. Crawford, at his suburban home near Adelaide, South Australia. We had been discussing entomology and entomologists, when he made a remark something like this: "Miss Ormerod is a noble woman, and is giving both her life and her wealth to the agricultural interests of England, and I cannot understand why she should not be better appreciated by Englishmen." The sentiment will be echoed by American entomologists, but I fear in our hurry and bustle, we forget to drop an occasional word of encouragement and appreciation, such as we ourselves would gladly receive. Working almost alone, and comparatively unaided, in a labour of love not always appreciated, it seems to me that words of encouragement from her colleagues, both in America and out of it, are but matters of justice. Other reports on Economic Entomology there are, and they come officially from the Board of Agriculture of England, but the writer has searched through them in vain for tokens of originality or just credit for the information contained in them. F. M. W.

NOTES.

The Editor regrets to announce that the main building of Trinity College School, of which he has been Head Master for the last twenty-five years, was totally destroyed by fire on the night of Saturday, February 9th. Though the weather was intensely severe and all the boys were in bed when the fire broke out, no one was injured in any way. School-work was resumed in temporary quarters on the Tuesday morning, and in a few days a large hotel and other premises were secured, in which the boys are comfortably provided for until the work of rebuilding is completed.

The Editor desires to thank his many friends for their kind letters of sympathy, and begs that his correspondents will pardon any delay in reply to their letters, as his time is so fully occupied with other matters. Though he lost a large number of books and valuable papers, his entomological library and collections were fortunately in his private residence, which was with much difficulty saved from destruction.

We are sorry to learn that others have been less fortunate than ourselves during this disastrous winter. MR. C. H. TYLER TOWNSEND had his valuable library, which was particularly rich in works on European and American Diptera, stored in a warehouse at Las Cruces, New Mex. During his absence at Washington, the building was burned down and all his property was destroyed. He will be very grateful to any correspondents who will send him as complete sets as possible of their publications. His address is now Brownsville, Tex, where he is acting as temporary Field Agent of the Division of Entomology, U. S. Department of Agriculture. MR. J. G. JACK, of Jamaica Plain, Mass., has also sustained a very serious loss by the destruction by fire of his library and collection. We trust that those who are in a position to do so will assist in replacing them.

MR. A. R. GROTE, of Bremen, Germany, has changed his address to "39 Gartenstrasse, Hildesheim, Germany."

We grieve to record the deaths of DR. GEORGE MARX, the eminent Arachnologist, who expired at Washington, D.C., on the 4th of January, aged 56 years; and of MR. BERTHOLD NEUMOEGEN, a frequent contributor to this magazine, and the possessor of a very valuable and extensive collection of Lepidoptera, who died of consumption, in New York, on the 21st of January, in the 50th year of his age.

Mailed March 30th, 1895.