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INSECT FRIENDS AND FOES OF AGRICULTURE.*

BY LAWSON CAESAR, GUELPH, ONT.

Every farmer is forced to come in contact with his insect foes, and, therefore, knows something about them, but very few farmers know that there is a large number of insects that are not foes at all, but are friends. We shall, therefore, discuss these friends first.

Insect Friends.

The first class of friends we shall treat of is composed of those insects which aid agriculture by acting as pollenizers of plants. Almost everyone knows that before a plant can produce a fruit or seed some of the pollen must first be placed on the sticky tip of the pistil. This act fertilizes the plant and is called "pollination." In this work honey bees are the most important insect agents, but bumble bees and numerous other wild bees help greatly, as do also wasps, various kinds of flies, moths, butterflies and many other insects. Many of the lower kinds of plants, or plants with inconspicuous flowers, are pollinated in other ways, such as by the wind, but nearly all plants with conspicuous bloom require the aid of insects for proper and full fertilization. What would happen if we had none of this class of insect friends? We should not have more than one apple, or pear, or plum, or peach or any of our other much loved fruit to the one hundred or more we now enjoy. Moreover, there would be practically no fields of tomatoes, peas or beans, or of several other crops that are so necessary to us as foods.

The second class of insect friends consists of those insects that supply us with food, either directly or indirectly, through serving as food for the fish and birds that we use as food. Many tons of honey are produced in every country by the honey bee. A large part of the food of fresh-water fishes consists of the water insects

*An address delivered before the School for Rural Leadership.

that live about the shores of the lakes and rivers that these fish frequent. Even the larvæ of the troublesome mosquito serve in this way a useful purpose. Both domesticated and wild fowl feed to a great extent upon insects, the latter especially during the nesting season. So without taking time to go more into details we see that many insects may be friends in this important matter of providing food for us.

A third manner in which insects may act as our friends is as scavengers. If all the dead animals and plants, including trees, of course, were to lie undestroyed on the surface of the earth, they would soon make an intolerable condition of affairs. But in the summer no sooner does an animal or plant die than there gather to it various insects that quickly hasten the process of decay. Some of the insects that feed on dead animals are carrion beetles, rove beetles, blow-flies and flesh-flies. Any one who has watched how quickly a dead horse or smaller animal becomes a seething mass of insect life will readily understand why it has been said that a blow-fly can destroy a dead ox as quickly as a lion.

In the case of trees we have all seen beautiful pines that have been cut down or fallen and allowed to lie for a year or two in the forest, and then, when they are examined, are found to be perforated in numerous places by borers. These borers are the larvæ of certain kinds of beetles, chiefly long-horned beetles. We feel disappointed at the injury to the tree, but in nature the insects while feeding themselves on the wood are at the same time serving a useful purpose, because these holes allow the more rapid and deep entrance of diseases and so hasten greatly the rate of disintegration of the tree. We see, therefore, that insects help us greatly by removing dead animals and plants, and thereby giving back to the earth the substances of which they are composed and at the same time making room for other animals and plants to take their place.

The fourth way in which insects serve as friends is by many useful kinds helping to control injurious kinds. One class of insect that helps in this way is known as parasites, and another as predaceous insects. The latter merely capture their victims and feed on them as a lion would capture and devour a smaller animal, but the former kind pass all their larval stage either in or

attached to their victims, finally killing them. There are many kinds of parasitic insects, some, the Tachina Flies, resembling very closely house-flies; others, the Ichneumon-flies, Chalcis-flies, etc., resembling wasps. Some of the Ichneumon-flies are quite large and sometimes have a very long ovipositor or egg-laying apparatus, while the Chalcis-flies and Proctotrupids may be extremely small, so small in fact, that one can scarcely see them with the naked eye. Some of these very small parasites attack insect eggs, laying their own eggs in these. A single tiny egg is large enough to supply all the nourishment necessary to carry one of these little creatures through all its stages to maturity. Some parasites lay their eggs on the back of their hosts, but many lay them inside the body. A few species deposit not eggs, but living maggots upon or near the victims. The larvæ of a parasite does not, as a rule, kill the thing it feeds upon until it is itself full grown and ready to transform into an adult.

How useful parasites are can be seen when we remember the severe outbreak of the Army Worm last summer. Towards the end of this outbreak examination in the field showed that there was scarcely one of these caterpillars that was not parasitized. This year I have seen only one Army Worm. Now, the parasites may not be the only cause of the disappearance of this pest, but they are certainly one of the great causes and probably the chief one.

There are many useful predaceous insects, but I shall mention only two: namely, Ladybird beetles and Syrphus-fly larvæ. Everyone knows the pretty little Ladybird beetles with their hemispherical shape and often brilliant colours. The larvæ of these look like little alligators and are just as fond of destroying other insects as are the adults. Syrphus-fly adults usually resemble small bees or wasps, but they have only two wings. They may often be seen feeding upon flowers or hovering above them. Their larvæ are legless, taper towards one end and are stout and usually grayish or brown in colour. The Ladybird beetles and the Syrphus-fly larvæ are the two most helpful insects we have in the control of aphids or plant lice. Without their aid it would often be almost impossible to save our crops from these prolific and very destructive little pests. This is, however, only a single il-

illustration of many that could be used to show the good predaceous insects do.

The more one studies insects and thinks over what takes place, the more inclined he is to feel that were it not for our insect friends our insect foes would make this earth almost or quite uninhabitable for man. I do not mean, however, that insects are the only forces at work in controlling our foes, because disease also plays a great part, as do also extremes of heat and cold and several other things.

We must pass on now to consider briefly our insect foes.

Insect Foes.

There is no doubt that injurious insects every year take a large toll from farmers and especially from fruitgrowers. As there is not time to discuss many of these insects, we shall devote our attention first to our worst two orchard insects, and then to a few of the chief pests of the field crops.

There are many insects that attack fruit trees, but two of these stand out prominently for their powers of destruction. These are the San José Scale and the Codling Moth. The former is the most destructive insect pest ever introduced into the province, but fortunately, though it has been here for twenty years, it has not spread beyond the south-western counties. It is a very small insect, circular, and when full grown, has about the same diameter as the head of a pin. Its powers of reproduction are wonderful: from a single female there may be more than a million offspring by the end of the year. As all of these attach themselves to the trunk, branches, twigs, leaves or fruit and suck the juices, they soon do a great deal of harm. Any orchard that becomes infested with this pest in the warmer parts of the Province, and is not sprayed, is doomed to complete destruction in a few years, even the largest apple trees being killed. An exception to this statement should be made in the case of sour cherries and to some extent of Kieffer pears, the former being immune and the latter not often severely attacked. Up to the present time there have been only a few parasites attacking this scale in Ontario, but we are hopeful that these will become abundant in a few years. We have endeavoured to hasten the process by introducing parasites from Pennsylvania, where they are doing much good. In the meantime

there is a very satisfactory remedy against the insect, and no man who uses it intelligently need lose a single tree or have his fruit discoloured and rendered unsaleable by the scale. Even the worst infested orchards, provided the trees are not too nearly dead, can be taken in hand and brought back into perfect condition. Fortunately, the spraying necessary for this pest kills several others also, and is very valuable against certain diseases of fruit trees.

The Codling Moth does no injury to the trees themselves, but attacks the fruit of the apple and pear. It is the insect that causes the apple to be wormy. It is found all over the province and in unsprayed or poorly sprayed orchards does a great deal of harm. In the warm part of the province, where there is a larger percentage of a second brood, the amount of injury to the fruit varies from 40% to 90%. In the colder portions it is less and runs from about 5% to 50%.

We can easily see, therefore, that the growing of clean apples is by no means an easy job. The fact is that insects and fungus diseases make it impossible to grow apples successfully on a commercial scale without spraying. It is, however, most gratifying to know that thorough spraying at the right time and with the right mixtures (see the Spray Calendar) not only completely controls these two insects, but practically all other orchard insects and diseases; so that in an average year it is not uncommon to find orchards in any of the fruit districts where over 95% of the fruit is free from insect injuries or fungus diseases.

We shall not devote further attention to orchard insect pests, but pass on to a brief discussion of the common insects of field crops.

The chief insects attacking such crops are grasshoppers, cutworms (including the army worm), wireworms and white grubs. These are familiar insects to almost every one. Each kind is capable of doing an enormous amount of injury, the amount depending partly upon the weather conditions. For grasshoppers we have at last in the so-called "Kansas Remedy" found a most satisfactory and cheap remedy, so that no crop need be severely injured by these insects if the owner uses this treatment. The same remedy, sometimes, however, with slight modifications, will usually prove quite satisfactory against cutworms and army worms.

It is interesting to know that attacks from grasshoppers, wireworms, white grubs and often from cutworms, too, can be prevented by simply following the practices of good up-to-date farming in which a short rotation of crops with fall ploughing and thorough preparation of the soil before seeding play a very important part. This is a great source of encouragement to the man who is trying to do his best. A short rotation of crops means that there will be no old pasture fields on the farm. These are the favourite breeding places of grasshoppers, wireworms and white grubs. It is a rare thing to find serious outbreaks of these pests on farms where no old pasture fields exist. Again, a short rotation of crops means that the insects in any particular field are deprived of their special food and either have to starve or seek this food elsewhere, often failing to reach it; for instance, wireworms and white grubs attack grasses and such cereals as wheat, oats and barley, but seldom do any injury to peas or clover; hence a short rotation of crops in which clover or peas play a part will help to starve them out. Good farming, moreover, means careful preparation of the soil for the seed and the selection of good plump seed, with the natural result that the plants will be more vigorous and thus better able to withstand the attacks of insects than weaker plants on poorly farmed land. An illustration of this is seen in the case of the Hessian fly. This insect delights in attacking weak or unthrifty wheat plants. I have counted as many as 1000 of the pupæ in a single square yard in a poor field of wheat. It is not at all uncommon to see two fields close together, one scarcely at all injured by the Hessian fly and the other severely injured; the chief reason for the difference being the better seed and condition of the soil in the former. I am not speaking now of the value of late sowing to prevent Hessian fly attack, though this is often very helpful. My aim has been to show that the better a man farms, whether he knows anything about insects or not, the less injury will be done by these to his field crops.

It is impossible to go into this subject now in fuller detail, but, in conclusion, it may be well to say that we should never get into a panic about insects and fear that some day some new and terrible pest will come to our country that will do incredible damage. New pests are not arriving so frequently as most people think,

and even if some do come, there is very little fear that methods of controlling them will not be found. Many of the insects that are thought to be new have been here for years, but have seldom been noticed because of the controlling influences mentioned above.

A NEW FLY OF THE FAMILY PHORIDÆ FROM CALIFORNIA.

BY T. D. A. COCKERELL, BOULDER, COL.

When recently (August, 1915) at La Jolla, California, I captured on the grounds of the Scripps Institution for Biological Research a Phorid fly remarkable for its relatively large size, and interesting to me on account of the armature of its legs, which recalled one of the fossil species from Florissant. The species is new, and may be called:

Dohrniphora gaudialis, n. sp.

♀—Length about 4 mm., wings over 3.5 mm.; dull black, the front and thorax above anteriorly somewhat polished; third antennal joint ferruginous, blackened above; palpi clear bright red, the spines strong and black; wings pale greenish, the heavy veins sepia; trochanters and immediately adjacent parts pale reddish; knees reddened; anterior tibiæ pale dull ochreous, and middle ones brownish in front; tarsi dusky brownish; extreme apex of abdomen light ferruginous. Head small; proboscis stout, longer than head; arista long, minutely plumose; front with the usual strong bristles, directed backward; ocellar region scarcely elevated; four scutellar bristles, the posterior ones longest; halteres black; wings with the two heavy veins running closely parallel, with a narrow interval between them, the second one (third vein of authors) minutely branched before the apex, which is about half way from base to apex of wing; costa bristly; first thin vein (fourth of authors) gently and evenly curved, not bent, failing at extreme base; third thin vein failing at end, but fourth reaching margin; hind femora high and flattened; anterior tibiæ with a bristle on inner anterior face at about end of first third, and a row of minute black setæ on apical half; middle tibiæ with two very long bristles on basal part,

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and several apical ones; the middle tibiae also have two black lines consisting of minute setae, one running the length of the tibia, the other only reaching middle, when it is interrupted by a shining patch of about ten rows of minute setae, arranged transversely, comb-like; hind tibiae very minutely hairy, but with no large bristles except the long apical spur, and a series of four small black apical spine-like bristles, the only other armature being on the anterior side, the end of which is fringed with minute black spinules, while just above is a weak patch of about four transverse rows of setae, like those on mid-tibiae; basitarsi on inner or anterior side with very well developed transverse rows of setae.

This is readily known from the other described American species by its large size and the armature of the legs. On account of the transverse rows of setulae on the legs it resembles *Phora multiseriata* Aldrich and *Phora laminarum* Brues, the latter being a Miocene fossil. I have ascertained that the middle tibiae of *P. laminarum* have a pair of long bristles on the basal part, exactly as on the insect now described. In the characters of the venation and the armature of the scutellum *P. multiseriata* is quite distinct from *D. gaudialis*, but the fossil species has four scutellar bristles, as in the La Jolla one. Thus it appears that our insect is actually more nearly related to a Florissant fossil than to any living species.

The specific name is derived from the name of the locality.

JEAN HENRI FABRE

A few days before the present issue of our magazine went to press, a telegram from Orange, France, appeared in the daily papers announcing the death on Oct. 11, 1915, of Jean Henri Fabre, one of the greatest entomological observers the world has ever known. Owing to his extremely secluded life, his intense aversion to publicity in any form, and his dislike of human society, it is only within recent years that Fabre's genius has been generally recognized, and among English speaking nations this recognition has been largely due to the publication of English translations of certain selections from his "Souvenirs Entomologiques," and to Miall's translation of Legro's beautiful work "Fabre, Poet of Science."

A more extended notice of Fabre's life and work will appear in our December number. An appreciative account of his writings by Prof. Wm. Lockhead was published in the 45th Annual Report of the Entomological Society of Ontario (1914).

A NEW DIASTROPHUS ON STRAWBERRY.

BY WILLIAM BEUTENMULLER, NEW YORK, N. Y.

Diastrophus fragariæ, n. sp.

Head jet black, face rufous and coarsely rugose, vertex and cheeks smooth and very highly polished. Antennæ 14-jointed, basal joints rufous, the following joints gradually becoming darker. Thorax jet black, smooth and highly polished, collar rugose, pleuræ somewhat shining. Parnal grooves and well defined, continuous and rather widely separated at the scutellum. Lateral grooves indistinct and scarcely perceptible. Median groove wanting. Scutellum coarsely rugose, obtusely pointed at the tip, foveæ at base shining and close together. Abdomen pitchy black, microscopically punctate, petiole rufous. Legs yellowish brown, claws black. Wings hyaline, ciliate, radial area closed, cubitus continuous, cross-veins heavy, all veins dark brown. Length, 2 mm.

Gall—On the petiole of Strawberry: Polythalamous, elongate cylindrical swelling tapering at each end. Red and villose like the rest of the petiole. The internal structure is spongy and

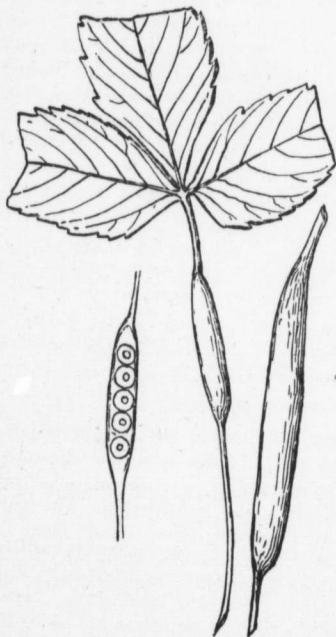


Fig. 20. *Diastrophus fragariæ* Beutm., galls on petioles of strawberry.

the rest of the petiole. The internal structure is spongy and

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contains a single row of 5-20 larval chambers. Length from about 25 to 50 mm. Width 3-5 mm.

Habitat—Toronto, Canada (A. Cosens).

The gall of this species has long been known. Saunders mentions it in his "Insects Injurious to Fruits," 1887, p. 331, and calls it the Strawberry Leaf-Stem Gall. Prof. S. A. Forbes also mentions the gall in the 22nd Report of the State Entomologist of Illinois, 1883 (1884), p. 97. H. F. Bassett speaks of a Cynipidous gall occasionally seen on the petiole of strawberry leaves (Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 325). Mr. L. H. Weld found the galls at Ithaca, New York and Evanston, Illinois and I found the same in the vicinity of New York City for some years past. In August, 1913, Mr. A. Cosens collected the gall on wild strawberry in Toronto, Canada. He transplanted some of the infested plants into pots and managed to mature the galls from which he reared five males, being the first one to succeed in obtaining the flies.

The illustration is from a sketch made by Mr. Weld and redrawn by Mrs. E. L. Beutenmuller.

NOTES ON THE STRAWBERRY LEAF PETIOLE GALL (*DIASTROPHUS FRAGARIÆ* BEUTM.)

BY A. COSENS, PH.D., TORONTO, ONT.

A cylindrical enlargement of the leaf petiole of *Fragaria virginiana* Duch. constitutes the gall. It has a somewhat segmented appearance owing to the separation of each larval cell from the adjoining one by a shallow annular constriction. The surface is usually coloured a rich reddish brown and bears a pubescence, varying with that of the petiole from which the gall originates. The species from which the producers were obtained was glabrous.

Length 10-50 mm. Diam. 3 mm.

In comparison with *Diastrophus fusiformans* Ashmead on *Potentilla monspeliensis* var. *norvegica* (L.) Rydb. this species differs in the following particulars: The arrangement of its



Fig. 30. Galls of *Diastrophus fragariae* Beutm. Upper figure, an immature gall; lower figure, gall from which the producers emerged. (Natural size.)

observation. The galls were removed after the leaves had withered, and were kept on earth, out of doors, during the winter. The producers emerged from May 12-14.

DESCRIPTIONS OF NEW SPECIES OF IPIDÆ (COLEOPTERA).*

BY J. M. SWAINE, ENTOMOLOGICAL BRANCH, DEPARTMENT OF
AGRICULTURE, OTTAWA.

Ips knausi, n. sp.—A large elongate species, length 5.8 mm., width 2.1 mm.; the sides parallel, thickly clothed with long light hairs in front, on the sides and behind. Allied to *emarginatus* Lec., but distinct in the punctuation of the discal interspaces of the elytra, and the characters of the declivity.

Description of the male: The *head* has the front densely

*Contribution from the Entomological Branch, Department of Apiculture, Ottawa, November, 1915.

larval cells in a row, along the petiole, produces a symmetrical swelling quite unlike the irregularly nodular deformity of the *Potentilla* gall. While a cross section of this latter species, at any level, will show several larval cells in the stem pith, just inside the ring of wood, only one will of necessity be cut in a similar section from the strawberry gall.

As the infected leaves wither prematurely, it is difficult to find the mature galls, although the young specimens are quite noticeable. The producers were secured by transplanting host plants so that they could be kept under ob-

granulate-punctate, rather densely hairy, with a wide, shallow, transverse impression between the eyes, and a shining median space towards the vertex; the eyes oblique, very narrow, and broadly emarginate in front; the antennal scape sparsely hairy without, the club wide, marked with three distinct, bisinuate sutures which are densely fringed with long bristle-like hairs; as broadly rounded at the tip as at the base, rather densely punctured below.

The *pronotum* is very slightly longer than wide, 10:9; with the base very broadly rounded; the hind angles broadly rounded; the sides slightly arcuately narrowed or nearly parallel for over two-thirds their length, then obliquely narrowed and slightly bisinuate in front; rounded on the front margin; the asperities of the cephalic half of varying size, the largest more or less concentrically arranged; the caudal half coarsely, closely and deeply, but not roughly punctured; thickly clothed with long hairs in front and about the sides.

The *scutellum* is minute, elongate, faintly channelled and shining.

The *elytra* are parallel for the greater part of the length, then rounded to the strongly produced, dehiscent and submucronate tip; densely clothed with long light hairs about the sides and around the margin of the declivity; with the elytral striae distinctly impressed, narrow, with deeply impressed, closely placed punctures of median size; the sutural striae a little more strongly impressed than the others, strongly divergent and widened behind; the interspaces very wide, not distinctly convex, except the first two, which are also more strongly granulate near the declivity; *the wide interspaces all confusedly punctured*, more sparsely on the disc towards the base, very densely and roughly on the sides and about the declivity; the declivity oblique, deeply concave, with the tip strongly produced; the first tooth, on the second interspace, acute, distinct and preceded by a row of granules; the third interspace with a row of granules at the top of the declivity; the second tooth, on the fourth interspace, large, conical, acute, adjacent but not united to the third; the third tooth very long, wide, compressed, with the sides parallel and the tip deeply emarginate, representing the united teeth of the 5th and 6th interspaces; the fourth tooth smaller than the second, conical, blunt, nearer to the third than

to the acute apical margin; the declivital margin, viewed from the side, straight and vertical from the base of the third tooth to the base of the acute apical margin; the acute apical margin elongated towards the tip so that the apex of the declivity becomes sub-acuminate, and the edge with two deep emarginations on each side; the depth of the declivity closely punctured and dull from numerous minute wrinklins of the chitin, the punctures bearing short, slender hairs throughout. The pubescence is long, light and prominent about the side and margin of the declivity.

The venter is densely punctured and clothed with long hairs.

This species was obtained through the kindness of Mr. W. Knaus. The type bears the labels, Cloudercroft, 9000 f., N. M., W. Knaus, 8-8-03, 197.

Ips perroti, n. sp.—Description of the type, a male: A slender species, dark reddish-brown in all my specimens; length 4 mm., width $1\frac{1}{2}$ mm., relative proportions, length of pronotum 29, length of elytra 46, width of pronotum behind 27, width of elytra in front 26, width of elytra behind 28.

The *head* has the front convex, somewhat flattened in front, rather closely punctured, more coarsely and roughly towards the eyes, sparsely granulate on the disc, more densely towards the epistoma, with a short, blunt median tubercle on the epistoma, and a row of smaller blunt tubercles along the epistomal margin; the disc rather sparsely clothed with slender hairs, and the epistoma densely fringed as usual; the genæ moderately closely and deeply punctured; the eyes with a very broad, shallow emargination in front; the antennal club with the first two sutures slightly bisinuate. at the middle, strongly bent distad at the sides.

The *pronotum* is slightly longer than the width, with the caudal margin strongly rounded; the sides nearly straight and parallel for two-thirds the length, rather strongly narrowed on the distal third and rounded in front; rather densely hairy on the sides and in front, glabrous on the disc; irregularly, not very coarsely asperate in front; smooth and shining behind and finely sparsely punctured, very finely towards the middle line and much more coarsely towards the sides; the median smooth space nearly obsolete, more distinct and somewhat impressed at the middle of the disc.

The *elytra* are one-half longer than the pronotum; a little narrower at the base than the pronotum, very slightly wider behind; the sides nearly parallel for about four-fifths the length, then rounded to the declivity, which is steep and truncate as viewed from above, with the tips dehiscent and slightly tuberculate; the elytral striae regular, distinctly, but slightly, impressed on the disc, except the sutural striae, which are much wider and deeper than the others and widened behind; the lateral striae not impressed; the striae punctures rather small and closely placed, more closely on the first two and the lateral striae; the first interspace convex, finely granulate near the declivity; the second convex, faintly granulate near the declivity; the remaining discal interspaces flat; all the discal striae uniseriately punctured throughout their length, closely towards the declivity, very sparsely towards the base; the lateral interspaces more closely punctured, uniseriately above, confused near the lateral margin, with the punctures nearly as coarse as those of the striae; the *declivity* very abrupt, deeply concave, not closely punctured, more coarsely than the disc; the suture elevated, and smooth on the lower two-thirds; the margin strongly elevated and armed with four teeth on each side; the tooth of the second interspace well developed, acute, recurved, preceded by a few minute granules; that of the third obsolete, or represented by the largest of a row of small granules; those of the fourth and fifth interspaces united at the base, the connecting ridge nearly vertical; the tooth of the fourth interspace acute, recurved; that of the fifth stout, capitate, acute-pointed; the fourth tooth conical, in the type occupying nearly all the short space between the raised apical margin and the third tooth; the raised apical margin wide, moderately produced and entire; the pubescence of the *elytra* long, erect, fine, rather dense on sides below and about the declivity; the discal pubescence fine and sparse.

The *female type* differs from the above only by the less strongly developed epistomal armature, and the different declivital teeth. The teeth are all acute and less strongly developed than in the male; the second and third teeth are similar in shape, conical, united at the base and but little larger than the first and fourth.

Labels with the male type: I. Perrot, Que. 1912; ♂ 218; ♂ type. Labels with the female type: I. Perrot, Que. 1912, ♀ 218; ♀ type. Host of type series *Pinus resinosa*.

Variations: The pubescence is somewhat abraded on the disc of the elytra in the type; and in some specimens the interstitial punctures of the disc are more numerous; the third discal interspace is frequently impunctate on the basal two-thirds; the frontal tubercle varies greatly in size, being nearly obsolete in some females; the strial punctures of the elytra vary considerably in size; the length varies from 3.5 mm. to 4.25 mm.

This species differs from *tridens*, *borealis*, and *interrupus* by the characters of the front which lie between the much sparser granulation of one sex of *borealis* and the extremely dense granulation of *interruptus*; from *borealis* in the longer, much more finely punctured pronotum, more sparsely punctured elytral interspaces and distinctly much more strongly developed declivital armature; from *interruptus* in the usually much smaller size and more slender form, finer and sparser pronotal punctuation, the much more abrupt declivity with strongly marked sexual variation, and the fewer and smaller granules on the first and second interspaces.

Dryocoetes sechelti, n. sp.— A very small species, with a subcircular, strongly convex pronotum, coarse elytral punctures and a flattened declivity. Length 2.1 mm.; comparative measurements: Pronotum, length 9, width 9; Elytra, length 15, width 9.

The head is more deeply embedded in the pronotum than usual; with the front convex, rather coarsely, closely granulate-punctate, with erect hairs from the punctures; the median carina narrow but distinctly elevated and shining, from epistoma to vertex; the epistomal fringe dense, longer and bright yellow on the middle third; the eyes wide, coarsely granulate and rather broadly emarginate in front; the antennal club much longer than the funicle; the pedicel as long as the outer four segments; the last segment as wide as the last four are long and the second very narrow; the club nearly as wide as long; with the distal densely pubescent part projecting strongly beyond the truncate tip of the basal corneous part which covers about four-fifths of the under surface, and is bounded distally by a distally convex suture, the distal fifth densely pubescent, the basal corneous part with a few

long hairs irregularly placed; the upper surface with the basal half corneous with the distal margin nearly straight, sparsely hairy, the distal half densely pubescent, obliquely subtruncate, with two sutures, the first of which is straight, and the second arcuate.

The pronotum is subcircular, as wide as long, rather strongly produced over the head, very broadly arcuate behind, strongly arcuate on the sides and in front, very strongly convex with the summit slightly behind the centre; very densely, rather finely and somewhat regularly asperate in front of the summit and on the sides behind, coarsely and densely granulate-punctate on the disc behind with the asperities there reduced to granules on the margin of the punctures; the pubescence rather thick and erect, longer in front and on the sides.

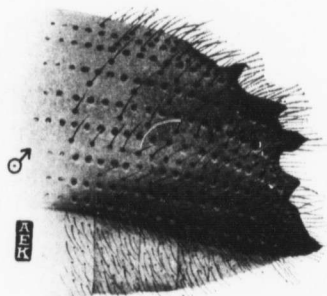
The elytra are as wide as the pronotum, the sides parallel well beyond the middle, then moderately arcuately narrowed and broadly subtruncate behind as viewed from above; the sutural striae wide and rather strongly impressed, the remaining discal striae slightly impressed, the last three on the sides strongly impressed; the strial punctures coarse, deep, subquadrate, and very densely placed; the interspaces a little convex, very little wider than the striae, closely, deeply uniseriately punctured, the punctures deep, but much smaller than those of the striae, a little coarser on the sides than on the disc, the declivity very steep, flattened from above, with the suture elevated, the sutural striae strongly impressed, the second striae distinctly impressed; the strial punctures as coarse as on the disc, the interspaces uniseriately granulate-punctate; rather thickly clothed with erect greyish-pubescence of moderate length. The venter is closely, coarsely, and roughly punctured.

There is no apparent sexual difference in our specimens, but the front is usually entirely retracted.

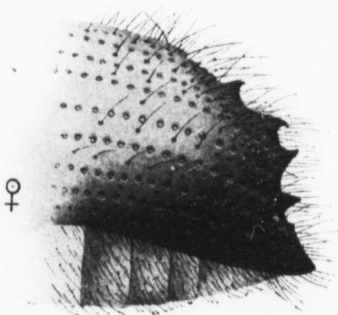
The pronotal asperities are sometimes coarser than in the type and always very dense; the elytral striae from the second outward are in some hardly perceptibly impressed on the disc, although distinctly impressed in the type.

Type locality: Sechelt, B. C., Canada; Type number, 2170.

Dryocoetes pseudotsugae, n. sp.—Description of the female type: Length 4.7 mm.; width 1.5 mm.; reddish-brown (not



IPS PERROTI, N. SP.; SIDE VIEW OF THE DECLIVITY OF THE MALE.
ENLARGED. ORIGINAL.



IPS PERROTI, N. SP.; SIDE VIEW OF THE DECLIVITY OF THE
FEMALE. ENLARGED. ORIGINAL.

fully chitinized); closely allied to *septentrionis*, but distinct in the confused small punctures of the interspaces, and the more flattened elytral declivity.

The front is as in *septentrionis*; but more densely granulate and hairy, with the postepistomal smooth space and median pit, and finely carinate above. The *pronotum* is as in *septentrionis*, but usually more densely punctured and more strongly granulate behind on the sides; the median carina narrow, distinct behind. The elytra are much as in *septentrionis*; but much more broadly rounded behind and with the declivity very distinctly flattened when viewed from above, though not so strongly as in *confusus* Swaine and *betulae* Hopk.; with the striae only lightly and narrowly impressed on the disc; the sutural striae rather strongly impressed on the basal third; the striae punctures small and moderately deep; the interspaces wide and flat; the interstriae punctures smaller than those of the striae and rather numerous, uniseriate on the 1st, 2nd and 4th interspaces, on the 3rd and 5th and the outer interspaces confused with usually smaller additional punctures; the declivity shining, distinctly flattened with the first two striae distinctly impressed, the 2nd interspace impressed at the tip, the interspaces on the declivity uniseriately very finely and rather closely granulate-punctate in both sexes.

The *male* has the front very wide, nearly as hairy as in the female, with the median area at the base of the epistoma widely impressed and shining.

Variations: The size is fairly constant, as represented in our collection, the length varying from 4 mm. to 4.8 mm. The most important variation is in the interstriae punctuation. The first, second and fourth discal interstriae are usually uniseriately punctured but often variably confused towards the base and declivity, the other interspaces are usually decidedly confusedly punctured from the base to the top of the declivity with punctures of large and smaller size.

It is apparently a good species, distinct from *septentrionis* by its flattened declivity and confused interstriae punctures.

It is very abundant on the coast of British Columbia in the bark of Douglas fir, and probably occurs also in other conifers. We have specimens from as far north as Inverness and Queen Charlotte Islands.

Type labels: Stanley Park, Vanc.; Douglas fir; 2639.

Phloeosinus pini, n. sp.—A small black species, with the front strongly carinate; the pronotum shining; the declivity without conspicuous sculpture; length 2.5 mm.; width 1.25 mm.

The *head* has the front flattened, densely, coarsely rugulose-punctate, with a fine, acute median carina on the cephalic half; the rugulose area extending backwards across the vertex as a roughly punctured area with its caudal margin converging from the eyes to the middle line on the occiput; the pubescence short, reddish, inconspicuous; the genæ densely punctulate with a few scattered moderate, finely setose punctures; the eyes narrowly emarginate, one-half divided; the antennal club nearly twice as long as wide, with the first two sutures moderately oblique, and with a well developed septum on the dorsal half, the third suture more strongly oblique and indistinct.

The *pronotum* is wider than long, 10.5:8; brightly polished; with the hind margin strongly bisinuate and obtusely angled at the middle; the sides very strongly arcuate on the caudal half, nearly straight on the caudal fourth, then strongly arcuately narrowed so as to be very strongly constricted behind the broadly rounded front margin, the constriction extending across the dorsum as an impression; the disc finely punctured, more densely behind, sparsely in front except along the front margin, coarsely punctured on the sides; the punctures finely granulate, more distinctly so on the sides and in front; the pubescence short and not very distinct; the median line very fine, smooth, more distinct along the middle third. A shallow, oblique impression extends latero-cephalad on the caudal half of the disc.

The *elytra* are wider than the pronotum, 12:10, stout, one-third longer than wide, 16:12 (at the base), one-twelfth wider behind than at the base; the front margins strongly arcuate and serrate, the serrations isolated on the sides; impressed about the minute scutellum; the hind margin, from above, broadly rounded; the striae very narrow; the strial punctures indistinct, fine and separated; the interspaces very wide, the second interspace much wider at the base, causing the remaining discal striae to be out-curved at the base; the interspaces slightly convex on the disc,

strongly convex on the sides; strongly rugulose-punctate, with larger transverse, subacute asperities intermixed with numerous smaller granules, the asperities numerous and dense towards the base, becoming uniseriate towards and upon the declivity; the declivital interspaces moderately convex, closely, finely punctured and uniseriately moderately asperate; the second more finely, the third more coarsely and wider; the ninth subcarinate on the sides; the pubescence very short, reddish, stout, stouter and a little more evident on the declivity.

The *male* has the front with a similar rugulose-punctate area, but with the region between the eyes less densely though coarsely rugulose and rather strongly and broadly impressed, with a well developed acute median carina on the cephalic half, ending in a small concave median epistomal lobe as in the female; with an obtuse elevation on each side opposite the middle of the eyes; the pronotum a little more strongly constricted in front, with the sides nearly straight behind; the declivity similar to that of the female, except that the second interspace appears slightly flattened, with the asperities smaller than on the others, and the asperities on the third are less numerous and rather distinctly coarser than those on the first. This may be individual, or may indicate the sexual differences so distinct in other species.

I have taken it only in twigs of *Pinus divaricata*, in the Riding Mountains, Manitoba. The occurrence of *Phloeosinus* in *Pinus* is unusual. Type series number, 2008.

Phloeosinus utahensis, n. sp.—A large species; length $3\frac{1}{8}$ mm., width 2 mm., colour black, with the elytra reddish.

The *head* has the front flattened in the female, densely coarsely rugose-punctate and rather densely clothed with short yellow hairs; with a faint, curved, transverse impression; the eyes narrowly, very deeply emarginate; the genæ rather densely, coarsely punctured; the antennal club elongate with the sutures oblique.

The *pronotum* is one-half wider than long, 16:11, widest behind, the hind margin bisinuate, the sides rounded and strongly narrowed towards the broadly rounded, reddish front margin, moderately constricted near the front with the constriction extending across the dorsum; finely, densely, deeply and evenly punctured

above, with the median carina very fine and nearly obsolete; the pubescence very short and indistinct.

The *elytra* are one-half longer than wide, 25:17.5; slightly wider than the pronotum; the base strongly arcuate, raised and serrate as usual with lunar asperities becoming acute and isolated on the sides; with the striae narrow, deep, distinctly and closely punctured; the interspaces wide, granulate-punctate and asperate as usual, more densely and coarsely towards the base; the asperities becoming uniseriate behind; the first and third interspaces strongly raised on the declivity, and the asperities as a row of small teeth with granules intermixed; the second interspace convex but less strongly raised, closely punctured and with a row of very few and much smaller points; the reddish pubescence very short, abundant but indistinct, denser, more evident and scale-like on the declivity, with minute slender hairs from the asperate punctures.

The *male* has the front widely and deeply impressed with a median carina on the cephalic half; the pronotum very broadly arcuate on the caudal half, and very strongly narrowed in front, with the median line fine and slightly elevated; the *elytra* with the discal asperities very sparse, but on the declivity the first and third interspaces bear each a regular row of large, compressed, black-tipped teeth; those of the first interspace are strongly compressed, with the distal edge elongate, the anterior angle rounded, the posterior angle elevated and acute, situated on the lateral half of the interspace, the mesal half of which is smooth and finely punctured; those of the third interspace smaller and more numerous than those of the first; the second interspace as wide as on the disc, flat, finely punctured and entirely without asperities; the fifth, seventh and ninth interspaces each with a row of much smaller but very distinct serrations. The pubescence is slightly longer on the declivity and less scale-like.

One male and one female from Stockton, Utah, through the kindness of Mr. W. Knaus. These are probably sexes of the same species, and are distinct from Leconte's type of *serratus*. Type number, 2182.

Phloeosinus hoppingi, n. sp.—A very small species, with the alternatè interspaces on the declivity strongly serrate. The length, 1.9 mm.; width, 1 mm.; the colour black, the basal margin

of the elytra, and the declivity reddish-brown, the antennæ and tarsi yellow.

The *head* has the front and vertex shining, moderately, not very closely, rather roughly punctured, rugosely on the sides; with a rather deep transverse arcuate impression and an acute well developed median carina between the impression and the epistomal margin; the pubescence short, erect, not conspicuous except the yellow dense epistomal fringe; the eyes deeply emarginate, the antennal club wide, six-tenths as wide as long, with the first two segments subequal in length and each nearly as long as the outer part, the first two sutures nearly transverse, the third strongly oblique, a strongly chitinized septum shown on the dorsal third of the first and second sutures.

The *pronotum* is wider than long, 6:5; with the hind margin bisinuate; the sides very strongly arcuate behind, strongly arcuately narrowed in front of the middle and bisinuate behind the broadly rounded front margin, widest near the hind margin; the disc rather coarsely, not densely, punctured, not distinctly granulate; the pubescence short, suberect, forming a conspicuous median line of hairs.

The *elytra* are one-third longer than wide, 13:10; the bases arcuate, elevated and serrate; the sides slightly wider at the middle; the striæ deep and moderately narrow; the stria punctures moderately small but distinct; the interspaces convex, closely coarsely granulate-punctuate, and coarsely uniseriately asperate on the disc near the suture and alternately on the declivity; the first interspace asperate only on the hinder half; the second asperate only on the basal half, more coarsely towards the base; the third asperate throughout, more coarsely towards the base; the fifth and seventh interspaces distinctly asperate on the hinder half; the declivity with the alternate interspaces more strongly convex and moderately, rather closely, acutely serrate; the 1st and 3rd punctured on the mesal side with the row of serrations along the outer side; the second interspace on the declivity hardly convex and narrower than the 1st and 3rd; the 9th carinate behind but hardly serrate; the pubescence fine but distinct, larger on the sides, closer and minutely scale-like on the declivity.

The *male* has the front rather coarsely roughly, closely punc-

tured, with the whole central portion broadly and deeply concave, but with the margins of the concavity rounded; the median carina well developed and acute extending from between the eyes to the nearly obsolete epistomal lobe; the pronotum is of the same relative length and width as in the female, but the sides are more nearly parallel behind and more strongly constricted in front; the elytral declivity with the serrations distinctly coarser, with the acute apices directed obliquely caudad.

Seven females and three males from California, received from Mr. Ralph Hopping; taken in "cedar limbs." Type number, 2171.

Phloeosinus vandykei, n. sp.—A small species, with rather sparsely punctured pronotum and deep narrow striae. Length, 2.2 mm.; width, 1.2 mm.

Description of the *female*: The *head* has the front flattened, coarsely, deeply rather sparsely punctured and granulate; with a low acute median carina becoming prominent on the epistoma; the pubescence short, stiff and erect; the antennal club over half as wide as long, 7.5:11, with the first two segments comprising more than one-half the mass; the first two sutures obliquely arcuate, the third more strongly oblique; the septa strongly developed on the first two sutures.

The *pronotum* is wider than long, 5:4; with the base bisinuate; the sides broadly rounded on the hinder two-thirds, and narrowed towards the front; constricted behind the front margin, which is very broadly rounded; the disc rather coarsely, deeply, rather sparsely punctured, the punctures finely granulate; the pubescence fine; the median line very finely faintly carinate behind.

The *elytra* are 1.4 times as long as wide; the bases arcuate, elevated, and coarsely serrate with the lunar serrations becoming coarser, acute, isolated and strongly oblique on the side; the sides somewhat inflated behind; the hind margin broadly rounded as viewed from above; the striae very narrow and deep, those of the disc outcurved towards the base; the striae punctures very small; the interspaces convex, sparsely rather coarsely asperate-punctate; the asperities uniseriate on the declivity, larger, confused and lunar towards the base, strongly oblique and finally longitudinal

towards and upon the sides at the base, moderately confused on the disc and sides except on the third, fifth, seventh and ninth, which are nearly uniseriate; the ninth interspace carinate; the second wider towards the base; the declivity with the first three sutures nearly equal, the first and third hardly elevated, the second not narrower and hardly impressed, but without asperities, the third uniting with the ninth, the fourth met on the declivity by the fifth, sixth, seventh and eighth; the asperities of the declivity uniseriate, fine and acute, and the surface of the interspaces there smoother and more shining than on the disc; the pubescence very fine, short and indistinct. The discal interspaces are frequently nearly uniseriately asperate; the asperities are reduced to fine granules on the sides.

The *male* has the front broadly and rather deeply concave; the pronotum more broadly rounded on the sides and more sharply constricted in front; and has the declivity smoother and more brightly polished, with the serrations nearly obsolete except for a few sparse granules on the third interspace.

Type locality: Huckleberry Meadow, Fresno Co., Calif.

Received through the kindness of Mr. Ralph Hopping. It was taken in "Cedar limbs." Type number, 2173.

Hylastes ruber, n. sp.—Stouter than usual, the pronotum shorter and nearly as wide as the elytra; the elytra with the striae hardly impressed, narrow, the strial punctures small, the interspaces flat and densely, rather coarsely granulate; length, 4.8 mm.; width, 1.75 mm.

The *head* has the front strongly convex, the middle line evenly moderately convex from epistoma to vertex; closely, moderately, rather rugosely punctured; the transverse impression at the base of the beak very faintly indicated; the epistoma moderately impressed on each side; the median carina acute, fine but well developed, extending to the middle of the front; the epistomal lobe wide, concave at the middle with the sides somewhat tuberculate; the pubescence minute and inconspicuous, nearly obsolete.

The *pronotum* is but very slightly longer than wide; broadly rounded behind; the hind angles rounded; slightly arcuate on the

sides, subparallel for three-fourths the length, then strongly narrowed and rather distinctly constricted; the front margin moderately rounded; considerably narrower than the elytra; the punctures rather small and close on the disc, dense and somewhat rugose on the sides, smaller, closer and somewhat rugose in front; the smooth median line slightly elevated throughout, slightly widest at the middle; the pronotum not acutely margined on the sides behind.

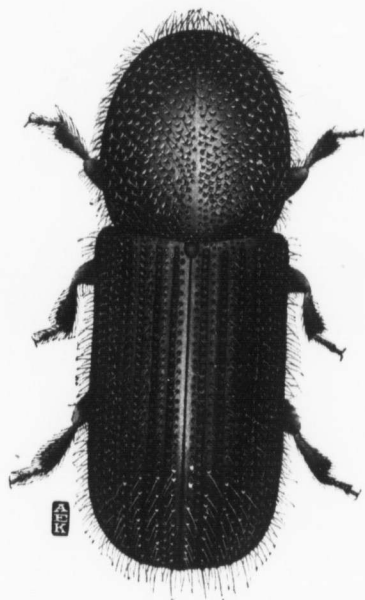
The *elytra* are twice as wide as long; moderately wider than the pronotum, 13 to 10.5; the base truncate, acute; the humeral angles rounded; the sides subparallel for nearly three-fourths the length, then strongly arcuately narrowed and semicircularly rounded behind as viewed from above, with the side margin bisinuate behind; very narrowly rounded at the apex; the striae very narrow and but faintly impressed upon the disc and sides; distinctly impressed on the declivity; the strial punctures small, not larger than those of the pronotum, closely placed, deep and bordered with black, of about the same size throughout; the interspaces flat upon the disc and sides, faintly convex behind on the disc and upon the declivity; densely, and rather coarsely granulate upon the disc, becoming finely asperate upon the declivity and confused throughout; the sides of the declivity impressed before the tip; the pubescence minute, reddish and moderately distinct upon the declivity; the basal third of the first three discal interspaces with the strial septa and interstrial transverse roughenings strongly oblique.

The venter has the last segment densely punctured, very broadly rounded behind, and moderately convex throughout: the prothorax below closely punctured and rugulose with the punctures more distinct than usual. There appears to be no sexual difference in the few specimens available; probably only one sex is represented.

This species is related to *macer* Lec., and differs in the distinctly stouter form; shorter and stouter pronotum, rugose on the sides and in front; and the striae much less distinctly impressed.

Type number, 2310a.

The type is from Golden, B. C.; also taken in the Creighton Valley, B. C., in bark of dying Douglas fir.



DRYOCOETES PSEUDOTSUGAE, N. SP. GREATLY ENLARGED.
ORIGINAL.

Variations in our few examples are slight; the pronotum is arcuately subparallel on the sides for three-fourths the length or more and constricted before the front margin, widest at or before the middle; sometimes slightly more elongate than in the type.

The types of these species are in the collection of the Entomological Branch, Ottawa.

SOME OLD CLASSIFICATIONS OF INSECTS.

BY HARRY B. WEISS, NEW BRUNSWICK, N. J.

From the time of Aristotle to the present, different naturalists have advanced and advocated various systematic arrangements of insects. Many of the older ones were never generally adopted and only a few in part hold good at the present day. Linnaeus arranged insects in seven orders, but as entomologists became more exacting, the number was gradually increased until thirty-seven are now recognized as set forth in Brues and Melander's "Key to the Families of North American Insects."

It is not the purpose of this paper to deal with the history of the various changes which have taken place, but simply to set forth, as a matter of entomological interest, some of the systems which were proposed several hundreds of years back.

ARISTOTLE'S SYSTEM.

Aristotle (384-322 B.C.), Greek philosopher.

I. Winged insects (*Pterota* or *Ptilota*)

1. With wing cases—beetles (*Coleoptera*)
2. With coriaceous wings—grasshoppers (*Pedetica*)
3. Without jaws—bugs (*Astomata*).
4. With powdery wings—moths, butterflies (*Psychæ*).
5. With four transparent wings (*Tetraptera*).
Without stings and larger—(dragon-flies).
With stings—bees and wasps (*Opisthocentra*).
6. With two wings (*Diptera*).
Without mouth-piercers and smaller—flies and crane-flies.
With mouth-piercers—gnats and gad-flies (*Emprosthocentra*)

II. Wingless insects:

1. Occasionally acquiring wings,
 - Ants (*Myrmices*).
 - Glow-worms (*Pygolampides*).
2. Without wings (*Aptera*).

ALDROVANDI'S SYSTEM.

Aldrovandi, Ulissi (1522-1605), Italian naturalist, studied law and medicine, occupied chair of natural history in 1560 at University at Bologna.

I. Land insects (*Terrestria*):

1. With feet (*Pedata*),
 - a With wings (*Alata*).
 - Without wing-cases (*Anelytra*).
 - With membranaceous wings (*Membranacea*).
 - Honey making (*Favifica*).
 - Not honey making (*Non favifica*).
 - With scaly wings (*Farinosa*).
 - With wing cases (*Elytrotata*).
 - b Without wings (*Aptera*).
 - With few feet (*Paucipeda*).
 - With many feet (*Multipeda*).
2. Without feet (*Apoda*).

II. Water insects (*Aquatica*).

1. With feet (*Pedata*).
 - a With few feet (*Paucipeda*).
 - b With many feet (*Multipeda*).
2. Without feet (*Apoda*).

RAY AND WILLUGHBY'S SYSTEM.

Ray, John (1628-1705), sometimes called the father of English natural history. Willughby, Francis (1635-1672), English ornithologist and ichthyologist, was pupil, friend, patron and co-worker of John Ray.

I. Insects undergoing no transformations.

1. Without feet.
 - a Land insects, including worms (*Terrestria*).
 - b Water insects, including leeches (*Aquatica*).

2. With feet (*Pedata*),
 - a With six feet (*Hexapoda*).
 - Land insects (*Terrestria*).
 - Larger, including lignivorous larvæ (*Majora*).
 - Less, including lice and springtails (*Minora*).
 - Water insects including the river shrimp (*Aquatica*).
 - b With eight feet (*Octopoda*).
 - With tails—scorpions (*Caudata*).
 - Without tails—spiders, mites (*Non caudata*).
 - c With fourteen feet—woodlice.
 - d With twenty-four feet.
 - e With thirty feet.
 - f With many feet.
- a Land insects (*Terrestria*).
 - With a roundish body—millipedes (*Tereti seu subrotundi*).
 - With a flat or compressed body—centipedes (*Plano seu compressa*).
- b Water insects (*Aquatica*).
 - With a round body (*Corpore tereti*).
 - With a flat body (*Corpore plano*).
 - With a double tail (*Bicaudatum*).

II. Insects undergoing transformations.

1. Transformations instantaneous.
 - a Lace-winged flies (*Libellæ seu Perlæ*).
 - b Wild bugs (*Cimices sylvestres*).
 - c Locusts and mantes (*Locustæ*).
 - d Field crickets (*Grylli campestris*).
 - e Hearth crickets (*Grylli domestici*).
 - f Mole crickets (*Grylli talpa*).
 - g Tree hoppers (*Cicadæ*).
 - h Cockroaches (*Blattæ*).
 - i Crane-flies (*Tipulæ*).
 - k Water-scorpion (*Scorpius aquaticus*).
 - l Water flies (*Muscæ aquaticæ*).
 - m May-flies (*Hemerobii*).
 - n Earwigs (*Forficula seu Auricularia*).
2. Transformations twofold, metamorphosis duplex.
 - a With wing-cases—beetles.

b Without wing-cases.

With mealy wings—butterflies and moths (*Alis fare-naceis*).

With membranaceous wings—bees, flies (*Alis mem-branaceis*).

With two wings.

With four wings.

Gregarious (*Gregaria*).

Making honey—bees (*Mellifica*)

Not making honey (*Non mellifica*)

Solitary (*Solitaria*).

Bee-formed (*Apiformia*).

Wasp-formed (*Vespiiformia*).

Butterfly-formed (*Papilioniformia*).

With an ovipositor (*Seticaudæ seu Triplia*).

SWAMMERDAM'S SYSTEM.

Swammerdam, Jan (1637-1680), Dutch naturalist.

- I. Transformations immediate, the insects being hatched perfectly formed—fleas, spiders, etc.
- II. Transformations taking place under a covering—locusts, crickets, bugs, dragon-flies, may-flies.
- III. Transformations with a pupa-case intermediate—beetles, wasps, saw-flies, gnats.
Transformations in the pupa state objected—moths, butterflies.
- IV. Transformations in the pupa state coarctate—ichneumons, flies, etc.

VALLISNIERI'S SYSTEM.

Vallisnieri, Antonio (1661-1730), Italian entomologist.

Vallisnieri arranged insects into the four following groups: Plant insects, Water insects, Insects inhabiting earthy or mineral substances and Insects inhabiting living animals.

LINNAEUS' SYSTEM.

Linnaeus, Carl von Linné (1707-1778), Swedish botanist.

- I. Winged insects:
 1. With four wings.
 - a Upper wings more or less crustaceous, the under wings membranaceous.
Upper wings quite crustaceous and not overlapping (*Coleoptera*).
 - Upper wings semi-crustaceous and overlapping—bugs, grasshoppers (*Hemiptera*).
 - b Upper and under wings of same texture.
Wings covered with small tiled scales—butterflies and moths (*Lepidoptera*).
 - Wings membranaceous and naked,
Without a sting—dragon-flies, etc. (*Neuroptera*).
 - With a sting—wasps, bees (*Hymenoptera*).
 2. With two wings—flies, gnats, etc. (*Diptera*).
- II. Wingless insects (*Aptera*).

LAMARCK'S SYSTEM.

Lamarck, Jean Baptiste Pierre Antoine De Monet, Chevalier de (1744-1829), French naturalist.

- I. Insects with jaws:
 1. With wing-cases—beetles (*Coleoptera*).
 2. With straight wings—crickets, etc. (*Orthoptera*).
 3. With four equal wings—dragon-flies (*Neuroptera*).
- II. Insects with jaws and a sort of sucker.
 4. With four unequal wings—bees, etc. (*Hymenoptera*).
- III. Insects with no jaws but having a sucker.
 5. With powdery wings—moths, etc. (*Lepidoptera*).
 6. With upper wings of unequal consistence—bugs, etc. (*Hemiptera*).
 7. With two wings—flies, etc. (*Diptera*).
 8. Without wings (*Aptera*).

LATREILLE'S SYSTEM.

Latreille, Pierre Andre (1762-1833), French naturalist.

- I. Insects with more than six feet and without wings (*Myriapoda*).
 1. With many jaws—woodlice (*Chilognatha*).
 2. With many feet—millipedes (*Chilopoda*).

II. Insects with six feet.

Without wings.

- a With organs of motion like feet (*Thysanura*).
- b Mouth with a retractile sucker (*Parasita*).
- c External mouth with a jointed tube enclosing a sucker (*Suctoria*).

With four wings.

A Upper wings crustaceous or coriaceous, at least at the base.

a With under wings folded crosswise—beetles (*Coleoptera*).

1, Pentamera; 2, Heteromera; 3, Trimera; 4, Tetramera).

b With under wings folded lengthwise (*Orthoptera*).Legs formed for running (*Cursoria*).Legs formed for leaping (*Saltatoria*).c With sucker enclosing several bristles (*Hemiptera*).

1, Heteroptera; 2, Homoptera.

Upper wings membranaceous.

a Wings naked and netted (*Neuroptera*)—1, Subulicornes; 2, Planipennes; 3, Plicipennes.b Wings naked and veined (*Hymenoptera*)—1, Terebrantia; 2, Aculeata.c Wings with dust-like scales (*Lepidoptera*)—1, Diurna; 2, Crepuscularia; 3, Nocturna.With two twisted elytra and two wings (*Rhipiptera*)—

1, Xenos; 2, Stylops.

With two wings (*Diptera*).

Latreille also wrote a paper on the Geography of Insects in which he divided the globe into twelve insect zones. His two main divisions were Arctic (all north of the equator) and Antarctic (all south of the equator). The Arctic was sub-divided into the Polar, sub-Polar, Superior, Intermediate, Supra-tropical, Tropical and Equatorial, while the Antarctic embraced the Equatorial, Tropical, Supra-tropical, Intermediate and Superior.

HOME'S SYSTEM.

Home, Everard (1756-1832), English naturalist.

• Metamorphogenoa—Having the embryo produced from an egg which is formed in the ovarium, subjected to transformation and breathing by air-tubes (spiracula); heart wanting, blood white.

1. The embryo developed from eggs attached under the tail—lobster (*Cancer*).
2. The embryo developed from eggs carried upon the anterior feet—spider (*Aranea*).
3. The embryo developed from eggs deposited under the cuticle of the skin or stomach—gadfly (*Estrus*).
4. Embryos developed from eggs for several generations, impregnated at the same time—plant louse (*Aphis*).
5. Embryos produced from eggs of one mother that compose the whole republic—bee (*Apis*).
6. Embryos from eggs deposited under water—water moth (*Phryganea*).

The foregoing classifications are representative of what were known as the wing, locality, transformation, mouth and egg systems; those of Aristotle and Linnaeus being examples of the wing system, those of Swammerdam and Ray & Willughby of the transformation system, those of Aldrovandi and Vallisnieri and one of Latreille's the locality system, and that of L^amarck the cibarian or mouth system. Home's classification represents the egg system and the tabulated one of Latreille's was known at one time as the modern or eclectic system, being a combination of the principles of several of the preceding ones.

De Geer, Louis Gerhard, Baron (1818-1896) Swedish statesman and writer, was also the inventor of a wing system. Cuvier, Georges Leopold Chretien Frederic Dagobert, Baron (1769-1832), French naturalist, and Fabricius, Johann Christian (1745-1808), Danish entomologist and economist, both put forth systems based on mouth structures, while Clairville, J, whose writings were published between 1798 and 1806, Leach, William Elford, who

was at one time connected with the British Museum and died in 1836, and Stephens, James Francis (1792-1852), an English entomologist, were all advocates of the eclectic system and originators of classifications along such lines.

MacLeay, William Sharp, an English entomologist, who published between 1819 and 1838, was the author of what was known as the quinary system, in which insects were arranged in circular groups of fives, so placed as to bring those having the nearest resemblance, contiguous to one another in their several circles. By some authors, insects were also arranged according to the condition of their food, such as those feeding on living substances (*Thalero-phaga*) and those feeding on dead substances (*Sapro-phaga*). These groups were subdivided, but such systems on the whole were never brought to any degree of perfection.

REFERENCES CONSULTED:

Encyclopædia Britannica.

1915—Brues & Melander, Key to Families of North American Insects.

1915—Woodworth, C. W., Classification of Orders of Insects, Ent. News, Vol. XXVI, p. 120.

1913—Bastin, Harold, Insects, Their Life Histories and Habits.

1906—Folson, J. W., Entomology with special reference to its Biological and Economic Aspects.

1905—Osborn, H. F., From the Greeks to Darwin.

1862—Hagen, Hermann August, Bibliotheca Entomologica.

1831—Insect Miscellanies (Published under direction of Society for Diffusion of Useful Knowledge, London, Chas. Knight, publisher).

1839—Westwood, J. O., An Introduction to the Modern Classification of Insects.

1832—Burmeister, H., Handbuch der Entomologie.