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1876.

REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF ONTARIO,

1873,

INCLUDING A REPORT ON SOME OF THE NOXIOUS, BENEFICIAL AND COMMON INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE ON BEHALF OF THE SOCIETY.

BY

THE REV. C. J. S. BETHUNE, M.A.,

Head Master of Trinity College School, Port Hope; President of the Entomological Society of Ontario;

WILLIAM SAUNDERS,

Editor of the Canadian Entomologist;

EDMUND BAYNES REED,

Vice-President of the Entomological Society of Ontario; and

JOSEPH WILLIAMS,

Secretary-Treasurer of the Entomological Society of Ontario.

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1874.

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REPORT OF THE ENTOMOLOGICAL SOCIETY OF THE PROVINCE OF ONTARIO, FOR THE YEAR 1873.

To the Honourable the Commissioner of Agriculture,—

Sir,—I have the honour to submit for your consideration the report of the Entomological Society of Ontario for the year 1873.

The accounts for the past year duly audited, and the list of officers elected for 1874 are also forwarded herewith. To carry out the design of the Department in promoting the knowledge of practical Entomology, the members of the Entomological Society again submit the Annual Report on some of the noxious, beneficial and common insects of this Province, which has been undertaken and prepared by the Rev. C. J. S. Bethune, Mr. Wm. Saunders, Mr. Edmund Baynes Reed, and myself.

The CANADIAN ENTOMOLOGIST is drawing to the close of its fifth annual volume and its general reputation and position as a scientific journal are well sustained; owing, however, to its necessarily limited circulation, the Society obviously can derive but little pecuniary addition to their funds from its publication.

In preparing the Annual Report the Directors strongly feel the necessity of obtaining a larger supply of woodcuts and electrotypes in order the better to illustrate its pages, and thus the more clearly and faithfully to lay before their readers a correct knowledge of the various insects treated of.

I have the honour to remain, Sir,
Your obedient servant,
JOSEPH WILLIAMS.
Secretary-Treasurer Entomological Society of Ontario

London, Ont., Nov., 1873.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Third Annual General meeting of the Society was held at their rooms, on Dundas Street, London, Ontario, on Thursday afternoon, September 25th, 1873.

The President, the Rev. C. J. S. Bethune, M. A., in the chair. The Minutes of the previous meeting were read and confirmed. The address of the President, the Report of the Council and the financial statement of the Secretary-Treasurer were then read and on motion duly received and adopted.

ELECTION OF OFFICERS FOR 1874.

The following officers were then elected:

President.—Rev. C. J. S. Bethune, M.A., Trinity College School, Port Hope, Ont.

Vice-President.—Edmund Baynes Reed, Esq., London, Ont.

Secretary-Treasurer.—Joseph Williams, Esq., London, Ont.

Council.—Wm. Saunders, Esq., London; R. V. Rogers, Jr., Esq., Kingston; Rev. Canon Innes, London; G. J. Bowles, Esq., Montreal; J. M. Denton, Esq., London.

Auditors.—Messrs. C. Chapman and J. H Griffiths, London.

The Secretary read a letter from Mr. Caulfield, of Montreal, on behalf of the Entomologists resident there, submitting their by-laws and requesting permission to found a branch of the Society in that city. This was most cordially given, and the Secretary was instructed to convey to Mr. Caulfield the best wishes of the parent Society for the future success of the Montreal Branch.

The President having intimated that owing to his residence at Port Hope, he felt great inconvenience in editing the ENTOMOLOGIST at London, and that he would prefer to resign the position of Editor-in-chief.

Mr. Wm. Saunders, of London, was unanimously appointed Editor, and Messrs. Rev. C. J. S. Bethune, E. B Reed, and J. Williams an Editing Committee.

Several Honorary and Ordinary members were elected.

A communication was read by the President in regard to the following resolutions, passed at the late meeting of the American Association for the Advancement of Science:—

"We, the undersigned Entomologists, assembled at the 22nd meeting of the American Association for the Advancement of Science, held at Portland, hereby respectfully petition the American Entomological Society of Philadelphia, and the Entomological Society of Canada, to appoint yearly meetings to be held at the same times and places with the annual meetings of the American Association. The undersigned are moved to this memorial from the considerations, that such prospective action of the Societies would ensure the annual assemblage of a large number of Entomologists resident over a wide extent of territory, and also practically enlarge the sphere, and increase the usefulness of these Societies.

"Resolved—That the American Association for the Advancement of Science hereby endorses the accompanying memorial, and invites the Entomological Societies to call yearly meetngs of their members in accordance with the request therein contained."

After some discussion Mr. Saunders moved, seconded by Mr. E. B. Reed—"That the Entomological Society of Ontario has heard with much pleasure the above resolutions of the American Association for the Advancement of Science, and will gladly do everything in its power to carry out the proposed arrangements and facilitate the annual meeting of American Entomologists."

"That we hereby tender our hearty thanks to the American Association for their cordial invitation, and that the Secretary be requested to forward a copy of this resolution to the above Association."

The meeting then adjourned.

Annual Address of the President of the Entomological Society of Ontario, 1873.

To the members of the Entomological Society of Ontario:

Gentlemen,—Ten years have now gone by since a few of us met at the house of Professor Croft, in Toronto, and organized this Society. We commenced with less than five and twenty members, and now our Secretary informs us that we have over three hundred names upon our roll. A twelve fold increase in a decade of years is certainly an evidence of progress upon which we may well congratulate ourselves, and which ought assuredly to stimulate all our members to use their utmost exertions for the maintenance and improvement of th Society. Those of us who from year to year have been entrusted by you with positions e office and duty in the Society, cannot but feel that it is for the best interests of our institof tion that more of its members should be led to take an active part in its work, and thus secuu-more efficiency in all our departments, and more certainty of a permanent development of re our operations. Hitherto the work has fallen upon a few of us, and we have endeavoured to perform it as efficiently and heartily as we can; but we find that year after year our own professional and other duties make increased demands upon our time and attention, so that with all the desire in the world to devote ourselves to our favourite branch of Natural Science and the operations of the Entomological Society, we are unable to do so to the same extent as in earlier years. On this account—not from any diminution of zeal and interest on our own part—we are most anxious that more of you should take your share in the work, and aid us in maintaining unimpaired the good reputation that the Society has already achieved. Each one, we are sure, can do something, and the united efforts of us all must assuredly be productive of satisfactory and permanent results.

Our sister Society—the Fruit Growers' Association of Ontario—we rejoice to see is rapidly growing in public appreciation and favour; its members' list of over 3000 names, its well-attended meetings in various parts of the country; its judicious distributions of fruit for experimental purposes, and the vigour and zeal of its executive, are all matters upon which we may well congratulate its President, Directors and Members. That it may go on and prosper, and extend its work throughout our land, till every resident of the Dominion enjoys the fruit of his own vine and his own fruit-tree, is our most hearty aspiration.

During the past year but little has occurred in an Entomological point of view that calls for especial notice on this occasion. A year ago I ventured to call your attention to the subject of Specific and Generic Nomenclature, which has been so unpleasantly exciting the minds of Entomologists both here and almost everywhere else. My remarks, I was gratified to find elicited a good deal of discussion in the pages of the Canadian Entomologist, and brought forth a very able paper upon the subject from the pen of Mr. W. H. Edwards, of West Virginia. The question, however, has by no means yet been set at rest, and will no doubt continue to exercise us all for some time to come. At the Dubuque Meeting of the American Association for the Advancement of Science, a sub-section of Entomology was formed, and a committee of its adherents specially appointed to consider and report upon a series of rules upon nomenclature. Unhappily—owing to various circumstances—no report was drawn up, though I must in justice state that my friend Mr. C. V. Riley, of St. Louis, took a great deal of pains to elicit the views of the members and to draw up some conclusions from them. Last month, at the Portland meeting of the Association—which, to my very great disappointment, unavoidable engagements prevented me from attending—a new committee was appointed to re-consider the subject, and we trust that some definite rules will have been decided upon by its members before the meeting of next year at Hartford, Conn.

You will all, I have no doubt, be gratified to learn that, upon the suggestion of the subsection of Entomology, the American Association unanimously passed a resolution inviting our Entomological Society of Ontario, as well as the American Entomological Society, to hold a general meeting of our members at Hartford next year during their annual session. I trust that this invitation will be cordially accepted and that a large number of us may there meet our American friends and enlarge and strengthen these cordial feelings of scientific brotherhood which have so long pleasantly existed between us. I may add, as a notable token of the estimation in which our branch of science is now held, that the Association will meet next year under the presidency of our ablest American Entomologist—Dr. J. L. Leconte, of Philadelphia.

You have already heard from our Secretary-Treasurer's Report the satisfactory condition of our finances and other business matters; I need not therefore trespass further upon your patience and attention. Heartily thanking you, gentlemen, for your kindness towards myself and my colleagues during our term of office, and for the honour which you have conferred upon me by calling me to preside over you.

I have the honour to remain, with best wishes for the advancement and prosperity of the Society,

Your humble and obedient servant,
CHARLES J. S. BETHUNE,
President Entomological Society of Ontario.

Trinity College School, Port Hope, Sept., 1873.

THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

TREASURER'S ANNUAL STATEMENT FOR THE YEAR ENDING, SEPT. 23, 1873

Receipts.

Balance in Bank of Montreal, from previous year		$ 255 19
Members' Fees		173 50
Government Grant—Additional for 1872	200	700 00
" " —Statutory Grant for 1873	500	
Cork, Sale of		15 58
Pins, "		38 66
CANADIAN ENTOMOLOGIST, Sale of back numbers		20 53
Lists and Labels, Sale of		1 90
American Naturalist		8 82
Individual Accounts		2 75
Expense Account, Discount, etc		26 56
Library Sale of Duplicate Books		15 00
Bank of Montreal, Accrued Interest		1 45
		$1259 94

Disbursements.

Expense Account, including Salaries, Rent, etc		$365 64	
Engraving for Annual Report		140 72	
CANADIAN ENTOMOLOGIST, Printing		375 26	
Library		34 91	
Pins		47 34	
Cork		101 01	
Individual Accounts		17 44	
Cash in Treasurer's Hands	$ 6 35		
Balance in Bank of Montreal	171 27*	177 62	
			$1259 94

**This Balance will all be absorbed in meeting liabilities to the end of December.*

We certify that the above is a correct statement of accounts for the year ending Sept. 23, 1873, as shown by the Treasurer's books, with vouchers for disbursements.

JOHN H. GRIFFITHS,
CHAS. CHAPMAN. } *Auditors.*

London, Ont., Sept. 21, 1873.

REPORT OF THE COUNCIL.

At the expiration of this the third year of the existence of the Entomological Society of Ontario, it again becomes the duty of your Council to submit a Report of the state of the Society.

Owing to various causes, such as pressure of business and the great distance between their respective homes, the members of your Council have not been able to meet together so often as could have been wished, both for the interests of the Society and for the promotion of that good feeling and mutual intercourse which it is so desirable to maintain.

It is gratifying, however, to be able to report the continued progress of the Society, and to know that its efforts are being recognised as tending to further those agricultural interests which form the main source of wealth of our fair Dominion.

It is with pleasure that your Council refer to the proposed formation of a Branch of our Society at Montreal, and we feel sure that the members generally will gladly welcome this addition to our ranks.

The publication of THE ENTOMOLOGIST is still regularly maintained, and this termination of our fiscal year also brings us towards the close of the fifth volume. It is much to be regretted that we still experience a difficulty in getting our members to assist the Editor by furnishing contributions from their pens. We feel sure that there are many amongst us whose powers of observation and daily experience of insect life might be rendered most valuable and instructive to others by the aid of printers' ink, and we would again earnestly appeal to the members of the Society to come forward and enable the Editor to keep up the regular issue of our periodical, and to supply him with their notes on anything they may deem of interest to the lovers of Entomology.

Submitted on behalf of the Council by
EDWARD BAYNES REED,
Secretary-Treasurer.

LIST OF HONORARY MEMBERS OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

1. Francis Walker, Elm Hall, Wanstead, Essex, England.	Elected	Feb. 16, 1865.
2. E. T. Cresson, Philadelphia, U.S.	"	Nov. 10, 1868.
3. W. H. Edwards, Coalburgh, Kanawha Co., Virginia West, U.S.	"	" "
4. Prof. Townend Glover, Agricultural Department, Washington, D.C.	"	" "
5. Augustus R. Grote, Buffalo, U.S.	"	" "
6. Dr. Geo. H. Horn, Philadelphia, U.S.	"	" "
7. Dr. A. S. Packard, Jun., Peabody Academy, Salem, Mass.	"	" "
8. C. V. Riley, State Entomologist, Missouri, U.S.	"	" "
9. S. H. Scudder, Boston, Mass., U.S.	"	" "
10. Dr. J. L. Leconte, Philadelphia, U.S.	"	" "
11. Baron R. Von Osten Sacken, Late Russian Embassy, New York, U.S.	"	Sep. 22, 1869.
12. Dr. Herman Hagen, Cambridge, Mass. U.S.	"	" "
13. Dr. Asa Fitch, State Entomologist, New York.	"	" "
14. P. R. Uhler, Baltimore, Maryland, U.S.	"	Sep. 25, 1873.
15. V. T. Chambers, Covington, Kentucky, U.S.	"	" "

EDITORIAL.

(*From the late Editor of the* CANADIAN ENTOMOLOGIST : *Published by the Entomological Society of Ontario.*)

Our readers will observe, from the alteration in our title-page, that a change has been made in the occupant of the Editorial chair of this publication. At the annual general meeting of the Society, held at London on the 25th ult., the Rev. C. J. S. Bethune tendered his resignation of the office of General Editor, and Mr. Wm. Saunders was unanimously elected to take his place. This change of personality will make no difference in the character and management of this journal, except in the direction of improvement in material and greater regularity in issue. For some time past Mr. Bethune has desired to vacate the position of Éditor—not from any diminution in interest in the publication, or from any cooling in zeal and attachment to the cause of Entomology—but solely because his position as Head Master of Trinity College School, entails upon him so much labour, and engrosses so much of his time, that he cannot satisfactorily perform the duties that properly devolve upon the Editor of the CANADIAN ENTOMOLOGIST. Since the removal of the head quarters of the Society to London, the labour attending upon the issue of this publication has gradually fallen more and more upon Mr. Saunders, though largely shared by Mr. Reed, the late energetic Secretary-Treasurer of the Society.

The retiring Editor—who will continue to aid in the maintenance of the journal, as far as his time will permit—begs to offer his most cordial thanks to all those kind friends who have rendered him so much assistance in the past, and to request that the same hearty support and co-operation may be afforded to his friend and successor.

INSECTS INJURIOUS TO THE RASPBERRY.

By W. Saunders, London, Ontario.

1. The Raspberry Rootgall Fly (*Rhodites radicum*, Osten Sacken).
2. The Red necked Agrilus (*Agrilus ruficollis*, Fab.).
3. The Raspberry Cane Borer (*Oberea tripunctata*, Fab.).
4. The Tree Cricket (*Œniveus canthus*, Serv.).
5. The Pale Brown Byturus (*Byturus unicolor*, Say).
6. The Raspberry Saw-fly (*Selandria rubi*, Harris).
7. The Raspberry Acronycta (*Acronycta venillii*, Grote and Rob.).
8. The Fall Web Worm (*Hyphantria textor*, Harris).
9. The Oblique Banded Leaf-roller (*Lozotœnia rosaceana*, Harris).
10. The Raspberry Plume Moth (*Pterophorus* ——?).
11. The Cucumber Flea Beetle (*Haltica*[*Crepidodera*] *cucumeris*, Harris).
12. The Raspberry Geometer (*Aplodes rubivora*, Riley).
13. The Flea-like Negro Bug (*Corimelœna Pulicaria*, Germ).

While the wild raspberries in most sections of our country, owing to the gradual clearing up of the lands, are yearly becoming scarcer, the cultivation of the better hardy sorts is on the increase, and will doubtless continue to extend in a ratio corresponding to the lessening supply of the wild fruit. In the natural state the individual plants of the raspberry are comparatively scattered and wide spread, in a cultivated one compact and thickly growing; and as this latter condition is much more favourable to the increase and spread of insect life, we may expect to hear in the future much more of "Insects Injurious to the Raspberry" than we have heard in the past. Hence an acquaintance with our foes present and prospective, and the best methods of successfully contending with them, will not be amiss, and in some measure to meet this want the present paper is offered.

AFFECTING THE ROOTS.

1. The Raspberry Root Gall Fly (*Rhodites radicum*, Osten Sacken).

This is the only insect which has thus far been found injuring the roots of the Raspberry. It is a small fly which produces a swelling or gall on the root, and although we have not yet heard of the work of this insect appearing anywhere in Ontario, it will in all probability be found here as it is common in Massachusetts and also in the Western States; hence as one of our prospective foes we shall devote a small space to it.

Fig. 1.

Colour Brown.

Figure 1 gives a good representation of one of these galls, which was found on the roots of a raspberry bush. The swelling is composed of a yellowish pithy substance, scattered throughout which are a number of cells, and in these are enclosed small white larvæ, the progeny of the little fly. These soon change to chrysalides, and the latter in turn in a short time produce the perfect insects, which eat their way out through the substance of the gall, leaving small holes to mark their place of exit. This same insect attacks sometimes the roots of Rose-bushes.

Whenever and wherever these swellings or excrescences are found, they should at once be committed to the flames.

AFFECTING THE CANES.

2. The Red-necked Agrilus (*Agrilus ruficollis*, Fab).

Fig.

This insect was first described by the great German Entomologist Fabricius, in the year 1801, but for very many years after this nothing was known of its earlier or larval history. In 1846, Professor S. S. Haldeman contributed a paper to the "Quarterly Journal of Science and Agriculture" in which details of the injury it does to the Raspberry were first given. More recently Prof. C. V. Riley, in the second volume of the "American Entomologist" has given a fuller account of the operations of this insect, and from this source much of the following has been condensed.

In the spring time when raspberry and blackberry patches are being pruned, the canes will often be observed to swell out in places to the length of an inch or more in the manner shown in figure 2. This swelling is a sort of pithy gall and has been named the Raspberry Gouty Gall, *Rubi podagra*, Riley, and is produced by the irritation caused by the presence of the larvæ of the Red-necked Agrilus. The swollen portions are not smooth like the healthy ones are, but have the surface roughened with numerous brownish slits and ridges. When these ridges are cut into with a knife there will be found under each of them the passage way of a minute borer. Figure 3 represents the little creature fully grown on a magnified scale, the hair line at the side showing its natural size. It is small, and with a body almost thread-like and of a pale yellowish or whitish colour, but with the anterior segments flattened out, somewhat like that of the larva of the common Flat-headed Apple-tree Borer. *Chrysobothris femorata*, but in a less degree. The head is small and brown, the jaws black, and the tail is armed with two slender dark-brown processes or horns, each with three blunt teeth on the inner edge. When full grown it measures about six tenths of an inch. In the earlier period of its history it dwells chiefly in the sap wood, and following a sort of irregular spiral course frequently girdles and destroys the cane. Usually several of these larvæ will be found in the same cane, thus lengthening the gall and causing it to assume a very irregular shape. It is said to infest the Philadelphia raspberry, the Doolittle black cap and the Wilson blackberry worse than other varieties. In April or May the larva penetrates into the pith, where it is more secure from insect and other foes, and there changes into the pupa state, and early in summer the perfect beetle appears. It is probable that the sexes couple some time in July and that shortly after this the female deposits her eggs on the young canes, where they hatch out tiny young larvæ, which eating into the cane, in process of time, develope the mischievous results already detailed.

Fig. 3.

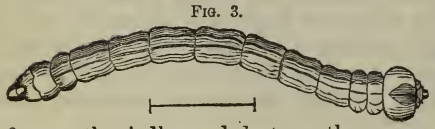


Fig. 4.

In figure 4 *c* we have the perfect insect magnified. It is about three-tenths of an inch long, with a rather small dark bronzy head, a beautifully bright coppery neck and brownish black wing-covers. The under surface is of uniform shining black colour.

The best method of getting rid of this troublesome pest, is to cut out the infested canes and burn them in spring before the beetle escapes.

3. The Raspberry Cane Borer (*Oberea tripunctata* Fab.).

This insect in the larval state lives in the centre of the cane, where it burrows a passage upwards and downwards often causing the death of the cane. Its natural home is among the

wild raspberries, but it has taken very kindly to the cultivated varieties and appears to like them at least equally well. The perfect insect is a long horned beetle, with a long and narrow black body with the top of the thorax and the fore part of the breast pale yellowish. The wing cases are covered with coarse punctures, and sometimes there are two black dots on the thorax. It is usually about half an inch in length.

This beetle appears on the wing in June, and after the pairing of the sexes, the female proceeds to deposit her eggs which she does in a very singular manner. She attacks the young growing cane and girdles it near the tip in two places, one ring being about an inch below the other. Between the rings—sometimes nearer the upper one, but more commonly nearest the lower one—the cane is punctured, and an egg thrust into its substance, near the middle. The tip of the cane above the upper girdle at once begins to droop and wither, and soon completely dies, when a touch will sever it at the point where it has been girdled, and no further growth takes place on that part of the cane.

The egg is a long and narrow one and quite large for the size of the insect; imbedded in the moist pithy substance of the cane, it soon begins to grow larger and in a few days it hatches into a small grub. The egg when of full size much resembles the egg of an Orthopterous insect, and this resemblance led both ourselves and Mr. Riley into an error, which was thus made public in our "Essay on the Raspberry, Blackberry, Strawberry and Currant." After having given details of the working of the beetle much as above, the following remarks occur: "A closer examination into the cause of girdling of the cane as described above shows that it is not always due to the beetle referred to, viz., Oberea.

"Indeed we now think it is doubtful whether that insect ever girdles the cane as described. We know that it does destroy raspberry canes, for we have found its larva late in the season boring down the middle of the stem, but at the suggestion of Mr. Riley, State Entomologist of Missouri, we have carefully examined a number of these examples of girdling during the summer, and found in every case that they were the work of an Orthopterous insect, one of the Grasshopper family which, girdling and puncturing the cane as already detailed, deposits a single long yellow egg in it, which when hatched produces an insect at once similar to the parent but without wings, which works its way out of the cane to enter it no more." Mr. Riley examined specimens of these eggs with us and we both felt persuaded that the conclusion then arrived at was a correct one, basing our opinion mainly on the appearance and size of the egg. But during the past summer with the view of placing this matter beyond the region of conjecture we collected specimens of these eggs, and on the 12th of July, while examining them under a microscope had the good fortune to see a young larva in the act of escaping, and fully satisfied ourselves that they were the larvæ of the beetle before referred to, Oberea.

The following description of the young larva was taken under a microscope:—

Length $\frac{7}{100}$th of an inch.

Head very small, reddish brown with a pale stripe down the front, and a few short yellow hairs; mandibles dark brown.

Body yellow, smooth and glossy, roughened a little at the sides with very minute hairs. the second segment or ring larger than the head, smooth, tinged with reddish brown in front yellowish behind. The third segment is much swollen, while the remaining ones are nearly uniform in size, but less in diameter than the third—no feet perceptible. This larva lived for a few days only, when for want of the moisture and abundance of food which surrounds it when in its natural position in the cane, it drooped and died.

We have not yet seen the beetles in the act of depositing their eggs, but we have seen them flying around among the raspberry canes, usually late in the day, towards evening, and in a few days afterwards have noticed abundant evidence of their work in the drooping tips of the ringed canes. When the young larva hatches it burrows down the centre of the stem where it lives in the pithy portion until it is full grown. It is said to undergo the change to the chrysalis state, also, within the stem where in due season the beetle matures and eats its way out, thus gaining its liberty.

The presence of these enemies may be easily detected by the sudden drooping and withering of the tips of the canes, they usually begin to operate early in July and continue for several weeks; hence by looking through the canes occasionally at this season of the year and removing all the withered tops *down to the lowest ring*, these insects may be easily kept under, for they are seldom numerous.

4. The Tree Cricket (*Œcanthus niveus* Serv.)

Of all the insects affecting the canes of the raspberry, this in our experience is the most troublesome; it is not, however, confined to the raspberry, we have already referred to it at some length as injuring grape vine canes in our paper on "Insects Injurious to the Grape," in the report for 1870. We shall notwithstanding, even at the risk of a little repetition, detail its history and describe its manner of working, since no doubt to many of our present readers the report of 1870 is not available. In the accompanying cut, fig 5 represents the male and fig 6, the female. Their colour is pale green, and they are exceedingly lively and musical, chirping merrily among the green leaves all the day. The perfect insects appear in the fall of the year, and it is then that the mischief making female in the carrying out of her instinctive desire to protect her progeny becomes such an enemy to the raspberry grower. She is furnished with a long ovipositor which she thrusts more than half way through the cane and down the opening thus made she places one of her long narrow yellow eggs, a second one is then deposited in the same manner alongside of the first, and thus the work is continued until from five to fifteen eggs or more have been placed in a row. The stem of the plant thus operated on is very much weakened, and is liable to break off on very slight provocation, or where this does not occur the branch sometimes dies beyond the punctured part; should it, however, survive and also escape being broken in winter, it is very apt to break from its own weight as soon as the foliage appears in spring, and thus the crop of fruit which would otherwise be secured is lost.

Fig. 5.

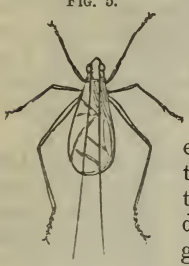


Fig. 6.

Early in spring the eggs begin to swell, and about midsummer, or sometimes a little earlier, the young insects appear, which much resemble the perfect insect in form, but lack the wings. When first hatched they feed on plant lice, and very probably continue to do so until nearly full grown. We have seen the matured insect feeding occasionally on ripe plums. Since they are known to destroy plant lice, it has been urged by some that they should be treated rather as friends than enemies; but we are of opinion that the injury they do far more than counterbalances any good deeds which can be placed to their credit, and we should heartily vote for their destruction. In the first place we would advise fruit growers to kill as many of the perfect insects in the fall as possible, which may be done by suddenly jarring the canes, when the insects fall to the ground, and then before they have time to hop or fly away stamp on them with the foot. The second and probably the most effectual way to lessen their numbers is to cut out, late in the fall or early in the spring, all those portions of the canes which contain eggs, and burn them. Wherever the eggs are deposited the regular rows of pinhole punctures can be readily seen, and ofttimes their presence is rendered more prominently apparent by a partial splitting of the cane. We have dissected the bodies of many of the females at different times, and found them to contain from twelve to sixteen eggs; it is possible that, in the case of all we have thus examined, some eggs may have been placed before the insects came into our possession; still we do not think that the number of eggs ever exceeds much the highest figure given.

Besides attacking the canes of the raspberry and grape, the tree cricket often injures those of the blackberry and the smaller branches of plum, peach and some other trees; but above all others they seem to have a preference for the canes of the Black-cap raspberry.

AFFECTING THE FLOWERS.

5. The Pale Brown Byturus (*Byturus unicolor*, Say).

This insect is a small beetle which we have found to be very destructive to the blossoms of the raspberry. It is a native of America, and was first described by Thomas Say in 1823 from a specimen brought from Arkansas. It is a little more than one-eighth of an inch long —Say's specimen was three-twentieths—of a pale reddish or yellowish brown colour, and densely covered with fine pale yellowish hairs. The surface when seen under a magnifying power is thickly punctured. Dr. Packard, State Entomologist of Massachusetts, in his

"Injurious Insects New and Little Known," states on the authority of Mr. J. L. Russell, of Salem, Mass., that this beetle eats the leaves as well as the buds and flowers. He says: "It eats long strips in the leaves but does the most injury to the fruit buds." For several years past we have observed now and then a considerable number of the flower buds of our blackberries and raspberries eaten into and injured or destroyed. On examining the buds a hole would be found on one side of each, through which the enemy had entered and eaten away partially or wholly the stamens as well as the spongy receptacle on which they are borne. Where the damage was only partial the flower usually expanded, but appeared very imperfect; but where the destruction of the sexual organs was complete, as was often the case, the buds frequently withered without expanding. We did not succeed in ascertaining the cause of this damage until the summer of 1872, when we secured several of these beetles; they were taken in the act of injuring the flowers in the manner already described, and we have met with them again during the past season in greater numbers. They attack the expanded flowers as well as the unexpanded ones, partially hiding themselves about the base of the numerous stamens they are consuming. Dr. Packard speaks of their occurring about the 18th of June, but we have found them much earlier than this, as early as the 27th of May. On this date during the past summer we found one of these marauders about nine o'clock in the morning eating a hole into a flower bud of a Black-cap raspberry, none of the flowers of which were open. It had eaten a hole in the side near the base just large enough to admit its body, and here it was consuming the internal organs of the flower. We found additional specimens occasionally from this date up to the middle of June; we have seldom seen them about during the middle portions of the day, but chiefly during the earlier hours of the morning and evening.

When the flowers are thus damaged, the fruit, if it forms at all, is always very imperfect, and should this insect become as plentiful as many others, it would doubtless prove a great hindrance to the successful culture of the raspberry Fortunately it has never yet shown itself in any great abundance; long may its ranks continue thin; should it in any case become inconveniently numerous it might be destroyed by hand-picking.

AFFECTING THE LEAVES.

6. The Raspberry Saw-fly (*Selandria rubi*, Harris).

Although this insect is quite generally distributed, and at times is very destructive to the foliage of the raspberry, it has, strange to say, been but little noticed by Entomologists in their publications. There is a short reference to it in "Harris' Entomological Correspondence," in a letter from Darling to Harris, written in 1846, where a very correct account is given of the manner in which the egg is deposited. There is also a much briefer paragraph in "Packard's Guide," and these are all the references we have been able to find.

The perfect insect, which is a four winged fly belonging to the order *Hymenoptera*, appears on the wing about the middle of May. We noticed them during the past summer first on the 10th; in the summer of 1872 they were not observed until the 21st; usually they may be found from about the middle of May until early in June. The wings, which are transparent with a shining surface and metallic hue, measure when expanded about half an inch across, the veins are black, and there is also a streak of black along the front margin extending more than half way towards the tip of the wing. The anterior part of the body is black, the abdomen dark reddish. In common with some other species of Selandria, these flies have a habit of falling to the ground when disturbed, especially in the cool of the morning, and remaining inactive long enough to enable one to catch them; but with the increasing heat of the day they are much more lively, and take wing readily when approached.

The egg, as it appears when squeezed from the body of the female, is about one-thirtieth of an inch long, and a little over one-hundreth of an inch wide at its widest portion. In form it approaches a long oval rather obtuse at the ends, with its greatest diameter a little before the middle. Colour white, with a faint yellow tinge and a smooth, glossy surface, semi-transparent. The enveloping membrane is very thin and easily ruptured, discharging watery-looking contents. Only seven or eight eggs were obtained from the body of the female examined; possibly it might have previously deposited most of its stock. The eggs are buried beneath the skin of the leaf, close alongside of the ribs and veins, placed there by means of

the saw-like apparatus with which the female is provided, where it swells somewhat and produces a slight discolouration of the cuticle on the upper surface. The skin covering the surface of the swelling is so thin and semi-transparent that the movements of the larva may be observed a day or two before hatching, by the black spots on the side of the head showing through. The larva escapes through an irregular hole made on one side of the swelling.

The young larva as it appears when fresh from the egg. Length, when in motion, about one-twelfth of an inch; head large, semi-transparent, greenish-white with a large black eye-like spot on each side, and with a number of short whitish hairs; mandibles pale brown.

The body above is nearly white, semi-transparent, and thickly covered with transverse rows of white spines, nearly all of which are forked towards the tip; some of the spines on the anterior segments are more compound, having four or five branches; the tips of all the branches of the spines are blunt, nearly rounded. The under surface is similar to the upper in colour and semi-transparency; feet and prolegs partake of the general colour.

After the first moult the head is medium sized as compared with the body, of a pale yellowish green, covered with short fleshy-looking hairs of the same colour. The body above is of a uniform pale greenish-yellow colour, excepting along the dorsal region, where, owing to the transparency of the skin, the internal organs show through of a deeper shade of green. The surface of the body is thickly set with short greenish-yellow tubercles, most of which are forked at the tips, the two branches spreading in opposite directions, the greater portion of them extending anteriorly and posteriorly. Out of three specimens of this age examined, one varied from the others in having a pale brownish yellow head. The under surface, feet and prolegs all pale greenish-yellow.

With the subsequent moultings slight changes take place in the colour of the head, first pale brownish or greenish-brown, then bluish-green, and sometimes the branches of the spines assume a brownish tint, especially on the anterior segments.

When full grown this larva measures a little over half an inch; it is nearly cylindrical, tapering slightly towards the hinder segments.

The head is rather small, nearly globular, pale green with a faint yellowish tinge, and a dark brown dot on each side, and a few very fine short hairs visible only with a strong magnifier. The mandibles are tipped with brown.

The body above is dark green, thickly set with green tubercles, from which proceed fleshy-looking, forked, pale green, hair-like branches, most of them with their branches extending anteriorly and posteriorly. On the anterior part of the second segment there is a row of four spines with five branches each, most of the others are forked, but some few of them have three branches each. There are eight spines or tubercles on most of the segments, arranged more or less perfectly in a double transverse row. In some specimens the hair-like branches or appendages are black at the tips, and occasionally entirely black from the point of divergence.

The under surface is similar to the upper; feet and prolegs green.

When mature—from the middle to the latter end of June—these larvæ penetrate below the surface of the ground, where they construct little oval earthy cocoons, formed by glueing together particles of earth with silky and glutinous matter. These cocoons are toughly made, and may be taken out of the earth in which they are embedded, and even handled roughly without much danger of dislodging the larvæ. The specimens which we have bred, when examined a week or two after the cocoons were constructed, were still in the larval condition, although somewhat contracted in length. They all dried up and died before changing to pupæ, so we are as yet unable to indicate when this change takes place, the appearance of the chrysalis or its duration. As we have not met with more than one brood in the season, it is probable that the larvæ remain in the ground for some weeks unchanged, gradually transform to pupæ, and remain under ground in this condition until early the following spring.

While in the larval state these insects may be readily destroyed by the use of hellebore, as recommended for the gooseberry worm.

7. The Raspberry Acronycta (*Acronycta venillii*, Grote & Rob.)

The caterpillar of this species, although never very numerous, has been found by the writer more or less injurious to the raspberry for some years past. It is a grey hairy cater-

pillar, which is found nearly full grown from the middle of July to the middle of August, and sometimes later, feeding singly on the leaves. Its length when in motion is about an inch and a quarter, but when at rest its body is contracted by some of the segments or rings being drawn within the others, and measures then not more than an inch. The body is thickest from the third to the seventh segment, tapering a little anteriorly and posteriorly. The head is medium sized, somewhat flattened, of a shining black colour with a few short whitish hairs, the upper portion being overhung with the long hairs on the second segment.

The body above is of a brownish black colour with a transverse row of paler tubercles on each segment from which spring clusters of brownish white or whitish hairs of varying lengths; there are from eight to ten of these tubercles on each segment. On the second segment these hairs are long and being arranged closely together they form a white fringe which overhangs the head; on the third segment the hairs are also tolerably long. Behind the third segment there is a distinct space along the centre of the back between the tubercles widest from the seventh to the tenth segments where the dark colour of the body is distinctly seen. The hairs on those tubercles along the sides of the body, which are situated immediately above and below the breathing holes are longer than the others, those clusters below the stigmata being more decidedly brownish in colour. Stigmata, oval, white. The under side is dull, dark, greenish brown, on the fifth, sixth, eleventh and twelfth segments are a few shining dots from which there arise a few short brownish hairs. The feet are of a shining black, slightly hairy, prolegs are also hairy, dark brown on the outside, paler within.

Within a short time the larva changes to a brown chrysalis within a rather tough cocoon formed of pieces of leaves or other suitable material interwoven with many silken fibres.

The moth measures when its wings are expanded about an inch and a quarter. Its fore wings are grey, thickly mottled and spotted with spots and streaks and dots of darker shades of grey and brown. The hind wings are of a dull, pale grey, deepening in colour a little towards the outer margin. The under surface of both wings is paler than the upper.

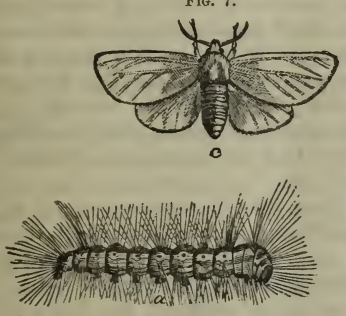
The best method of destroying this insect, as far as we know, is by hand picking.

8. The Fall Web-Worm. (*Hyphantria textor*, Harris.)

This insect has within the past few years become extremely abundant and destructive throughout the greater portion of this Province, chiefly affecting our apple, pear and cherry trees but sometimes found on our blackberries and raspberries, indeed scarcely anything seems to come amiss to it. Besides the fruit trees already named, hickory, ash, elm, willow, oak, birch and buttonwood are named among the trees of which it is especially fond.

In June or July a small, pure white moth or miller, *c*. Fig. 7, lays a cluster of eggs on a leaf near the extremity of one of the branches, and from this deposit originates a host of mischief makers. Soon the eggs hatch and the larvæ at once begin to feed on the green and pulpy portion of the upper surface of the leaves, gradually enclosing the whole branch and sometimes adjoining branches in a slight silken web, by means of which many of the leaves are drawn towards the stem. When seen from a distance a branch thus affected has a scorched and withered look, as if it had been suddenly blighted, a closer examination reveals the presence of the spoilers, a small army in numbers snugly enclosed within the web, and here and there where patches of the green substance of the leaf still remain, groups of these ever hungry caterpillars are busy at work. Before attaining maturity they lose their love of society, abandon their friends and scatter far and wide, feeding on almost every green thing they meet with.

Fig. 7.



When mature these larvæ are a little more than an inch long, see A. in Fig 7, of a bluish, black colour. with a wide band of a paler hue along each side, and a transverse row of little knobs or tubercles on each segment, from each of which there arises a cluster of whitish or reddish hairs. These larvæ are very active and run briskly when disturbed. Hand picking is the best remedy here also, go carefully over the branches and give no quarter.

9. The Oblique-Banded Leaf-Roller. (*Lozotænia rosaceana*, Harris).

This insect has already been referred to in previous Reports, in that of Mr. Reed, "On Insects Injurious to the Plum, 1870," and in that of my own, "On insects Injurious to the Currant and Gooseberry," but since it is equally destructive to the raspberry we call attention to it here once more. It belongs to a family of moths called leaf-rollers, from the fact that their larvæ have the habit of rolling up the leaves or portions of them, and thus constructing a rude case in which they live and by means of which they are partially protected from birds and other enemies.

The caterpillar is about three quarters of an inch long, of a yellowish green colour, with a pale brown head, and a few fine whitish hairs scattered over the surface of its body, arising from very small slightly elevated shining tubercles or dots, so small as to be scarcely visible without a magnifying lens. After becoming full grown it changes to a dark brown chrysalis, usually within the case in which it feeds, and works its way partly out before the moth escapes.

Fig. 8.

In the annexed figure 8 the caterpillar is shown a little enlarged, and the brown chrysalis from which the moth has escaped is placed underneath.

The moth see figure 9 measures when its wings are spread from three quarters of an inch to an inch, its fore wings are of a light cinnamon brown colour, crossed by bands and lines of a darker shade. The hind wings are pale yellow. The fore-wings are very much arched on their outer edge, and are curved at the tip into a sort of hook or short tail

Fig. 9.

Whenever these clusters of curled and twisted leaves are found, they should be picked and crushed without delay.

10. The Raspberry Plume Moth, (*Pterophorus.*——— *?*)

This insect has not in any instance nor is it ever likely to be very numerous or troublesome; still it is an interesting creature and claims some attention. We first observed the larvæ feeding on Raspberry during the summer of 1872, and found them again during the past season. When first met with on the third of June the larva was a tiny thing, two-tenths of an inch long with a pale brown head sprinkled with hairs of the same colour and with two small blackish dots on each side. The body was of a pale greenish white. with transverse rows of shining tubercles from each of which there arose from two to six fleshy-looking spreading hairs. On the second segment these hairs were placed singly, a front row overhanging the head with others behind them. Down the back was a row of depressed dots, looking almost like punctures through the opaque skin, and through which the movements of the internal organs could be seen. The terminal segment was green, edged with dark brown behind.

This larva attained its full growth about the tenth of June, when it measured about 3½ tenths of an inch in length; the following description was then taken:—Head small, pale green, with a faint brownish tinge, semi-transparent, with a few very fine short hairs, and a faint brown dot on each side; body pale yellowish green, streaked with pale yellow; terminal segment green, its sides a little deeper in colour than the upper portion; feet and prolegs greenish, semi-transparent, the prolegs very slender and rather long.

One of these became a chrysalis on the 11th of June, and immediately before this change took place the larva spun a loose web of silk over the surface of a portion of the glass in which it was confined. This web covered more space than the chrysalis did, and in it the hinder segment of the chrysalis was firmly secured, and besides this it seemed to be attached along its entire length. The chrysalis was less than three-tenths of an inch in length, tapering behind to a point, and enlarging continuously towards the front, where near the end it sloped abruptly

to the tip. Its colour was pale greenish, with the anterior segments hairy, with stiffish looking yellowish hairs of varying lengths; along the back was a depressed line of a green colour, margined on each side with a whitish ridge, and on each segment along these ridges from the fifth to the twelfth inclusive, was a small whitish tubercle, from which arose a small spreading cluster of stiff-looking whitish hairs. On the 20th of June this chrysalis was observed to be growing darker, and on the 22nd the moth appeared.

The moth is a very beautiful and delicate creature, measuring when its wings are expanded, a little over half an inch. The fore wings are of a deep brownish copper colour with a metallic lustre, with a few dots of silvery white. They are cleft down the middle about half their depth, the division as well as the outer edge being fringed. The hind wings, which are similar in colour to the fore wings, are divided into three portions, the hind one being almost linear, and all deeply fringed. The antennæ are annulated with silvery white, the legs and body are also spotted with the same.

Should this insect ever appear in sufficient numbers to require a remedy, hellebore would probably prove efficient.

11. The Flea Beetle (*Haltica* [*Crepidodera*] *Cucumeris*, Harris).

The insects comprising the family to which this flea beetle belongs although they are most of them small, are on no account to be despised. The celebrated turnip fly or more properly turnip beetle which lays waste the turnip fields in Europe, is one of them, and the species we have now under consideration, as well as one or two others, are very destructive to the turnip in this country, devouring the seed leaves of the plant as soon as they appear above ground. But they do not confine their attacks to the turnip ; they injure the young cabbage, the potato, and occasionally the raspberry. We found them during the past season abundant on our raspberry bushes early in June, actively hopping about from leaf to leaf like fleas, and eating very small holes in the leaves of the plants ; they did not however do any very considerable damage. Harris says, " The flea beetles conceal themselves during the winter in dry places under stones, in tufts of withered grass and moss, and in chinks of walls. They lay their eggs in the spring upon the leaves of the plants on which they feed. The larvæ or young of the smaller kinds burrow into the leaves, and eat the soft pulpy substance under the skin, forming therein little winding passages, in which they finally complete their transformations. Hence the plants suffer as much from the depredations of the larvæ as from those of the beetles, a fact that has too often been overlooked. The larvæ of the larger kinds are said to live exposed upon the surface of the leaves which they devour, till they have come to their growth, when they are changed to pupæ, and soon afterwards to beetles. The mining larvæ, the only kinds which are known to me from personal examination, are little slender grubs, tapering towards each end, and provided with six legs. They arrive at maturity, turn to pupæ, and then to beetles in a few weeks. Hence there is a constant succession of these insects in their various stages throughout the summer."

Powdered hellebore has been recommended as a remedy for this beetle, as well as Paris green mixed with flour in the proportion of one part of the green to 15 or 20 of flour. The latter we think would be likely to prove most effective.

AFFECTING THE FRUIT.

12. The Raspberry Geometer, (*Aplodes rubivora*, Riley.)

The larva of this pretty geometric moth feeds principally on the fruit of the raspberry. It was first described by Mr. Riley in his first Report "On the Noxious Insects of Missouri," where he described the larva and chrysalis as well as the perfect insect. Subsequently the same insect was described by Mrs. Mary Treat, of Vineland, N. J., and from these two published accounts most of the following is condensed.

As already stated these larvæ feed chiefly on the fruit of the raspberry, although Mrs. Treat says they occasionally feed on the leaves as well.

Fig. 10.

Figure 10 represents the larva natural size, on the fruit of the raspberry, at *a*. *b* shows an enlarged side view of one of the rings or segments of the body of the larva, showing the hairs with which the body is furnishod. The moth of its natural size is shown at *c*, while at *d* we have an enlarged outline of one pair of the wings.

With regard to the larva and its habits we cannot do better than quote from Mrs. Treat: "I found my little raspberry caterpillars had a decided preference for the Philadelphia raspberry, though I occasionally found them upon the Black-caps. They also seemed to have a great passion for ornaments, for they had stuck all over their bodies dried anthers of flowers and small bits of sticks and leaves, which gave them a very comical and grotesque appearance.

"I confined several of these larvæ in a box, giving them daily a fresh supply of raspberries, and they seemed to thrive as well in confinement as in the open air. Knowing their fondness for ornaments, I could not deprive them of these, so I cut white paper and thread, together with leaves into small bits, and distributed them in the box. Very soon they were decked out in these, the white paper and thread adding materially to their grotesque appearance. Not always satisfied with their own accumulations, they would sometimes take the ornaments from their neighbours, and appropriate them to their own use.

"I once left the cover to the box not quite secure, and one of them made its escape, completely stripped of its ornaments; it had left all in the box behind, in squeezing through the aperture. I no sooner returned it to the box than it began to take the ornaments from its comrades to readorn itself, rather than to pick up its own, a process which those that were being stolen from did not seem at all to relish.

"After they ceased eating and were ready to become pupæ, they spun loose cocoons, which they fastened to the top and sides of the box, taking their ornaments to decorate their cocoons, which, in consequence, wore a very rough, uneven appearance. In a few days a little pea green moth issued from these rough cocoons—the most delicate, beautiful little creature imaginable."

The colour of this larva is light yellowish gray, darker behind each joint, with a prominent thorn on each side of the back and with several smaller warts and prickles below: see *b*. figure 10. Mr. Riley speaks of this insect as being quite common on both the raspberry and blackberry in some parts of Illinois. He says. "It has the peculiar faculty of thoroughly disguising itself with pieces of dried berry, seed, pollen, and other *debris* of the fruit which it sticks to a series of prickles with which it is furnished. Add to this disguise the habit which it has of looping itself into a small ball, and it almost defies detection. It is most numerous during the months of June and July." This desire which the larvæ has of disguising itself has doubtless been given it as a means of protection against small birds, and predacious insects, nevertheless it does not escape enemies altogether, Mr. Riley speaks of one species of parasitic insect which he has bred from their cocoons.

The moth, *c*. figure 10, when its wings are expanded measures about half an inch. Its colour is pale green with a very delicate semi-transparent appearance, crossed by two lighter lines, body green above, white beneath.

13. The Flea-like Negro Bug (*Corimelaena pulicaria*, Germ).

This is a very disgusting pest which attacks the raspberry fruit. Its presence may be discovered by the fruit having a very nauseous *buggy* odour, and the insect being so small it is

Fig. 11.

often taken into the mouth unnoticed until the nauseous flavour reveals its presence. In figure 11, we have a magnified outline of this insect, with one of the natural size along side of it. Its colour is black, with a white stripe each side. It is furnished with a pointed beak or sucker which it thrusts through the skin of the fruit and thus lives on the juices which it extracts. It affects the blackberry and sometimes the strawberry as well as the raspberry although very seldom to the same extent. Mr. Riley in his second Report refers at some length to this insect, where he says, " it abounds also in certain weeds, among which may be mentioned the Red Root or New Jersey Tea Plant (*Ceanothus Americanus*) and neck weed or Purslane Speedwell (*Veronica peregrina*). In the month of June under these two last named plants, they may be found in countless numbers of all sizes and ages, from the small light brown, wingless, newly hatched individuals, to the full fledged jet black ones. In fact they breed on these weeds, and there is no more effectual method of checking their increase and thus preventing their injuries to our cultivated fruits, than by sprinkling these weeds, and the ground underneath them, with a good strong solution of cresylic soap."

INSECTS

INJURIOUS TO THE STRAWBERRY.

By W. Saunders, London, Ont.

The Strawberry False Worm (*Emphytus maculatus*, Norton).

In that portion of last year's Report which treated of "Insects Injurious to the Strawberry," some reference was made to the strawberry false worm, and some details of its appearance and history quoted from Mr. Riley's Reports; up to that time we had no personal acquaintance with the insect. On the 8th of July last, specimens of the larvæ, some full grown, others only partially grown were brought to us by Mr. William Russell, of London, Ont., who found them destroying the strawberry plants in his garden. Mr. Russell tells us that he had some of the worms last summer, for the first time—on his vines, although not in snch numbers as he has had them during the present year. He says they appear to come on the driest ground first. Three days later we visited Mr. Russell's garden and found many of the plants badly eaten, some indeed completely riddled; it was nearly eight o'clock in the evening and many of the larvæ were found feeding on the upper surface of the leaves, although some were still half coiled up on the under side. Mr. Russell says he can rarely find any on the leaves during the middle of the day, either above or below, but finds them late in the evening and early in the morning, and thinks they must descend to the ground in the day time, and hide, and crawl out again in the evening. He had tried hellebore with water freely, but with less success than he anticipated; probably the mixture of Paris green and flour would prove a more effectual remedy.

The following description of the larva was taken July 9th, 1873. Length $\frac{6}{10}$ths of an inch; body thickest on the anterior segments, tapering behind. Head rather small, pale yellowish brown, with six black spots or dots, two on each side and two in front, one of the latter just above the middle, the other on the upper margin, the last rather the largest and deepest in colour. Mandibles dark brown.

The body above pale greenish with a faint whitish bloom; skin semi-transparent revealing the movements of the internal organs in dark greenish moving patches. There is a broken band along each side of a deeper shade of green, composed of spots or patches which coalesce on the anterior segments but are distinct and separate behind; below the bands the body is paler with a faint yellowish tint.

Under surface pale yellowish and semi-transparent; feet and prolegs—of which latter there are eight pairs—all pale yellowish.

A number of these larvæ were put into a flower-pot with some leaves and earth, when those which were full grown soon disappeared. On turning the earth out—in which they had buried themselves—on the 23rd of July, we found that some of them had formed oval cocoons by sticking together small fragments of earth, and within this enclosure they were preparing for their next change; they had already contracted in length, but were still in the larval condition.

Fig. 12

We insert again for the benefit of those who may not have last year's report, figures illustrating this insect in its various stages. 1, shows the underside of the pupa or chrysalis; 2, a side view of the same; 3, an enlarged view of the perfect fly, showing the arrangement of the veins on its wings; 4, the larva or worm crawling; 5, the perfect fly of the natural size; 6, the larva at rest; 7, the cocoon; 8, one of the antennæ of the insect enlarged, showing the joints; 9, an egg magnified.

The Strawberry Chrysomelan (*Paria sexnotata*, Say).

This insect was first described by Thomas Say, in a communication to the Academy of Natural Sciences of Philadelphia, in the year 1824, who found it in considerable numbers on the common juniper in July. It is a stout, shining small beetle, about $\frac{3}{20}$ths of an inch long, with a pale—sometimes darker—body and wing-covers spotted with black, and ornamented with regular rows of punctures which disappear towards the tip; beneath it is blackish. This little creature is very active, hopping briskly about when approached or disturbed, and is provided with an excellent appetite. Specimens were brought to us by Mr. Deadman, of Delaware, Ont., on the 24th of May, with loud complaints of the amount of damage they were doing to a large bed of his strawberries. The leaves which were brought with them were completely riddled, innumerable holes being eaten through them. Four of these beetles were put into a wide mouth phial with a portion, about one-third, of a large strawberry leaf, and in three days they had destroyed the greater portion of it by eating irregular holes all over it.

This insect prevailed on Mr. Deadman's farm for several weeks in immense numbers, and did a considerable amount of damage to his strawberry beds, destroying in all from one-third to half-an acre. Mr. Deadman noticed a remarkable coincidence for which we could suggest no reasonable explanation. Over certain portions of his strawberry beds he had sown a mixture of lime and salt as a manure, and on all the portions where this lime and salt mixture had been scattered, the beetle abounded on the vines, and along the borders of such salted patches for a foot or two; as far as the influence of this mixture might be expected to extend; all other portions of his strawberry beds were *free from* attack. We were not able to discover anything in reference to the larva; the beetle in this case continued its depredations for several weeks, and then gradually died out about two weeks before the fruit matured. As the fruit was partially grown at the time of the appearance of this beetle, objections were made to using anything poisonous to destroy them for fear of affecting the fruit; we are not aware of its having been noticed before as injurious to any of our fruits.

ON SOME INNOXIOUS INSECTS.

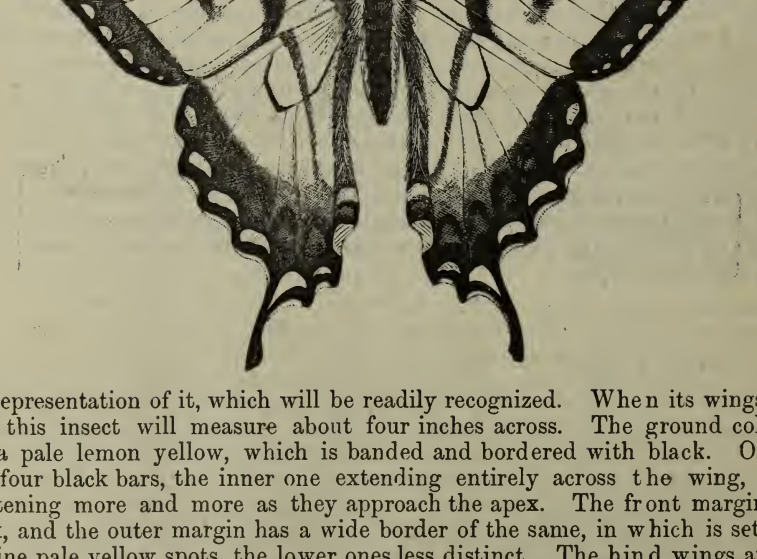
By W. Saunders, London, Ont.

Following the plan inaugurated in our Report for last year, we present our readers with a chapter in which will be given the life history of several of our common insects, which are neither injurious nor beneficial to the farmer or fruit grower, but which, from the frequency with which they are met with, or else from something remarkable in their appearance or methods of life, excite curiosity and claim attention.

The Tiger Swallowtail (*Papilio turnus.*—Linn.)

Everyone must have seen the large Tiger Swallowtail Butterfly, floating about in the warm days of July and August, enjoying the sunshine, and sipping the honey from flowers. It is among our largest and handsomest butterflies. In figure 13 we have an

Fig. 13.



excellent representation of it, which will be readily recognized. When its wings are fully expanded this insect will measure about four inches across. The ground colour of its wings is a pale lemon yellow, which is banded and bordered with black. On the fore wings are four black bars, the inner one extending entirely across the wing, the outer ones shortening more and more as they approach the apex. The front margin is edged with black, and the outer margin has a wide border of the same, in which is set a row of eight or nine pale yellow spots, the lower ones less distinct. The hind wings are crossed by a streak of black, which is almost a continuation of the inner band on the fore wings. There is a short black streak a little beyond, at the end of the discal cell, and a wide black border, widening as it approaches the inner angle of the wing. Enclosed within

this border and towards its outer edge are six lunular spots, the upper and lower ones reddish, the others yellow above; and about these spots, and especially towards the inner angle of the wing, the black bordering is thickly powdered with blue scales; the outer margin of the hind wings is scolloped and partly edged with yellow, the inner margin is bordered with dusky for about two-thirds of its length, followed by a small yellow patch, which in turn is succeeded by a larger black spot centered with a crescent of blue atoms, and bounded below by an irregular reddish spot margined within with yellow. The hind wings terminate in two long black tails edged on the inside with yellow. The body is black above, margined with pale yellowish; below, yellowish streaked with black.

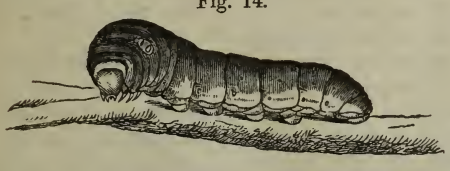
The under surface of the wings somewhat resembles the upper but is paler.

This species passes the winter in the chrysalis state, and appears first on the wing from the middle to the latter end of May, but becomes much more plentiful during July. Whether these July insects are a second brood, or whether the bulk of the chrysalides which have wintered do not mature until about this time, we have been unable to determine; individuals which we have wintered over have escaped from chrysalis as late as the 3rd of June.

The eggs of *turnus* are deposited singly on the leaves of the different plants or trees on which the larva feeds. They are between one-twentieth and one-twenty-fifth of an inch in diameter, subglobular. flattened at the place of attachment; colour dark green, surface smooth, without reticulations, but showing a few small irregularly distributed dots under a magnifying power of forty-five diameters. In about ten or twelve days they begin to change colour, becoming darker, and very dark just before the young larvæ are hatched.

When fresh from the egg the larva is about one-tenth of an inch long, with a large black head, and with a black body roughened with small brownish black tubercles. The second segment is elevated or thickened and of a dull glossy flesh colour, with a prominent fleshy tubercle on each side, and a patch of white on the seventh and eighth segments, which is wide anteriorly, and pointed behind; there is also a dull flesh coloured streak along the back on fourth and eleventh segments. The twelfth segment has a pair of fleshy tubercles, rather prominent, but not so large as those on the second; both those on the second and twelfth have several short whitish hairs arising from them. The under surface is brownish black, with the feet and prolegs of the same colour.

Fig. 14.



The full grown larva, see figure 14, taken July 14th, measured one and a half inches in length. Its head is rather large, and of a reddish brown colour, sprinkled with very short white hairs.

The body olive green, of a slightly darker shade on the anterior segments, paler on the sides of the body, over which there is a whitish bloom produced by a multitude of very minute white dots, with small short hairs of the same colour issuing from them; the anterior segments of the body are wrinkled. On the front edge of the second segment is a raised yellow fold slightly overhanging the head, and on each side of the fourth segment is an eye like spot nearly oval in shape, yellow, enclosed by a ring of black, centered with a small elongated blue dot, which is also set in black, and has above it on each side a black line, nearly crossing the yellow spot. On the hinder portion of the fifth segment is a raised yellow fold, bordered behind with rich velvety black, the latter visible only when the larva is in motion; on the terminal segment is a similar fold flattened above with a slight protuberance on each side. On the fifth segment in front of the yellow fold are two blue dots, one on each side of the dorsal line; there are also faint traces on the hinder segments of a continuation of these dots in longitudinal rows.

The under surface is of a paler green than the upper, with a whitish bloom; prolegs of the same colour, feet tipped with brown.

As the larva approaches maturity, and is about to change to a chrysalis, the colour of the body gradually grows darker, until it becomes dark reddish brown, the sides nearly black. The minute whitish granulations and the blue dots become much more distinctly visible, giving the larva a very different appearance. It then selects some suitable spot

in which to pass the chrysalis state, where it spins a web of silk in which its hind feet are entangled, and having prepared and stretched across a silken band to sustain its body in the middle, it casts its larva skin, and remains a dull brownish chrysalis until the following spring.

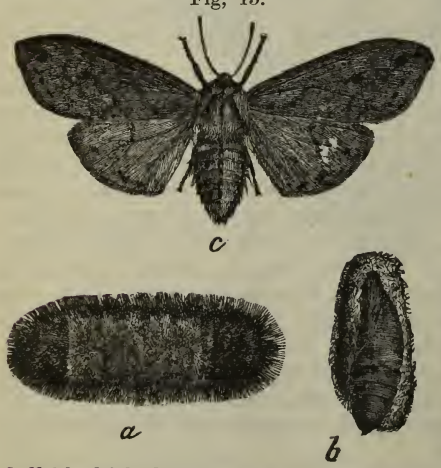
This insect is widely distributed, being found throughout the greater portion of the United States and Canada. The larva feeds on a number of different trees, but chiefly affects with us the apple, cherry, thorn, and basswood.

The Isabella Tiger Moth (*Pyrrharctia* [*Spilosoma*] *Isabella*,—Sm.)

There are but few of our readers who are not familiar with the caterpillar of the Isabella Tiger Moth, one of our commonest "woolly bears," and one found we believe in almost every part of Canada and the northern United States. This larva in common with many other members of the family (Arctiadæ) to which it belongs, hybernates during the winter. It acquires nearly full growth in the autumn, and then having selected a cosy sheltered spot under bark, log, rail, stone or board in which to hide, it coils itself up into a sort of ball and sleeps through the long and dreary winter; and about the time when the birds come back, and the warm days of spring begin, this bristly creature rouses itself to commence life anew. At times it is deceived by occasional warm days in mid-winter when it may be seen wandering about in search of food, but again seeks some hiding-place and resumes its state of torpidity with returning cold. It is one of the few caterpillars which present themselves to us full grown in early spring, and from its peculiar appearance can scarcely fail to attract attention. It has not towander far for food, for being possessed of a very accommodating appetite it feasts on almost the first green thing it meets with, grass or weed, or early plant, and having fed but a short time, it spins its cocoon, and becomes a chrysalis.

The caterpillar is about an inch and a quarter long; its head and body are black, and it is thickly covered with tufts of short, stiff, bristly hairs, which are dull red along the middle of the body and black at each end. When handled it immediately coils itself into a ball and remains for some time motionless. It is very tenacious of life: we have known the larva to be frozen in a solid lump of ice, and when thawed out move around as if nothing had happened. It sometimes occurs, although very rarely, that this larva becomes a chrysalis early in the fall, and produces the moth the same season. We have never met with an instance of this but once, see Canadian Entomologist, vol. i, p. 26; its usual course is that which has already been partially described.

Fig, 15.



Its cocoon, *b*, fig. 15, is spun in some secluded nook, and is of a dark colour, of an elongated oval form and curiously wrought with a network of silk, in the meshes of which are interwoven the black and red hairs from the body of the caterpillar. Within this enclosure the insect changes to a dark brown chrysalis, and remains as such about two or three weeks, sometimes longer, when the moth having burst its shelly covering, softens the silky fibres of which its cocoon is formed by a liquid with which it is furnished, and makes its exit through a hole at one end of the cocoon.

The moth, *a*, fig. 15, when its wings are spread, measures about two inches. Its wings are of a pale yellowish buff colour, with a few dull blackish dots more numerous on some specimens than in others. The hind wings are sometimes paler than the fore wings, and at other times tinged with orange red, while in other specimens we have observed that the under surface of the fore wings assumed a dull rosy hue. The body is a little deeper and richer in colour than the wings, and the abdomen is ornamented with longitudinal rows of black dots; on the upper surface there

is a row down the middle of the back, and one on each side, and on the under surface there are sometimes two additional rows of smaller dots.

Although this insect is so common and well known in its larval condition, it is not often seen on the wing. It flies at night, and being seldom attracted by lights, it rarely finds its way into our houses. It is also subject to the attacks of ichneumons, which destroy some of the caterpillars before they reach maturity.

In the July number of the CANADIAN ENTOMOLOGIST, Mr. O. S. Westcott, of Chicago, names two species of these ichneumons, which he has bred from cocoons of *Isabella*. They are *Ichneumon signatipes*, Cresson, and *Trogus obsidianator* Brulle.

ARCTIA SAUNDERSII.—GROTE.

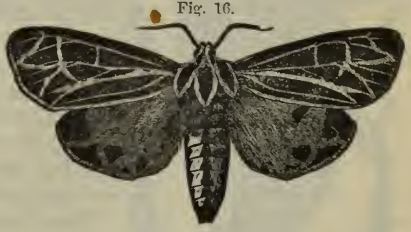


Fig. 16.

This is the name of another of our tiger moths, a very handsome creature, not so common as that last described, but much more beautiful, see fig. 16.

The antennæ are black, with a brownish tinge. Head, flesh coloured above, black at the sides ; the thorax pinkish buff with five black spots, two small ones in front, and three larger ones behind them.

The fore wings are black, with many pale flesh coloured stripes ; the front margin, the veins and their branches, are narrowly striped. There is a central longitudinal linear stripe across the wing above the middle, and a wider one having its origin at the base immediately under the linear stripe, and deflected from thence to the hind margin where it is forked. There is a zigzag band something like a W across the outer edge ; there are also two or three cross stripes, the middle one being most conspicuous, and usually forked.

The hind wings are pale reddish buff, sometimes much deeper and brighter in colour, with five or six black spots, one towards the middle of the wing, the others arranged along the hinder margin, where they form an irregular band. The fringes of the wings are whitish.

The under surface of both wings is paler, with the markings less distinct. The upper surface of the body is reddish, with an irregular black band down the middle of the back ; the under side is dark brown, with many whitish hairs. When the wings are fully expanded this moth measures from one and a-half to one and three quarter inches.

It appears upon the wing early in July, is inactive and remains hidden during the day, but flies into lighted rooms at nights, where it may frequently be found resting on ceilings and walls during the day. During the month of July they seek their mates, and after this the female lays her eggs, usually on some low-growing plant, where they soon hatch into small hairy caterpillars. After attaining about half or less than half their growth they stop feeding, and seek some sheltered and safe hiding-place where they hybernate for the winter. Awakening in spring they feed readily on almost any green thing which may come within their reach, eating during the night, and hiding under logs and chips and stones during the day. They attain full growth early in June, when they measure from an inch and a quarter to an inch and a half in length. The head is small and black, reddish at the sides ; the body above dull black, rather glossy, with a slight reddish tinge , on each segment there is a transverse row of black tubercles emitting tufts of stiff, bristly hairs of the same hue ; the hairs on the two hinder segments are longer than those on the others. There is a faint whitish dorsal line from the head to the third segment, and another faint mark of the same colour on the terminal segment, The under surface is dull red, the feet and prolegs of the same colour.

About the middle of June these larvæ seek some suitable spot, where gathering together a few bits of dried leaves or other rubbish, and uniting them with silken threads, under this slight enclosure the change to a chrysalis takes place, when the hairy covering is shed, revealing a nearly smooth dark brown pupa. After remaining in this inactive condition about a fortnight the perfect insect makes its escape, appearing in all its gay and attractive colours.

The Gigantic Water Bug (*Belostoma grandis.*—Linn.)

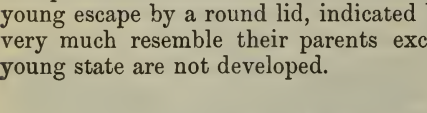
Fig. 17,

This very large bug, which is represented in figure 17, is often a subject of wonder. It is frequently washed up along our lake shores, is often seen in swampy waters, and at other times and in other places intrudes itself upon our notice, always exciting the astonishment of the beholders by its size and strength. This insect belongs to an entirely different order from those already referred to, they belonged to the lepidoptera or scale winged insects– this to the order hemiptera, which embraces all those insects which may be correctly and properly known as true bugs. The genus *belostoma*, to which this particular insect belongs, includes some of the most gigantic forms, some species being as much from three to four and a half inches long—the species with which we are immediately concerned often measures nearly three inches. These insects have very flat oval bodies, small heads, large eyes, and large membranous wings, which enable them to fly considerable distances. Their fore feet are armed with sharp claws, while their hinder limbs are broad and flat and adapted for swimming. Westwood says: "The females of some species of *belostomœ* carry their eggs upon their backs, arranging them in a single layer with great symmetry." They feed upon aquatic insects and not upon vegetable food. They are furnished with a sharp and formidable beak, which they thrust through the bodies of the creatures they attack, at the same time holding their victims firmly fast with their sharp-clawed fore-legs. Dr. Packard says, in his "Guide," p. 537: "Professor A. E. Verrill has sent me the eggs and freshly hatched young of one of our New England species of *belostoma*, the former of which he found in the spring under an old log just at but above the edge of the water. On the 18th of June they hatched out a most amusing flock of young bugs, nearly as large as squash bugs, and light yellowish green in colour, which soon changed to dark gray." The young, two days old and previous to moulting, were ·35 of an inch long. The eggs are smooth, cylindrical, ·16 of an inch long, and are deposited in a mass of about ninety eggs, attached by the posterior end to a mass of silk gum. They partially overlap each other, and the young escape by a round lid, indicated by a semicircular white line." The young insects very much resemble their parents excepting in size, but their wings, however, in this young state are not developed.

The Many-Lined Julus—(*Julus multistriatus.*—Walsh).

There are several species of Julus commonly known as "thousand-legged worms," inhabiting Canada. The small species represented in fig, 18 is common in the Western States, and very probably occurs with us also, although not so commonly as *J. Canadensis;* there is however so much similarity between the different species composing this family as they occur with us, that the figure of any one of them will very well serve to illustrate the group. These are not true insects, but resemble them in many respects, and are often to be seen in collections of insects shown at our various exhibitions. They belong to the order *myriapoda.* In their nervous, digestive, respiratory, and reproductive systems, they very closely resemble those of the larvæ of insects, the circulatory system is however of a lower type.

Fig. 18.



The body is almost perfectly cylindrical, the head large, with thread-like antennæ; their numerous feet are short and slender, attached to the under surface of the body nearly in the middle. When in a state of activity these feet move with a sort of wave-like motion, but when at rest or disturbed the body is frequently coiled up. They are commonly

found under sticks and logs, especially in moist rich woods, and they are said to feed on vegetable substances, and also on dead earthworms and snails. Van der Hœven says, "In the spring the female deposits her eggs in masses of sixty or seventy, in a hole excavated for the purpose under the ground; after three weeks or more the young make their appearance." The body of *Julus Canadensis* consists of fifty-three rings or segments, its colour is chesnut brown, and it is ornamented with a black line down the back and a row of black dots along each side.

To many timid persons these creatures are a source of terror, on account of the popular belief in their being poisonous, and many would as soon think of handling a snake as of touching any one of them; this belief is however entirely without foundation, for none of the members of this interesting family are known to be poisonous, and we have handled many a score of them without experiencing the least degree of unpleasantness, in short it may be confidently asserted they are perfectly harmless.

HOUSEHOLD PESTS.

By Joseph Williams, London, Ontario.

1. The Bacon Beetle (*Dermestes lardarius*).
2. The Clothes Moth (*Tinea flavifrontella*).
3. The Mosquito (*Culex pipiens?*).
4. The House Fly (*Musca domestica*).

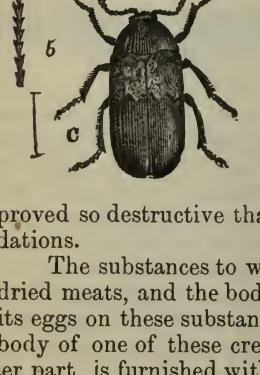
INTRODUCTION.

As, hitherto the insects treated of in these annual Reports have been principally those affecting our field and garden products, it has been thought advisable and appropriate to the character of the Reports, to say a few words concerning those insects which flourish in the abodes of man. We give nothing original in these articles, merely selections from standard authors of such descriptions and facts as may most clearly show the history and character of each insect. Under the circumstances, we have not thought it necessary to insert authors' names in the body of the articles, but trust this will be suffient acknowledgment.

The Bacon Beetle (*Dermestes lardarius*, Linn).

Dermestes lardarius is a European insect which has become naturalized in this country. The accompanying figure will give an idea of the appearance of the Bacon Beetle throughout its various stages, which we will endeavour to make more plain by verbal description.

Fig. 19.



When fully developed this beetle measures about a quarter of an inch in length, is of a dull blackish colour, and has the base of each wing cover of a pale buff or ash tint; each wing cover is also marked with three black spots. Its body is of an oblong oval shape. The insect is furnished with two horns or antennæ, which are notched regularly; it has short legs, is very timid and slow in its movements, and when disturbed or handled it seeks shelter or counterfeits death, a deception which all insects belonging to the same family—*Dermestidæ*—are guilty of.

The perfect insect itself does not produce the ravages which are associated with its name, but the larvæ or maggots that it gives birth to are the mischief workers. In some instances it has proved so destructive that great rewards have been offered for a remedy against its depredations.

The substances to which the Bacon Beetle is most injurious, are bacon, cheese, hams, dried meats, and the bodies of dried insects in the cabinet of the entomologist. It lays its eggs on these substances, and after a certain time the young larvæ come forth. The body of one of these creatures is elongated, tapering from the head to the tail, which latter part is furnished with two short, curved, horny spines on the last segment. It is of a

russety brown colour above, whitish beneath, and is freely covered with moderately long hairs also of a brownish shade. It is quite active in its movements, crawling with a wriggling motion. As soon as it leaves the egg it attacks the food upon, or near which it has been placed by its far-seeing parent, and of course renders it unfit for use to man. When feeding on beetles, moths or butterflies, as it frequently does to the dread of the entomologist, it at once makes its way into the interior, and skilfully hiding itself in the body it is consuming, leaves on its departure nothing but the mere shell which falls to pieces on very slight disturbance. The amount of meats and other articles of food which the larvæ of *Dermestes lardarius* destroy is very great, owing to the abundance of them produced by one pair, and their rapid growth to a perfect state. It is usually in carelessly kept houses and dirty meat shops that these creatures are found in greatest abundance, or where meats are stored for a great length of time, in unfavourable localities, without frequent examination. Owing to its great range of appetite, it is a true pest to careless housekeepers, but it may be unknown in a well kept house. In the case of ravages among other insects or stuffed birds, the larvæ may be readily destroyed by the free application of purified benzine, which will not injure the collectors' specimen in the slightest degree. Camphor is sometimes employed to keep the beetles from such objects, but when the larvæ are formed the first named remedy is the only one which has been found of much service.

The Clothes Moth (*Tinea flavifrontella*).

This little moth, of which we give a representation in fig, 20, causes great destruction of furs and woollens in many families, especially in the more careless.

Fig. 20.

Tinea flavifrontella is a very small moth of a uniform light buff colour, with a silky iridescent lustre, the hind wings and abdomen being a little paler, The head is thickly tufted with hairs and is a little tawny. The wings are long and narrow, with the most beautiful and delicate long silken fringe, which increases in length towards the base of the wing. This moth begins to fly about in May and lasts throughout the season. They flutter about with a noiseless stealthy flight, and when they have found a suitable place deposit their eggs. Although they give preference to woollen or fur materials, yet they have been known to deposit on a mass of cotton.

From the eggs are hatched numerous very small caterpillars or larvæ. The caterpillar is a little pale, delicate worm, about the size of a darning-needle, and less than half an inch in length. See fig. 21. The head is of a pale horn colour, and is armed with a formidable pair of jaws which it uses as a scythe, to cut its way through the world.

Fig. 21.

The larva fashions for itself a curious dwelling-place, in the following manner: (See fig. 21.) Very soon after its birth the young larva begins to cut down the woolly fibres or soft hairs of its resting place, and placing them in successive layers, joins them together by silken threads, thereby forming a cylindrical tube of thick warm material, lined with fine silk spun by the larva itself. This case is not perfectly cylindrical, being slightly flattened in the middle, and contracted a little just before each end, both of which are always kept open. It varies in colour according to the material upon which the larva has been feeding, but is usually marked with rings or lines of different shades. The larva increases in size after several days' feeding on wool, and his case becomes too small for comfort. Shall he leave it and make another, or shall he be economical and alter his old one? The latter course is followed, out come those scissor-like jaws and a great rent is made along each side of one end of the case. Two wedge-shaped patches mend the breach; the little creature retires for a moment and reappears at the other end, and there performs a similar operation, when he once more breathes freely, and laughs and grows fat on horse hair and lamb's wool. In this way he enlarges his case until he stops growing. Several experiments were indulged in at the expense of a larva of *Tinea flavifrontella*, by cutting off portions of its case, when it was found that the little creature built up the part again in a few days.

Most people could easily spare these voracious little worms hairs enough to serve as food and afford material for the construction of their paltry cases, but that restless spirit that ever urges on all beings endowed with life and motion, never forsakes the larva of the clothes moth. He will not drag his heavy case over rough hairs and wool, so he cuts his way through, and the more he travels the more mischief he does.

In process of time the larva or caterpillar changes into the pupa or chrysalis, in which state it is to all appearance dead. The chrysalis is considerably curved, with the head smooth and rounded. The long horns or antennæ, together with the hind legs, are folded along the breast. At first the chrysalis is whitish, but just before the advent of the moth it becomes of a yellowish varnish colour.

When the moth is about to emerge from the chrysalis the skin of the latter splits open on the back, and the perfect insect glides out, and so quickly is the operation performed, that the observer must look sharply to detect the different steps.

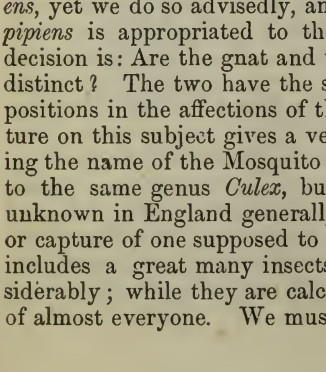
Our little *Tinea flavifrontella*, whose development we have now traced from the egg, proves itself true to the instinct which has been implanted in the species, and earns the name of a "household pest."

There are several allied species which have much the same habits, except that they do not construct cases; they eat carpets, grain and natural history specimens.

Remedies.—Early in May woollens and furs should be carefully dusted, shaken and beaten. Powdered black pepper, camphor, tobacco leaves, red cedar, and paper sprinkled with turpentine, have all been used to repel this moth. The cloth-lining of carriages can be secured forever from the attacks of this insect by being sponged over with a solution of corrosive sublimate in alcohol. Benzine, carbolic acid, and carbolic preparations are certain destroyers and preventives of these moths.

The Mosquito (*Culex Pipiens ?*).

Fig. 22.



We are sure all our readers will recognize our common foe in the figure, and will retain a lively recollection of its peculiarities. As it is some time since we have listened to their cheery music we may be in a position to examine impartially their beauties and admire those marvels of structure which abound in the body of a mosquito in all its stages.

It may not be out of place here to give one of the stories which is supposed to settle the derivation of the word Mosquito. It was given by some coloured person in the South: "De white man he come, he settle down, he grow de corn and cotton, den come de little fly—cry golly? How he bite! Whoop! whoop! White man slap him face and stamp like mad. He say 'must-quit-oh.' He shout louder den ebber, and whop de other side, 'must-quit-oh?' Den behind, den before, dis side, dat side, all de time 'must-quit-oh!' 'must-quit oh!'" This derivation of the word is certainly ingenious, and has quite as much appearance of probability as many other derivatives.

Although at the head of this article we give the name of the mosquito as *Culex pipiens*, yet we do so advisedly, and under certain restrictions. In England the term *Culex pipiens* is appropriated to the insect popularly known as the gnat; and the question for decision is: Are the gnat and the mosquito one and the same insect, or are they perfectly distinct? The two have the same appearance and blood-thirsty habits, and hold similar positions in the affections of the English and American peoples respectively. The literature on this subject gives a very uncertain sound, no writer, as far as we have seen, giving the name of the Mosquito in entomological terms. It is said by many that it belongs to the same genus *Culex*, but the specific name is invariably absent. The mosquito is unknown in England generally, except where some one reports the supposed observance or capture of one supposed to have been brought from some foreign country. The genus includes a great many insects spread all over the world, and resembling each other considerably; while they are calculated, from their habits, to force themselves on the notice of almost everyone. We must bear in mind that differences of climate and other circum-

stances may work considerable changes in one and the same species, and may possibly cause as great a difference as appears between the gnat and the mosquito.

We are all well acquainted with the peculiar buzzing singing of the mosquito and its graceful flight, except when us-ward, but there are many points of beauty and interest about the insect which can only be revealed by the microscope.

The body is long and cylindrical. When in a state of repose one of its wings is crossed over the other. They present a charming appearance when seen through a microscope, their nervures as well as their edges being completely covered with scales shaped like oblong plates, and finely striated longitudinally. These scales are also found on all the segments of the body. The antennæ, especially those of the male, have a fine feathery appearance.

Their eyes, covered with network, are so large that they cover nearly the whole of the head. Fig. 23 shows the head of the mosquito magnified, with its eyes and mouth parts.

Fig. 23.

The instrument which the insect employs for puncturing the skin is called the trunk, and is well worthy of our attention. That which is generally seen is merely the case of those instruments which are intended to pierce our skin and suck our blood, and in which they are held as lancets and other articles are held in a surgeon's case. The case is cylindrical, covered with scales, and terminates in a small knob. Split from end to end that it may open, it contains a perfect bundle of stings. Reaumur observed, that this compound sting enters the skin to a considerable depth, bending the case into a bow until the two ends meet. According to this naturalist the sting is composed of five parts, but at present it is believed there are six. Each part more or less resembles a sword in miniature. The sting of a mosquito bears about the same proportion to the point of the finest needle, that the latter does to a sword point.

It is to be borne in mind that it is only the female mosquito which is so annoying to humanity, as to shake one's belief in that amiability of character which we are always disposed to accord femininity. Packard thus graphically describes the operation of puncturing:—"As she leaps off from her light bark, the cast chrysalis skin of her early life beneath the waters, and sails away in the sunlight, her velvety wings fringed with silken hairs, and her neatly bodiced trim figure (though her nose is rather salient, considering that it is half as long as her entire body), present a beauty and grace of form and movement quite unsurpassed by her dipterous allies. She draws near and softly alights on the hand of the charmed beholder, subdues her trumpeting notes, folds her wings noiselessly upon her back, daintily sets down one foot after the other, and with an eagerness chastened by the most refined delicacy for the feelings of her victims, and with an air of *velpeau redivivus*, drives through crushed and bleeding capillaries, shrinking nerves and injured tissues, a many-bladed lancet of marvellous fineness, of wonderful complexity and fitness." "Her hind body may be seen filling with the red blood until it cries quit, and the insect withdraws its sting and flies sluggishly away. In a moment the wounded parts itch slightly, though a very robust person may not notice the irritation, or a more delicate individual if asleep; though if weakened by disease, or if stung in a sensitive and highly vascular part, such as the eye-lid, the bite becomes really a serious matter." It is not at all probable that such a painful wound is caused by the simple puncture of such a small instrument; indeed it is admitted that it is caused by the exudation of a very small quantity of liquid during the puncturing process, and which probably serves to dilute the blood. A good remedy is to wash the part immediately and thereby dilute the poison.

At the proper time the female lays her elongated oval eggs in a boat shaped mass which floats on the water. Our readers will perhaps not feel much pleasure in learning that the fecundity of these insects is extraordinary. Many generations are born in a single year, each generation only requiring a few weeks to arrive at a condition to bring forth another.

From these eggs are hatched numerous larvæ or grubs. The larva lives at the bottom of pools and ditches, feeding upon decaying matter, thus acting as a scavenger

and in this state doing great benefit in clearing swamps of miasma. It rises to the surface for air, which it inhales through a single respiratory tube, situated near the tail. They are consequently obliged to hold their heads down. In the vicinity of the respiratory tube is an orifice which forms the exterior termination of the digestive tube.

When the larva is about to transform into the pupa or chrysalis state it contracts and enlarges anteriorly near the middle, the larval skin is thrown off, and the insect appears in quite a different form ; the head and thorax are massed together, and the rudiments of the mouth parts, wings and legs are folded on the breast. In a few days the pupa skin is cast, the insect availing itself of its old habiliments as a raft upon which to float, while its body is drying, grows lighter, and its wings expand for its marriage flight. The males are beautiful, both physically and morally, as they do not bite : their manners are more retiring than those of their stronger-minded partners, as they rarely enter our dwellings, but live unnoticed in the woods. A mosquito lives three or four weeks in the water before changing to the adult or winged state ; how long afterwards they live we do not know.

The House Fly (*Musca Domestica*).

This insect is so well known to all our readers that it needs no more introduction than the mention of its name. It is very widely distributed, being found in almost every part of the world. Indeed I believe we are correct in saying that wherever man takes up his residence, it is shared to a greater or less extent by *Musca domestica.* Thus, being a creature so familiar to us all, the knowledge of its history, habits and structure should possess great interest. How often is the question asked, in the spring or early summer time, " Where do all these flies come from ?" and how seldom is an intelligent answer given. About that time of the year several smaller species of flies are very abundant, and it is commonly supposed that these small flies grow into the larger ones, people generally knowing little or nothing of the well established fact that winged insects never grow ; their growth is completed in the earlier or larval stages of their existence, and when once they have arrived at perfection, they cease to grow, and the end and aim of their existence appears to be the propagation of the species.

As we are so familiar with *Musca domestica* in its perfect or winged state, we will follow its history from this point. In this insect the sexes are perfectly distinct, the female being recognisable by the presence of a little tube or ovipositor situated at the end of the abdomen. This organ is formed of three or four rings which the fly can extend or retract after the manner of a telescope, and which it employs for the purpose of depositing her eggs. Internally the organs of the female consist of a pair of branching tubes in which the ova are developed. The male is furnished with tubes and glands necessary for the development of the fructifying element.

A celebrated German naturalist, Keller, who studied attentively ths history of the house fly, tells us that the female deposits her eggs six or eight days after impregnation. his she usually does in such decaying substances as her instinct shows her to be suitable for the nourishment of her larvæ, as for example in the heaps of decaying vegetables found near our dwellings. If the fly be enabled to choose the place which suits her best for the deposition of her eggs (as for instance in a sugar basin in which is placed a quantity of decaying wheat,) she takes an exact survey of every part, and selects that in which she believes her ova will be best preserved, and her young larvæ well cared for. In some places there would be too much moisture, there the maggots would be drowned : in others too little, where they would be liable to be dried up But having at length chosen a suitable locality, one neither too wet nor too dry, she protrudes her little ovipositor, and therewith lays her eggs by the side of and upon one another, with the same precision that the cleverest hand would arrange larger objects. She then sits perfectly still without moving a member of her body excepting the ovipositor ; indeed it would appear as though she were not quite conscious while the operation is being performed, for as long as she is not absolutely touched one may approach her as nearly as possible without causing the least symptom of alarm. During this operation which lasts from six to eight minutes, the fly deposits from seventy to ninety eggs. A large number of winged insects die as soon as they have deposited their eggs, but this is not the case with *Musca domestica :* it is believed

the same insect deposits eggs three or four times during her short life, which lasts only a few weeks.

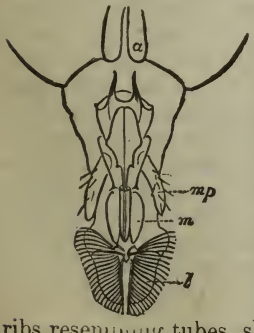
Assuming that the fly deposits eighty eggs at one sitting, and that she does this three or four times during her life, and knowing that the progeny in a very short time become parents themselves, it has been calculated that a single female might in one season, provided all her progeny survived, become the parent of upwards of two millions of flies. Here then we have a basis of calculation sufficient to account for the greatest increase we have ever witnessed, for, presuming that but comparatively few of our summer tormentors find hiding places sufficiently warm and sheltered to winter in, they would be quite numerous enough, taking into account their natural rate of increase, to stock our houses by midsummer. It is also quite probable that millions of eggs which are laid in the fall pass through the rigours of winter unharmed, and hatching out by the warmth of the sun in early spring, add greatly to the numbers of those who have survived in the perfect state.

In summer the eggs are hatched in a few days after being deposited, into long white maggots or larvæ. The body of a larva is divided into thirteen rings or segments. The anterior one, or head, being furnished with a pair of hooked jaws, and rudimentary eyes. These are the only external organs; the creature is perfectly smooth and without feet. While in this state it is constantly devouring the substances in which it was hatched, and rapidly increases in size, and in a few days assumes the pupa or chrysalis state. This change is effected by the hardening of the outer skin, which becomes brown and tough, forming a little barrel shaped case, very much resembling a grain of rice in the husk. While the insect is in this second stage it is undergoing those remarkable changes, both internal and external, which raise it from the type of a worm to that of a highly organized insect. These metamorphoses are soon completed, when the fly forces its way out of its prison house in the following manner:—By a series of muscular efforts it detaches itself from the pupal covering, and then strikes its head repeatedly against one end of the case until it bursts open as it were upon a hinge, when the fly emerges; at this stage the fly presents an odd appearance, being full grown and perfect, with the exception of the wings, which are soft and flabby, and not more than one-fourth their natural size. However this imperfection is soon remedied, as the wings reach their proper size and hardness in a few minutes, and the active little creature flies away to bask in the sunshine with his fellows, or to join them in sipping the delicacies of our tables whenever they come within reach.

Having now briefly gone over the history of our *Musca domestica*, we will glance at a few of the most important and interesting features in its structure. Common and insignificant as we regard the house fly, it is a creature of most delicate and intricate organization, furnishing examples of delicacy of structure, and adaptation of means to ends, before which the highest skill of man falls as comparatively nothing. In the case of our house fly, the microscope has proved invaluable; it has shown in the structure and appearance of those parts which we will briefly attempt to describe, and has enabled the skilful naturalist to observe how the insect performs many of its functions.

First of all, the proboscis or tongue claims our attention. We give a magnified representation of that organ in fig. 24, along with other parts of the mouth.

Fig. 24.



The maxillæ are minute; their palpi, *m p*, being single-jointed, and the mandibles, *m*, are comparatively useless, being very short and small compared with the lancet like jaws of the mosquito. But the tongue itself, or the labium (*l*) as it is called, is the most curious piece of mechanism. It consists of a tubular bag, formed of thin transparent membrane, dilated at its extremity, where it forms a large sucking disc. This disc is divided into two broad flat muscular leaves, which present a sucker like surface. These leaves are supported on a framework of modified tracheæ, which end in hairs projecting externally. The whole tongue is so constructed as to gather the fluids to which it is applied, and pass them to an aperture in the centre which leads to the throat or gullet. On the under surface of this sucking disc are a number of ribs resembling tubes sliced lengthwise, the open portions of which face downwards, forming passages for the liquid food. It will be observed that these ribs are distributed with great beauty and regularity, and most of them empty themselves into four main

trunks before entering the throat. The proboscis is strengthened across the middle by a strong muscular band, which probably serves the purpose of dilating and contracting it.

The next point of interest is the antennæ. These are small horns situated beyond the base of the proboscis, and are covered with hairs. It has long been and still is a disputed point among naturalists, as to what functions these organs perform. Some attribute to them the sense of hearing, others of smell, and others again that of touch. In the case of moths it has been shown by actual experiment that these organs serve to direct the flight. Dr. Clemens, an American entomologist, has experimented on the cercopia moth, and he found that the excision of one antenna made the flight of the insect very irregular and unnatural, while the loss of both seemed to have deprived it of almost all power in guiding itself in the air. Whether these organs serve the same purpose in the case of *Musca domestica* we are uncertain, but it is probable they do.

The eye will next occupy our attention, and it is an object well worthy of it. To the unaided vision it may present no extraordinary appearance, but when examined skilfully by the aid of a microscope, its true structure is revealed in all its beauty. The house fly has two eyes which are situated one on each side of the head; they are, comparatively speaking, of enormous size, as they occupy a very large portion of the head. Each eye is compound, consisting of about two thousand separate lenses, each one of which is complete in itself, and capable of conveying a distinct impression to the sensory organs. Until recently it was a question much discussed among naturalists, whether these remarkable compound eyes of the fly conveyed to the nerve centres of that insect one or many images of objects presented to them. Many were of opinion that each lens conveyed a distinct image, but of late it has been shown that such is not necessarily the case, for although it can be clearly demonstrated that each facet receives a distinct image, there can be little doubt but that the various images meet at a common centre, and are conveyed to the sensory organs as a single picture. Our own eyes afford us an illustration of this principle, for even if we look at one object with both eyes, and a distinct image is reflected on the retina of each, yet we do not *see* two objects, but only one distinct image. Therefore the immense number of eyes the fly has, while giving it an enormous range of vision, need not necessarily yield a confused impression.

We will next consider the breathing apparatus of *Musca domestica*. This consists of a series of air tubes or tracheæ in the body, terminating externally in trap doors, or spiracles as they are technically termed. The tracheæ are small tubes which branch in all directions, and are found distributed freely throughout the body. The air from without enters freely through the trap doors above mentioned, and traverses these tubes, thereby performing exactly the same function as the lungs of man. Under the microscope these tracheæ reveal a most wonderful structure, which we will refer to in the language of Professor Rymer Jones:—

"There is one elegant arrangement connected with the breathing tubes of an insect especially worthy of admiration; and perhaps in the whole range of animal mechanics it would be difficult to point out an example of more exquisite mechanism, whether we consider the object of the contrivance, or the remarkable beauty of the structure employed. The air tubes themselves are necessarily extremely thin and delicate, so that on the slightest pressure their sides would inevitably collapse, and thus completely put a stop to the passage of air through them, producing of course speedy suffocation of the insect had not some means been adopted to keep them always permeable; and yet to do so, and at the same time to preserve their softness and perfect flexibility, might seem a problem not easily solved. The plan adopted, however, fully combines both these requisites. Between the two thin layers of membrane which form the walls of every air tube, a delicate elastic thread (a wire of exquisite tenuity) has been interposed, which winding round and round in close spirals, forms by its revolutions a cylindrical pipe of sufficient firmness to preserve the air vessels in a permeable condition, whilst at the same time it does not at all interfere with its flexibility; this fine coil is continued through every division of the tracheæ, even to their most minute ramifications, a character whereby these vessels are readily distinguishable when examined under the microscope."

Man has imitated this exquisite contrivance in the spiral wire spring which lines flexible gas-pipes; but his wire does not pass between the two coats of membrane. One of the most interesting points of the contrivance is the way in which the branches are (so

to speak) inserted in the trunk, the two wires uniting without leaving a blank. It is difficult to describe how this is done; but by tracing home one of the ramifications, one may see that it is performed most accurately—the circumvolutions of the trunk wire being crowded and bent round above and below the insertion (like the grain of timber round a knot), and the lowest turns of the branch wire being suitably dilated to fill up the hiatus. The chemical name of the substance forming this wire is *chitine*.

The tracheæ terminate outwardly, as we said before, in spiracles, or trap doors, arranged along the sides of the fly. They serve to allow the free entrance of air into the tracheæ, at the same time excluding dust and other foreign matter. These spiracles are narrow oval orifices, which are closed sufficiently by means of minute delicate hairs, which form a network over the entrance.

The feet of *Musca domestica* are also objects of interest. Each foot is furnished with two large moveable claws, which it can affix to any little inequalities of surface; but the great bulk is composed of two large cushions or pads, or *pulvilli*, as they are technically called. These pads are furnished with a great number of filaments, or soft hair-like bodies situated on the margins. Many explanations have been given of the manner in which flies walk on polished surfaces, especially if they are placed vertically. It was long supposed that the *pulvilli* were mere suckers, and that the fly sustained itself in unnatural positions by forming a vacuum between these and the surface of the object; in which case the atmosphere would press with sufficient force on the outside of the sucker to hold the weight of the fly. One writer and microscopist stated that the under portion of the pads were beset with numerous bristles, or tenters, working in an opposite direction to the large claws, thereby enabling the insect to take advantage of any slight irregularities of surface. In the case of polished bodies of glass and such substances, he gratuitously supposed it to be covered with a "smoky tarnish," into which these minute hairs might be fastened. However, the accepted explanation now is,—that the small filaments belonging to the *pulvilli* each terminate in a small fleshy bulb, which is kept moist by a viscid liquid: these constitute the organs of adhesion. Although they are very minute, yet their number is very great, and they expose considerable surface.

Towards the close of autumn vast numbers of flies fall victims to a curious disease, which is highly interesting to the microscopist. Occasionally there may be noticed numbers of dead flies adhering to the walls and windows, often so far retaining the attitude of life that it is difficult, without touching them, to assure one's self that they are not actually on the point of taking flight. Insects in dying usually draw up the legs and cross them on the body, but in this case the dead body is supported on the outstretched legs, whose feet seem still to retain their adhesive property. If the body be on a window a halo may be observed around it, nearly an inch in diameter, and composed of a whitish dust, which, on examination by the microscope, is found to consist of the spores of a fungus. The abdomen is much distended, and the rings composing it are separated from each other, the intervals being occupied by white prominent zones, constituted of a fungoid growth, proceeding from the interior of the body. Further examination will show that the whole of the contents of the body of the fly have been consumed by the parasitic growth, and that nothing remains but an empty shell, lined with a thin felt-like layer of the interlaced threads of this fungus, the name of which is *Empusa muscæ*.

In conclusion, we will say a few words in favour of our "household pest." Most of us have experienced in the summer time, during showery weather, the sharp bite of a fly, which is usually supposed by most people to be the common house fly; but, although their appearance may seem similar, the two are perfectly distinct. They differ so much in structure and habits that entomologists have placed them in separate genera. The proper name of the house fly is at the head of this article, while the bloodthirsty little creature we have referred to rejoices in the title of *Stomoxys calcitrans*.

ON SOME COMMON INSECTS

WHICH AFFECT

THE HORSE, THE OX AND THE SHEEP.

COMPILED BY EDMUND BAYNES REED, LONDON, ONTARIO.

1. THE HORSE BREEZE-FLY (*Œstrus* [*gasterophilus*] *equi*, FAB).
2. THE OX BOT-FLY (*Œstrus bovis*, CLARK).
3. THE SHEEP BREEZE-FLY (*Cephalœmia* [*Œstrus*] *ovis*, LINN).

The insects above named, whose history and habits we propose to lay before our readers, belong to that division of the insect world commonly included under the name of Flies.

They are known however to science as *Diptera*, from two Greek words *dis*, two, and *pteron*, wing, and may be shortly described as suctorial insects, possessing in the perfect state only two membranous wings.

Several of the most eminent Entomologists, such as Reaumur, De Geer, Fischer, have devoted considerable attention to the natural history of these flies, but it is to the laborious and thorough investigation of the celebrated English Veterinary Surgeon, Bracy Clark, that we are indebted for a very complete history of many of the members of the particular genus now before us, the *Œstri*, whose popular names of Breeze, Gad and Bot-flies, are so well known to every stockbreeder.

Each species of *Œstrus* is parasitic upon a peculiar species of mammiferous herbivorous animals, and selects with wonderful instinct as the spot in which to deposit its eggs, that portion of the body of the animal which is best adapted for the welfare of its progeny, that is in places either where the larvæ when hatched may burrow into the back or other part of the body, or where the larvæ may be removed by the tongue of the animal itself into its mouth, and thence to the stomach, in which, exposed to a temperature of more than one hundred degrees Fahrenheit, they remain until full grown, when in either case they quit the body, and making their way to the earth undergo their transformations in the ground.

Providence has doubtless created these animals to answer some beneficent purpose. Mr. Clark conjectures that they act as counter irritants upon the system of those large animals they attack, such as the horse, ox and sheep; and by acting the part of perpetual stimuli or blisters, do modify the effects of grass feeding and repletion. Of course when certain limits are exceeded these insects become the causes of diseases, and sometimes even of death.

According to Mr. Westwood, the larvæ or grubs of *Œstri* exhibit three principal variations in their habits, being either *cutaneous*, when the grubs (commonly called Worrils,

Wormals, or Warbles), reside in tumours beneath the skin of the animal attacked, for example the ox bot-fly; *Cervical*, when the grubs burrow into the maxillary and frontal sinuses, through the nostrils, as is the case with the sheep breeze-fly; or *gastric*, when the grubs, called in this case bots, are introduced into the stomach, like those of the horse gad-fly.

We gather from various sources that the horse, sheep, ox, ass, reindeer, rhinoceros, stag, antelope, camel, hare, rabbit, rat and mouse are subject to the attacks of these insects, and it is mentioned as a singular anomaly that some of the genera which contain the largest species among them, inhabit the smallest animals.

These insects whose habits are so formidable, and whose economy is so extraordinary, have the appearance of large hairy flies, the hairs being often coloured in transverse bands.

Having thus learned something of the general history of the breeze-flies, let us now take them in order and more minutely examine the three several species we have alluded to.

1.—The Horse Breeze-Fly (*Œstrus* [*gasterophilus*] *equi*, Fab).

Fig. 25. Male.

M. Joly thus describes this fly. The head is large and obtuse, the face light yellow with whitish silky fur, the eyes blackish, the antennæ ferruginous, the thorax grey, and the abdomen of a reddish yellow, with black spots. The wings are whitish, not diaphanous, with a golden tint, and divided by a winding band of blackish colour; the feet are palish yellow. The body of the female, fig. 26, is long, tapering and sharp pointed, while that of the male is round and obtuse.

No quadruped is more infested by the breeze or bot-fly than the horse. During the months of July and August when horses are generally turned out to grass, the *Œstrus* frequents the pastures for the purpose of laying its eggs. We will refer here to Mr. Newman's description of extracts from Mr. Clark's masterly essay.

Fig. 26. Female.

The female Œstrus in approaching the horse for the purpose of depositing her eggs, carries her body nearly upright in the air, the protruded ovipositor being curved upwards and inwards. Suspending herself for a few seconds before the part of the horse on which she intends to deposit the egg, she suddenly darts upon it, and leaves the egg adhering to the hair. She hardly appears to settle, but merely touches the hair with the egg held out on the projected point of the abdomen or ovipositor as it is called, the egg adhering by means of the glutinous liquor with which it is covered. She then leaves the horse at a small distance, prepares a second egg, and poising herself before the part deposits it in the same way: the liquor dries, and the egg becomes firmly glued to the hair. This is repeated until four or five hundred eggs are sometimes placed on one horse. The skin of the horse is usually thrown into a tremulous motion on the touch of the insect, which merely arises from the very great irritability of the skin and cutaneous muscles at this season of the year, occasioned by the heat and continual teasing of the flies, till at length these muscles appear to act involuntarily on the slightest touch of any body whatever.

The fly does not deposit her eggs at random on the horse's body, but selects those parts which are most likely to be nibbled by the horse. The inside of the knee is frequently chosen, but all naturalists must have remarked how commonly the eggs of the bot are deposited on that part of a horse's shoulder which he can never reach with his mouth, and thus to a casual observer it would seem they must perish and fail in the object for which their parent designed them. Now there is a provision of nature which exactly counteracts this difficulty. When horses are together in a pasture and one of them feels an irritation on any part of the neck or shoulder which he cannot reach with his mouth, he will nibble another horse in the corresponding part of his neck and shoulder, and the horse so nibbled will immediately perform the kind office required, and begin nibbling away in the part indicated.

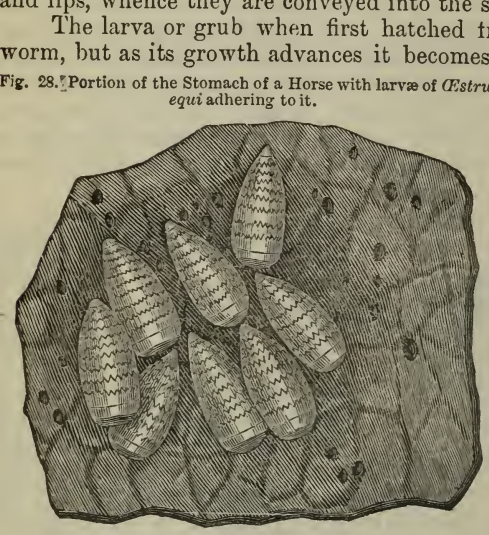
Tha eggs of the horse *Œstrus*, which are white and of conical form, adhere to the horse's hair as shewn in fig. 27. They are furnished with an operculum or lid which at the time of hatching, about twenty days after they are deposited opens to allow of the exit of the young larva. It was at first supposed that the horse licks off the eggs thus deposited, and that they are by this means conveyed into the stomach, but Mr. Bracey Clark says, "I do not find this to be the case, or at least only by accident, for when they have remained on the hair four or five days they become ripe, after which time the slightest application of warmth and moisture is sufficient to bring forth in an instant the latent larva. At this time, if the tongue of the horse touches the egg its operculum or lid is thrown open, and a small active worm is produced, which readily adheres to the moist surface of the tongue, and is thence conveyed with the food to the stomach." Thus a horse which has no ova deposited on him may yet have bots by performing the friendly office of licking another horse that has."

Fig. 27. Eggs of the Horse Breeze Fly deposited on the hair of a horse.

It is worthy of remark that it is probable the greater part of the eggs deposited by this fly are taken up in consequence of the irritation of other flies, which by their stinging cause the horse to lick himself, and thus receive the larvæ of the *Œstrus* on the tongue and lips, whence they are conveyed into the stomach.

The larva or grub when first hatched from the egg, is a small, active, rather long worm, but as its growth advances it becomes thicker and broader, and set with bristles. The body is of a whitish or yellowish red colour, and is composed of eleven segments, armed at the lower edge with a double row of triangular spines or bristles, large and small alternately, black at the point which is always turned backwards. The larvæ usually hang in clusters from the lining of the stomach, see fig. 28; they maintain their hold by means of two dark brown hooks with which their head is furnished. The spines with which the whole surface of the body is provided contribute to fix it more solidly, preventing the grubs by the manner in which we have seen they are placed from being carried away by the food which has gone through the first process of digestion.

Fig. 28. Portion of the Stomach of a Horse with larvæ of *Œstrus equi* adhering to it.



The larvæ are generally found adhering to the white insensible lining or tissue of the stomach. They make small deep round holes wherever they adhere to this lining, and sometimes penetrate through it, but not through the other layers or coats of the stomach.

When they are removed from the stomach with a sudden jerk so as not to injure them, it is said that they will if fresh and healthy attach themselves to any flaccid membrane, and even to the skin of the hand.

The larva when matured leaves the membrane to which it has been attached, and traversing the whole length of the intestinal canal, leaves it by the anal orifice, and falls to the ground, where seeking a suitable place of retreat it undergoes the change into a chrysalis, the skin hardening, and becoming a dark reddish brown colour. After remaining torpid for a few weeks in this state, the perfect insect having assumed its mature form bursts the lid at the anterior end of the chrysalis, and makes its exit. In a few hours afterwards having dried its wings it flies off and seeks its mates.

It is curious to note the agitation and terror produced both by this fly and by another horse breeze-fly (*Gasterophilus hæmorrhoidalis*, Leach), which deposits its eggs upon the lips of the horse. This latter is described by Mr. Clark as "very distressing to the

animal from the excessive titillation it occasions, for he immediately after rubs his mouth against the ground, his forefeet, or sometimes against a tree with great emotion, till finding this mode of defence insufficient, he quits the spot in a rage, and endeavours to avoid it by galloping away to a distant part of the field, and if the fly still continues to follow and teaze him, his last resource is in the water, where the insect is never observed to pursue him. These flies appear sometimes to hide themselves in the grass, and as the horse stoops to graze they dart upon the mouth or lips, and are always observed to poise themthemselves during a few seconds in the air, while the egg is prepared on the extended point of the abdomen."

Remedies.

Mr. E. Verrill, from whose valuable paper on the external and internal parasites of man and domestic animals, we quote, writes thus :—

The amount of injury caused by the bots of horses has long been a matter of dispute, many writers claiming that they are very injurious, and even at times fatal, while others deny this and consider them as harmless, or even beneficial. This can be definitely settled only by experiment, but most reasonable men would be content to forego any possible benefit and be satisfied with a healthy horse, destitute of bots. No doubt many diseases due to other causes are commonly attributed to these insects, but that they are frequently the cause of serious trouble, is generally believed and admitted. In this instance prevention is comparatively easy, while all writers admit that there is no reliable cure, no matter how much they may differ in other respects. The means of prevention consist chiefly in frequently removing and destroying the eggs, and also in removing and destroying the full grown larvæ when observed attached to the rectum. The eggs being large can easily be seen, and can be removed either by thorough washing and brushing, or by cutting the hairs off with scissors. A wash of carbolic acid soap has been recommended to destroy them. In some countries the grooms frequently wash out the mouths of the horses with a suitable brush in order to remove the young larvæ. Many drugs have been recommended to remove bots from the stomach, but none that do not endanger the life of the horse can be relied on ; and in cases where they bring away the larvæ it is possible that those that are already in the intestines are the only ones affected. Spirits or oil of turpentine is a remedy in common use, but should be used with caution, if at all. A better plan under ordinary circumstances is to keep the horses in good health in other respects, so that they can the better sustain the attacks of the larvæ, until they naturally pass away, which will usually take place without serious injury. In exceptional and severe cases only, resort should be had to special medicines of a dangerous or doubtful character, and then they should be given if possible in accordance with the advice of a competent physician.

No. 2.—The Ox Bot-Fly (*Œstrus bovis* Latr.).

Fig. 29. The Bot Fly. *Œstr us bovis.*

This is a large and handsomely-coloured fly.

M. Joly describes it as having a very hairy body, a large head, the face and forehead covered with light yellow hair, the eyes brown and the antennæ black. The throat is yellow, barred with black, the abdomen of a greyish white at the base, covered with black hair on the third segment, and the remainder of an orange yellow ; the wings are smoky brown.

The fly appears during the summer months, and the female lays her eggs on the backs of cattle. There seems to be a considerable difference of opinion as to the manner in which the egg is deposited. Mr. Bracey Clark holding very decidedly

that the fly does not pierce the skin of cattle with its ovipositor at all, but merely glues its eggs to the hairs, while the grubs, when hatched, eat their way under the skin; while Reaumur asserts, on the contrary, that the mother fly deposits her eggs in the flesh itself. At all events, the grubs are found in large open tumours on the backs of horned cattle, making for themselves, says Reaumur, "a place where food is found in abundance, where they are protected from the weather, where they enjoy at all times an equal degree of warmth, and where they finally attain maturity." Those parts of the animal's body in which the larvæ are lodged can be easily recognized, as above each larva can be seen a tumour or bump, which has been, not inaptly, compared to the swelling produced on the forehead by a smart blow.

In these larvæ we find a double modification of structure admirably in accordance with their habits. Residing immoveably in a fixed spot, they do not require the strong mouth hooks which the horse bot employs to retain it in its station in the stomach, where it is, of course, subjected to a variety of action, the parts of their mouths are therefore soft and fleshy: on the other hand, the extremity of the body being exposed at the orifice of the tumour, it is in this part of the insect that the large spiracles or breathing pores are found. It is, therefore, very essential to the grub that the hole of the tumour should remain constantly open, for by this aperture a communication with the air necessary for respiration is preserved, and the grub is thence placed in the most favourable position for receiving air.

It is commonly on young cattle of two or three years old that these tumours are found, it being very rare to find them on very old animals.

The larvæ when young are white, but become brown by degrees, attaining at maturity a very deep colour. They are furnished with transverse rows of minute hooks, which are probably used in moving about, and are, doubtless, a source of great irritation. The larva when mature is about an inch long. The bumps are scarcely perceptible before the beginning of winter, and the larvæ live in them during the entire winter.

Reaumur tried to discover how the larva, when arrived at its full growth, succeeds in leaving its abode, for the opening of the tumour is smaller than its body.

"Nature," says Reaumur "has taught this worm the surest, the gentlest, and the most simple of methods, the one to which surgeons often have recourse to hold wounds open or to enlarge them. They press *tents* into a wound they wish to enlarge. Two or three days before the worm wishes to come out, it commences to make use of its posterior part as a *tent* to increase the size of the exit from its habitation. It thrusts it into the hole and draws it out again many times in the course of two or three days, and the oftener this is repeated, the longer it is able to retain its posterior end in the opening, as the hole becomes larger. On the day preceding that on which the worm is to come out, the posterior part is to be found almost continually in the hole. At last it comes out backwards and falls to the ground, when it gets under a stone or buries itself in the turf, remaining quiet, and preparing for its last transformation. The skin hardens, the rings disappear, and it becomes black. Thenceforth the insect is detached from the outer skin which forms a cocoon or box. At the front and upper part of the cocoon is a triangular piece which the fly gets rid of when it is in a fit state to come into the open air."

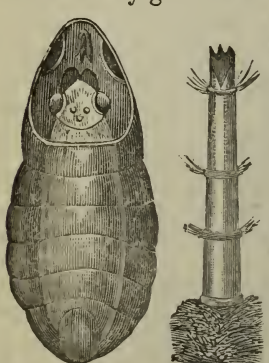


Fig. 30. Imago of bot fly emerging, and ovipositor of female.

Fig. 30, taken from Reaumur's drawings, represents the fly emerging from its cocoon. The ovipositor or instrument by which the eggs are laid is also shown. This instrument, which is attached to the anus of the female, is a tube composed of four pieces which, like the joints of a telescope, are retractile within each other.

Reaumur, whose theory is, as we have seen, that the fly pierces the flesh when depositiug her eggs, states that the act is not attended with much pain unless some very sensible fibres are touched.

"It ought to be remarked," says Rennie, from whom we quote, "that cattle have very thick hides, which are so far from being acutely sensitive of pain that in countries where they are put to draw ploughs and waggons they find a whip ineffectual to drive them, and have to use a goad in form of an iron needle at the end of a stick. Were the pain inflicted by the bot-fly very

acute, it would find it next to impossible to lay thirty or forty eggs without being killed by the strokes of the ox's tail, for though it has been supposed that the fly is shrewd enough to choose such places as the tail cannot reach, Reaumur saw a cow repeatedly flap its tail upon a part full of the bumps, and in another instance he saw a heifer beat away a party of common flies from a part where there were seven or eight bumps. He concluded, therefore, with much plausibility, that these two beasts would have treated the ox-flies in the same way if they had given them pain when depositing their eggs. The extraordinary effects produced upon cattle on the appearance of one of these flies would certainly lead us to conclude that the pain inflicted is most excruciating. Most of our readers may recollect to have seen in the summer months a whole herd of cattle start off across a field in full gallop, as if they were racing, their movements indescribably awkward, their tails being poked out behind them as straight and stiff as a post, and their necks stretched to the utmost. All this consternation has been known from the earliest times to be produced by the fly we are describing.

Virgil gives a correct and lively picture of it in his Georgics, of which the following is a translation :—

> Round Mount Alburnus, green with shady oaks,
> And in the groves of Silarus, there flies
> An insect pest (named *Œstrus* by the Greeks,
> By us *Asilus*) : fierce with jarring hum
> It drives, pursuing, the affrighted herd
> From glade to glade ; the air, the woods, the banks
> Of the dried river, echo their loud bellowing.

We might adduce several other instances of similar terror caused among sheep, deer and horses, by insects of the same genus, which are ascertained not to pierce the skin. It is therefore most probable that the fly terrifies the ox by her buzzing, rather than pains him by piercing his hide, her buzz, like the rattle of the rattle-snake, being instinctively understood, and intended it may be to prevent an over population by rendering it difficult to deposit the eggs.

According to Kirby and Spence, when cattle are employed in agriculture the attack of this fly is often attended with considerable danger, since they then become unmanageable, and whether in harness or yoked to the plough will run directly forward. At the season when it infests them close attention should be paid, and their harness so constructed that they may easily be let loose.

The number of bumps to be found on a beast is very variable. Rennie says that on one cow only three or four bumps may be observed, while on another there may be thirty or forty. They are not always placed on the same parts, nor arranged in the same manner : commonly they are near the spine, but sometimes on or near the thighs and shoulders. The grub being confined in a tolerably large fistulous ulcer, a part of the cavity must of necessity be filled with pus or matter. This matter appears to be the only food allowed for the grub, for there is no appearance that it lives like the grubs of flesh flies upon putrescent meat. Mandibles indeed, similar to those with which other grubs break their food, are altogether wanting. A beast which has thirty, forty, or more of these bumps upon its back, would be in a condition of great pain and suffering terrible indeed in the extreme if its flesh were torn and devoured by as many large grubs ; but there is every appearance that they do not generally inflict much pain. Indeed so far are they regarded from being injurious, that they are looked on as proofs of the goodness of the animal, since these flies only attack young and healthy animals. It is said also that the tanners prefer those hides that have the greatest number of bot holes in them, which are always the best and strongest.

Remedies.

Although these insects do not cause any permanent injury, yet their presence in large numbers may occasion some little inconvenience.

Mr. Verrill states that they can be pressed out of their burrows with the thumb, care being taken not to crush or burst them in the burrows ; or the openings of the tumours may be enlarged with a sharp knife, and then they can easily be removed, and the wound will soon heal.

The flies frequent chiefly the uplands, and especially the vicinity of trees, and seem to avoid water or damp localities, a fact that cattle seem to learn by experience. Owing to this habit cattle that graze on meadows are generally free from them, or nearly so, although those on the neighbouring hills may be attacked.

The Sheep Bot-Fly (*Cephalæmia* [*Œstrus*] *ovis*, Linn.).

Fig. 31.—The Sheep Bot-Fly.

This fly, which is a great deal smaller than the ox-fly, which it somewhat resembles, has a large hairy head, and ash-coloured thorax, with four black lines and small black spots.

The abdomen is light ash, more or less spotted with black. The female has a tapering abdomen, with a long ovipositor, which is curved forward when about to deposit the eggs.

Mr. Riley states that this insect is the dread of sheep, in the Old as well as the New World, and was made mention of by a Greek physician as far back as the year 560.

"Even at the sight of this insect," says Figuier "the sheep feels the greatest terror. As soon as one of them appears the flock becomes disturbed; the sheep that is attacked shakes its head when it feels the fly on its nostril, and at the same time strikes the ground violently with its fore feet; it then commences to run here and there, holding its nose near the ground, smelling the grass, and looking about anxiously to see if it is still pursued. It is to avoid the attacks of the *Cephalæmia* that during the hot days of summer, sheep lie down with their nostrils buried in dusty ruts, or stand up with their heads lowered between their fore legs, and their noses nearly in contact with the ground. When these poor beasts are in the open country, they are observed assembled with their nostrils against each other and very near the ground, so that those which occupy the outside are alone exposed."

According to the generally received opinion, the fly deposits an egg which hatches out and climbs up the nostril of the sheep. Mr. Riley, the State Entomologist of Missouri, asserts, however, that it is now an established fact that the flies deposit *living* maggots, previously hatched in the oviduct, on the margins of the nostrils of the sheep. "On one occasion," he writes, "in 1866 I myself obtained living maggots from one fly, and Mr. Cockrell has since obtained over three hundred living moving worms from one fly that was caught while she was after the sheep. Many flesh flies, if they cannot find suitable meat or carrion on which to lay their eggs, retain these eggs so long in their bodies that they hatch them into living larvæ; and it is not impossible that the above observations were made with flies that had been so circumstanced, but I think it highly improbable, and strongly incline to believe that it is the normal nature of this fly to produce living larvæ. I incline the more strongly to this belief from the fact that it would be difficult to attach an egg to the slimy nostrils of a sheep."

The maggots are deposited during the early summer months, and proceed at once to ascend the nostrils of the sheep by means of the hooks with which the head is furnished, and by these and their continual writhing motions, they cause great irritation in their passage to the frontal sinuses, where they attach themselves to the membranes which line the cavities and feed upon the mucus, which is of course greatly increased by their presence. The larvæ remain nearly a year before reaching maturity. Mr. Verrill states that they cause great inflammation and are present in large numbers, and severe illness, or even at times convulsions and death result. This disease is known as "grub in the head" among farmers.

It has been asserted by many agricultural writers that it is ridiculous to maintain the idea that sheep die from grub in the head, and many even deny that the grub is capable of doing any injury to the sheep whatever, but these assertions Mr. Riley combats most successfully. "If," he writes, "grub in the head be not productive of inconvenience or disease, whence the suffering condition, the loss of appetite, the slow, weak gait, the frequent coughing, the slimy and purulent matter, sometimes so profusely secreted as at times to almost prevent the animal breathing? Whence the tossing and lowering of the head, and the fits of frenzy, to which so naturally quiet and gentle an animal as the sheep

is subject ? All these symptoms result from grub in the head, and the animal frequently gets too weak to rise, and finally dies. The grubs cannot live in the head of the sheep without causing great irritation by the spines with which the ventral region is covered, and the hooks with which they cling to such a sensitive membrane as that which lines the sinuses. Moreover, when numerous enough to absorb more mucus than the sheep secretes, the grubs will feed on the membrane itself, and (according to the evidence of some practical sheep men) will even enter to the brain, through the natural perforation of the ethmoid bone, through which pass the olfactory nerves ; in either of which cases they must cause the most excruciating pain."

When the larva has reached maturity it descends the nostrils of the sheep and falls to the ground, where it finds a place of shelter amongst the roots of grass, or in the earth, and after contracting to half its former size undergoes the transformation into the pupa state. In this condition it is smooth, hard and tapering towards the head, the colour is black. After remaining quiescent from forty to fifty days, according to the climate, the fly pushes open the little lid or cap piece at the head of the cocoon and emerges in the perfect state. It is curious to note that their only instinct is the perpetuation of their species, for the perfect fly has no mouth and cannot therefore take any nourishment. Except when depositing their eggs the flies seem sluggish and inactive. Each female produces several hundreds of young. We may mention as a quaint tradition that the larvæ of bots found in the heads of sheep and goats used to be prescribed as a remedy for the epilepsy. The ancient Delphic oracle advised one Democritus who applied to it, as follows :

"Take a tame goat that hath the greatest head,
Or else a wilde goat in the field that's bred ;
And in his forehead a great worm you'll finde,
This cures all diseases of that kinde."

Whether Democritus was cured does not appear, the story shows however that the ancients were aware that these maggots made their way even into the brain of living animals.

The common saying that a whimsical person is *maggoty*, or has got *maggots in his head*, perhaps arose from the freaks the sheep have been observed to exhibit when infested by these bots.

Remedies.

Various methods of prevention have been adopted. Randall says that "some farmers turn up the soil in portions of their pasture, so that the sheep may thrust their noses into the soft ground on the approach of the fly, while others smear their noses with tar or cause them to do so themselves." "But," adds Mr. Riley, "as the fly is very persevering, and generally attains her object, the means to be depended on the most is, the dislodging of the "grub" or larva and so far lime has been thought to be the most effectual, and should be given them that they may, by sniffing it, cause sneezing, and in many cases dislodge the grub. Some sheep breeders are in the habit of fixing salt logs in their pastures of sufficient length to enable all the sheep to get at them. Into these logs at distances of five or six inches, holes are bored with a two inch augur, and during the fly season a little salt is kept in these holes, while every two or three days tar is smeared around them with a brush. The sheep in obtaining the salt smear their noses with the tar, the odour of which keeps away the flies."

Mr. Verrill states that "when the larvæ have actually entered the nostrils in large numbers, they may be removed to a considerable extent by a feather wet with oil of turpentine, camphor, or a weak solution of carbolic acid or creosote. Salt water or diluted carbolic acid may also be injected into the nose with a syringe. It is doubtful, however, whether any remedies will reach the larvæ which have taken up their abode in the more remote cavities in the bones of the forehead and beneath the basis of the horns ; therefore it is better to apply these remedies early and often, if necessary."

NOTE.—The Council of the Entomological Society of Ontario regret to state that the President, the Rev. C. J. S. Bethune, has been prevented, by severe domestic affliction, from completing his portion of the report in time for publication. It will, they trust, be embodied in that for the ensuing year.