

Mr. Reed was also a constant contributor to the Canadian Entomologist. His articles related chiefly to the Lepidoptera and included descriptions of larvæ, records of rare captures, collecting notes, and popular papers on various common insects. He was equally interested in both systematic and economic Entomology.

Though specially devoted to the study of insects, he was for many years engaged as an amateur in taking meteorological observations. In co-operation with the Observatory at Toronto, he installed the necessary apparatus, using the tower of the Cathedral for his anemometer and vanes, and connecting them with his house which was near by. His records were so accurate and satisfactory that he was selected to take charge of a newly-established Observatory at Victoria, British Columbia, to which place he removed in 1890 and there remained for six and twenty years—respected by all who came in contact with him and beloved by his friends.

During Mr. Reed's residence in London the writer had the pleasure of intimate friendship with him, and often enjoyed his hospitality when attending the Annual Meetings of the Society. He was always an agreeable and sympathetic companion, merry and vivacious, cheerful and happy hearted. Since his removal to the distant Pacific Coast, the friendship has been maintained by correspondence in default of ever meeting; his last letters related to the celebration of the Society's Jubilee, in which he was deeply interested.

C. J. S. BETHUNE.

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## POPULAR AND PRACTICAL ENTOMOLOGY.

### ON THE PORTRAIT OF A WOLF SPIDER.

BY CHARLES MACNAMARA, ARNPRIOR, ONTARIO.

The number of species of insects and their allies in the world is a frequent subject of discussion among entomologists, and it may be remarked that writers differ a good deal on the question. But I have never come across any attempt at a general insect census. Doubtless the numbers are too appalling, and the would-be enumerator must shrink aghast before the frightful superabundance of invertebrate life. To count the stars of the Milky Way would be

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easy compared with numbering these little creatures. If the task were attempted, the ordinary units of our decimal notation would be found useless, and our only hope would be to adopt some vast measure like the "light-years" of the astronomer. But if we cannot even guess at the number of individuals in these lower forms of life, we may at least form some rough estimate of the *relative* abundance of the various orders and like divisions.

But here again there are likely to be decided differences of opinion. There is such a tremendous flow and ebb in the tide of "insect" life—using the term in its wide, popular significance—that it is not easy to infer which kind is really in the majority. Speaking of conditions in this country, the student of pond-life must be persuaded that at certain times of year there are more *Daphnia* and *Cyclops* and other minute crustaceans in his pools than any other form of *Arthropoda* in the district. Again sometimes lepidopterous larvæ, such as the tent-caterpillar and the army-worm, seem to outnumber all other insects. May-flies and grasshoppers also appear on occasion in immense numbers. The minute springtail, too, must not be forgotten, for certain species of this family sometimes emerge in winter in such abundance as to blacken the snow over considerable areas. Mosquitoes are quite as plentiful as anyone could desire, but we are perhaps apt to over-estimate their importance in the numerical scale on account of their obtrusive manners which force them unduly on our attention, and the same is true of the house-fly. But I was long convinced that ants must hold the record for numbers of individuals, for anyone who has collected them must have been struck by their wide distribution and their great abundance. They are to be found simply everywhere: in dense woods, mossy swamps, dry, open fields, rocky hills, and hot, sandy beaches. The sacred dwelling of man himself is seldom exempt. One or other species of the *Formicidæ* adapts itself to these most varied habitats, and flourishes in all.

However, I recently changed my opinion on this point. In the course of a forty-mile drive on the first of October last through parts of the counties of Renfrew, Lanark and Carleton in Ontario, I was fairly astounded at the evidence of the numbers of spiders there must be in the country. Our road lay mostly through culti-

vated land, and everywhere over the tens of thousands of acres we passed were laid the gossamer threads of spiders, so thickly set that I doubt if one could have placed as much as a finger tip anywhere in the fields without touching several strands of the webs. Every tall weed and every fence streamed with the threads, and towards evening the rays of the westering sun were reflected from the shimmering fields like moonlight on a lake. All this was the work of so-called gossamer spiders, formerly thought to be a distinct kind but now known to include the young of many different species. The number of individuals necessary to produce the wonderful effect must have been stupendous indeed, for our drive did not circumscribe the area thus affected, and no doubt the same condition obtained for many miles around our course.

Spiders are always connected in the popular mind with the spinning of webs and snares to catch the unwary fly, but a great many species resort to no such subterfuge. Of course, all true spiders can spin, but many use their silk only for the manufacture of egg-bags or to line their burrows, or as a life-line by which they can drop from danger or save themselves from a fall. Chief among those that spin no web may be mentioned the Attids or Jumping Spiders which leap on their victims unawares; the Thomisids or Crab Spiders that lie in wait in flowers to seize insects that come in search of nectar; and the Lycosids or Wolf Spiders, exceedingly active runners, that hunt down their quarry in much the same manner as their mammal namesakes. Of these three families the Wolf Spiders are by far the commonest, and are found everywhere in great variety. The original of the accompanying "portrait" belonged to a rather small-sized species numerously inhabiting a sandy beach on the shores of the Ottawa River near Arrprior. The claw terminating the palp shows this specimen to be a female, for the palps of male spiders end in a curious knob-like organ. This species, which is a typically swift runner, is thickly clothed with very fine, light brown hair, with darker markings—it might almost be called a "fur"—a coloration well calculated to conceal it in its sandy habitat. Indeed, I seldom saw one of these spiders on my frequent visits to this spot during the summer, but one day in the late autumn I noticed the surface of the beach dotted with scores of tiny heaps of fresh, damp sand. On investiga-

tion each of these was found to close the mouth of a vertical tunnel twelve to eighteen inches deep, at the bottom of which was a torpid spider of this species, evidently retired for the winter. Obviously the spider population of the beach was much greater than I had suspected.

Keeness of vision is as necessary to the wolf spider as agile limbs, and so it is well provided with eyes, which are, too, much better developed than those of the snare weavers that depend largely on their sense of touch to acquaint them of the approach of their prey. Apparently the "Wolf" can see in every direction, above, before and behind. On the front of its head a row of four small eyes surmounted by two larger ones inform it of happenings before it and to either side, while two other large eyes on the top of the head are directed upwards and backwards. The powerful jaws, armed with a pair of needle-sharp fangs, each grooved with a poison duct, are almost hidden by the long hair covering them. She has indeed a repulsive countenance. We are often told of the beauties revealed by the microscope. In this case it is a horror that has been disclosed. But the race is not always to the swift nor the battle to the strong, for with all her panoply, this redoubtable spider was overcome by an antagonist more terrible yet, as I will relate.

One day in early September when seated on a log at my favorite beach, and taking a quiet entomological survey of the surroundings. I suddenly caught sight of an extraordinary many-legged insect buzzing rapidly across the sand towards me. A second glance resolved the anomaly into a digger wasp dragging with it a wolf spider which it had paralyzed with its envenomed sting, and was carrying to its nest to provide fresh food for its future larvæ. The wasp's shallow, sloping tunnel was in the sand close to my feet, and she quickly pulled her prey within. I waited some time in vain for her to emerge, and then dug up the nest. The wasp escaped with a whirr of wings but the wretched spider, although alive, was incapable of movement of any kind, and remained inert in my hand. Commiserating a spider caught at its own rapacious game is something like wasting pity on the incinerated crew of a baby-killing Zeppelin, but I could not help feeling sorry for this erstwhile lightning runner of the sands doomed never to move its swift limbs

again. Here, however, was an excellent and unusual opportunity to secure a photograph of a wolf spider. For the living, uninjured Lycosid is so nimble and nervous that it is a most difficult matter to photograph it successfully, while it is very hard to "set up" the dead spider properly. So I carefully carried my spider home.

Here a few concise, technical notes may be of interest to the photomicrographer. The negative of the accompanying photograph was made with an ordinary whole plate view-camera provided with both front and back focussing. A half plate or even quarter plate camera would have served equally well or better, but no smaller instrument of sufficient extension was available. The lens used was an Aldis photomicrographic anastigmat of 2 in. focus, an admirable little lens of moderate price that can easily hold its own with much more expensive objectives. My camera and object stand is a home adaptation of the swinging frame of the photo-engraver. It consists of a board 4 ft. long by 14 ins. wide swung by cotton ropes at the four corners from two light trestles about 3 ft. high, and is a device I find very useful to avoid vibrations during long exposures.

At one end of the board is a narrow, longitudinal slot, one foot long, through which a bolt with a wing nut fastens the camera firmly at any position along the slot. As the object must be placed very close to a lens of such short focus, if the latter is mounted in a lens board in the ordinary way, the shadow cast by the relatively large camera front is sure to cause trouble. To obviate this I have the lens mounted at the truncated apex of a copper cone, 3 ins. long, the base of which,  $2\frac{1}{2}$  ins. in diameter, screws into a lens flange attached to the usual lens board which fits the camera front. A stand was made for the spider with several small blocks of wood, about 8 in. x 3 in. x 1 in. thick, piled up like steps of stairs. On these, by means of dark-room pins, was fastened a curved piece of smooth, white paper, with its top sloping away from the lens. The middle of the curve formed a little shelf just opposite the lens, and on this the spider was placed. This arrangement offered a plain background, and a shadowless support on which the spider was carefully posed, her limbs and palps being put in position with a couple of botanical needles.

The illumination used was daylight, the whole apparatus having been set up in a large bay window looking north. A camera extension of 18 inches was employed, which, with the 2-inch lens, gave an image enlargement of 8 diameters. The ground glass of the camera is provided with a clear spot in the centre, and on this the image was critically focussed with the aid of a focussing magnifier. The lens was stopped down to f.45 to gain the necessary depth of field, and the required exposure was calculated with a Watkins exposure meter, the normal time, as shown by the meter, being multiplied by the square of the magnification, in this case 64.

The plate was a Wratten & Wainwright backed panchromatic, but as it was used without a screen, any good ortho plate would have given much the same result. It is customary in photographic data to mention the developer, but for ordinary negative work there is no essential difference between the many developers on the market, and one should always use the solution one is accustomed to. Personally, I admit a preference for the well known "B. J." pyro-soda, and with this the spider negatives were developed. Several exposures were made of different views of the spider, and thanks to the excellent lens and small stop, all the negatives turned out so sharp and with such good depth of focus that they can be enlarged to any reasonable size. In fact I have enlarged the "portrait" to 75 diameters, and only stopped at that size for want of a larger sheet of bromide paper. The image would not be unduly soft at 150 or 200 diameters.

The spider proved a most amenable sitter, and would remain motionless for an indefinite time in any position she was put in. But if the poison of the wasp had fettered her limbs, it had not tamed her ferocious spirit, for I can read a felonious glare in those nightmare eyes.

After photographing her, I kept her under observation in a pill box to see if the effects of the wasp's sting would wear off. After about a week the paralysis seemed to be passing, and she began to make a few constrained movements. I hoped, if she recovered, to set her free once more on her native beach. But who can escape his fate? The very steps we take to avoid our destiny lead us irresistibly towards it. This spider's doom was to be eaten alive by a wasp larva, and it found her even in the pill box; my



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intervention availed nothing. One day I opened the box as usual, and to my surprise found therein a small voracious grub which had already devoured about half of the hapless Lycosid. I had carried none of the wasp's nest material from the beach with the spider, and although I am told that these wasps are not known to attach the egg to the food supply, I can only suppose that in this case the egg was in some way fastened to the victim, and when it hatched out the grub began work at once on the food supply provided by the marvellous instinct of its mother. Next day there remained only the scattered legs of the spider, and a couple of days later, the grub itself, pining for the "optimum" conditions of its sandy nest, died also.

### INSECTS IN OCEAN DRIFT.\*

#### I. HEMIPTERA HETEROPTERA.

BY H. M. PARSHLEY, BUSSEY INSTITUTION, HARVARD UNIVERSITY.

Insects cast up by the waves are often found on the shores of bodies of fresh and salt water, as is well known to most collectors. Specimens found in this way are usually few and scattering, and their presence in the water is probably due simply to an unusually venturesome flight which may have carried them too far for a safe return to land. On rare occasions, however, much more extensive flights may occur, with the result that the shipwrecked are cast ashore in unbelievable numbers, sometimes forming a windrow for miles along the beach. This phenomenon is not to be explained in connection with the spring and fall flights when the air seems alive with insects on the wing, as it has been observed at various other seasons, and for the same and other reasons such flights do not appear to be nuptial in character. Sometimes a violent off-shore wind has been held accountable for the presence of the insects in the water, but this explanation will not fit the cases which I have observed; in fact, no satisfactory hypothesis has been advanced as yet. As a knowledge of the species concerned is important in the explanation of insect activity, I append a list of the Hemiptera Heteroptera which I have taken in ocean drift, leaving the list of the other groups for a later paper.

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