SUPPLEMENT TO PSYCHE,—I.

INSECT FAUNA OF THE GIANT CACTUS OF ARIZONA: LETTERS FROM THE SOUTHWEST.*

BY H. G. HUBBARD.

TUCSON, AR., Dec. 24, 1896.

"It is possible with some trouble to reach the nearest of the Giant Cacti (*Cereus giganteus*) on the hills about 2 miles to the south of here. In general there is absolutely nothing to be found on or about these great green posts which rise out of the hard ground like a stone monument in a grave yard, but on one occasion I found a cavity which was fairly alive with a rather large grey-colored Hemipteron (*Narnia femorata* Stal) evidently a plant-feeding species. The same cavity contained fresh seeds of the "Palo verde" (*Parkinsonia*), apparently carried in by a mouse or rat, and among these there were specimens of *Bruchus amicus*. I had also the luck to find one of the great cacti prostrate and entirely disintegrated and reduced to dust by the ants and termites. Under the debris of this I found quite a collection of insects: several pairs of the large Monilema of this region (*M. giganteum Lec.*), and a numerous colony of Lampyrid larvae † and their cast skins, and also the larva of a Collops. There are also numerous fragments of Tenebrionidae (Asida, Nyctobates, Eleodes etc.) and Lamellicornia (Diplotaxis, Listrochelus, Euphoria etc.) under this debris but none of these can be found alive at this season.

TUCSON AR., Dec. 26, 1896.

"Yesterday being Christmas I made an expedition to the nearest hill about 2 miles south of here, and the first giant cactus which I reached proved to be a veritable bonanza. It was a grizzled old trunk some 15 feet in height, and as it stood close to a wood chopper's road it had fortunately been chopped by somebody's axe and had on one side a cavity about as large as my hat. This cavity was partly filled with black rotten material, and I found at the first examination that this debris was literally swarming with insects. The rotting was constantly advanced by great numbers of huge dipterous maggots (*Volucella avida* O. S.), aided by

* These letters were addressed to the undersigned and are now, after the death of the lamented author, published without alterations, except that a number of determinations wherever these were not furnished by Mr. Hubbard, have been inserted. These determinations were made by the specialists attached to the U. S. National Museum. Some of the new species of Coleoptera are described in the Appendix.—*E. A. Schwarz.*

† The imago subsequently bred, proved to be *Lycaina discoidalis* Horn.

several small species (*Ceratopogon*, *Limosina*, *Scatopse*, *Drosophila*), and all parts of the mass were overrun with Coleoptera. The desicated hard part produced two species of small Calandridae (*Cossonus hubbardi* Sz., n. sp, and *Apotrepus densicollis* Casey), and also a few specimens of both Scydmaenidae (*Eumicrus lucanus* Horn) and Pselaphidae (*Tyrus elongatus* Brend., *Trimium puncticolle* Lec.), numberless small Aleocharinae and a few Trichopterygidae (*Trichopteryx*, two apparently undescribed species). The moister parts were alive with Hydrophilidae, both large and small (*Dactylosternum cacti* Lec., *Pelosoma capillosum* Lec., *Cryptoleurum cerei* Schwarz, n. sp.) and small Histerids of various species (*Paromalus opuntiae* Lec., *consors* Lec., *gilensis* Lec., *Acritus arizonae* Horn). There were in numbers two large Styphylinidae, a Philontid with large head and red elytra (*Belonuchus ephippiatus* Say), the other a monstrous Aleocharid, the largest I ever saw (*Maseochara semivelutina* Solsky). Besides these there were countless smaller Aleocharids (*Maseochara opacella* Sharp, *M. puberula* Casey, *Apheloglossa rufipennis* Casey,three or four species of Homalota, a Falagria and an undetermined genus). Among the Dipterous larvae, and apparently feeding upon them, were several perfectly huge Histerid larvae, over an inch long, and to-day on returning I found the imago (*Hololepta yucateca* Mars.) deeply buried in the very heart of the trunk and always in the galleries of the large Calandrid *Cactophagus validus* Lec. Of this Calandrid I have not found the imago, but its larva resembles very much that of *Rhynchophorus cruentatus*. Among other Staphylinidae found in the moister portions of the pulp there are three Tachyporids, one very large (*Physetoporus grossulus* Lec.), and the two otheı rather small (*Erchomus convexus* Er. and *E. punctipennis* Lec.) ; a few specimens of *Xantholinus dimidiatus* Lec., *Lithocharis tabacina* Casey, very abundant, and rarely a species of Omalium (*O. cacti* Schwarz, n. sp.)

I took home yesterday a sack-full of the débris, and all this morning I was occupied in examining it, and every time I opened the sack I found something new. Some of the small Rhynchophora I could not have discovered in the field; they are as difficult to see as a Micropeplus among old leaves, although they are much larger and live in burrows in the hard outer crust. In the dry débris there is also *Ditoma gracilis* Sharp, not rare, *Ditoma sulcata* Lec., common, and a larger Trogositid (*Alindria teres* Melsh.), very rare; there were also a few specimens of a reddish Tenebrionid (*Ulosonia marginata* Lec.) ; a narrow species (*Cynaeus angustus* Lec.), two smaller Hololeptas (*H. cacti* Lec. and *vicina* Lec.), and a minute Staphylinid (*Oligota* n. sp.).

It is very singular that in this fermenting cactus pulp the interior of which was saturated with moisture I

did not find a single Nitidulid beetle either in the larva or adult. Of insects belonging to other orders, there is quite abundant in the pulp of the giant cactus a Forficulid (*Spongophora brunneipennis* Serv.) and two Pseudoscorpions (*Chelifer* n. sp., and *Chelanops* sp.

It is evident that the giant cactus, whenever it is injured, furnishes a retreat and food for a very large fauna of insects, especially Coleoptera. The trouble is to find one which is attacked at all by insects.

TUCSON, AR., Dec. 28, 1896.

I have to add to my last letter an interesting discovery which I made this afternoon in continuing my study of the fauna of the giant cactus. It is stated that a small owl makes its nests in holes which are excavated in the trunks of this cactus by a woodpecker and I have frequently noticed that holes are seen in the trunks 8 or 10 to 15 feet above the ground. To-day I cut down with my hatchet one of these great plants in which was a perforation far above my reach. On examining the fallen trunk I found the hole contained abundant excrement of some bird but no nest. However, there were some curious ticks which remind me of the Ornithodorus of the Gopher tortoise of Florida and which I suspect to be parasites of the bird that made and used the hole. More interesting still it was to find that the hole gave admission to the insect fauna of the cactus, principally to the great Cactophagus larva which ploughs its long galleries into the woody skeleton of the plant and which is followed by the immense dipterous (Volucella) maggots and all the multitudinous insects that follow in their train, among their number perhaps the most important being *Dactylosternum cacti* and its larvae. The depredations of these insects cause the rotting of the cactus especially within the internal bundle of woody rods which alone enables these gigantic plants to uphold their great weight. Even this woody bundle is preforated and entirely blackened and rotted, while the whole interior of the plant becomes a yet black mass of the consistency of soft mud. The cactus thus attacked sends out branches just below the wound in the exterior, and the first result is that the huge trunk breaks apart at that point and the upper portion falls at length to the ground. It is this process that produces the numerous examples of these cacti in which the upper half of the stem is missing, while the older portion supports a number of great branches. Without the intervention of the bird in making its burrow the insect fauna of the cactus could never exist; for no insect can penetrate the tough and silicious rind of the plant. It is most remarkable how quickly the plant repairs a casual wound extending into its pulpy exterior. The wounds made Saturday afternoon with my hatchet are to-day (Monday) so hardened on the exterior that no ordinary insect could effect an entrance. The surface already presents an incipient

crust which ultimately becomes a woody layer one-fourth an inch thick and so hard that it resists the blow of a sharp hatchet and turns the edge of a knife. In the deep holes made by the birds the sunlight and air are excluded, and perhaps the caustic action of the birds' dung keeps an open sore which the fly maggots soon convert into a rotting mass. When one considers the great numbers of insects which are dependant upon this cactus it is not a little remarkable that their existence should depend for the most part, if not entirely, upon the operation of a bird.

I made my first discovery of this fauna upon Christmas day, and being unable to complete my examination in one afternoon I took home with me a part of the disintegrated contents of the rotten spot which formed a hollow that would hold perhaps a half a peck. The next day I revisited this cactus and brought home with me more of the rotten contents, and although I have spent one whole day and two half days in examining this material and picking out the insects in my room I have not yet finished. Of the many thousands of larvae I have secured and preserved a good series. I do not think that in all my experience I have ever found so many different species of Coleoptera in one confined space, and as I have practically examined but a single cavity there is no knowing how many more species remain to be discovered. I have noted 30 distinct species of Coleoptera upon a superficial examination and I know that there are several others overlooked in the mass.

TUCSON, AR., Jan. 3, 1897.

Since I last wrote I have been following up the insect fauna of the Giant cactus. These plants grow only on the rocky hillsides, and although there are many of them in the aggregate they are generally a long way apart, and it requires much climbing over rocks to reach them. Sometimes there is a family of them together, but they are more often many rods apart. The trouble is to find one in good condition for insects. I find many of them prostrated either by the prospectors searching for ores or by the wind but not one in several square miles is in the right condition, and I believe it takes a year for them to rot or dry up. Most often they are too old, and inside the split and hardened skin is only a mass of black dust and a great bundle of wooden rods. I have sifted these dry interior contents but found only the elytra of *Cactophagus validus* of which I have full grown larvae from the heart of the cactus. I will come upon the living imago some day. I found lately a huge trunk, cut down and partly rotten and filled with countless myriads of Staphylinidae, large and small, the little Histeridae, the Hydrophilidae, large and small, with Pseudorcorpions and flies by the millions. There will be fifty species at least of this cactus fauna; unfortunately some of them are extremely rare or hard to find in the swarming mass of small Staphylinidae. The most difficult to secure are the minute and very rare Pselaphids, Scydmaenids, Trichopterygids etc. These are found in the half dry parts on the edges of

the putrescent mass, but the skin of the cactus toughens in drying and has to be cut apart with an axe, and of course in such violent handling all the fine things are lost. I have secured some of these small species in one or two specimens; one of these is an *Holoparamecus* (*H. pacificus* Lec.). Of the two species of Trichopteryx mentioned before I have a fair series. Yesterday, there turned up in considerable numbers a small, shining brown Cryptophagid (*Ephistemus cactophilus* Sz. n. sp.), very similar to that we found at Crescent City under decaying weeds. The minute new Oligota with red elytra was also very abundant. There is further a great Staphylinid, a most beautiful fellow, with the body blue black except the two last segments which are bright orange (*Xanthopygus cacti* Horn). It is as wild as *Listotrophus cingulatus*. I have found it twice and got three or four specimens each time.

My most interesting discovery in the giant cactus is contained in some pieces of cactus pulp which I mail with this, nearly dry and quite hard. These came from a cavity in a giant cactus which had been excavated by birds. In these hardened crusts which were hanging in the cavity like bits of dry meat, there breeds a most marvellous Scolytid beetle of a genus quite unknown to me, with a long horn on the head of the male. This horn is double but united until near the extremity where it is parted and the tips are oddly pointed (*Cactopinus* n. g., *hubbardi* Schwarz n. sp.) I notice that in the mature specimens the horn projects forward but all immature males have the horn curved back over the thorax. I have taken about 300 specimens, also larvae, but it took an entire day to get them out. I never saw them before, although I have examined crusts from many holes.

The fact is there must be a certain amount of moisture in the crusts; if the pieces are stone hard as they usually are these Scolytids cannot excavate. A cavity in this condition does not occur very often, and I do not feel sure that I shall ever find the like again. It is for this reason that I took a good supply of this Rhinoceros Scolytid of the Giant Cactus. In these or similar crusts I find occasionally the small Calandrid *Apotrepus densicollis*, difficult to see in the débris by reason of its dark color and rough sculpture. I have the larvae of that also. There is finally a small red, hairy Clerid larva penetrating these crusts and feeding upon the larvae of the Scolytid but I have not yet found the imago.

I find also that the flat Opuntias (*O. engelmanni*) on the hills near the giant cacti sometimes have rotten hearts in the main stem filled with the large Volucella larvae, *Belonuchus ephippiatus* and the Aleocharinae of the giant cactus. I even found *Hololepta yucateca* in one such stem, and perhaps the larger part of this fauna may be found in such places.

TUCSON, AR., Jan. 15, 1897.

Yesterday the sun came out between

clouds, and I seized the opportunity to get up in the hills among the giant cactus. I found a mountain side covered with cacti of the utmost variety with the Giant Cereus by thousands. There were, however, few of the latter with large cavities, and it was only after prolonged search that I found one immense fellow the lower three feet of which was entirely dead, even the heart and all around, but this part was quite dry, and the skin hung in patches upon the wooden axis. Only a small corner was wet and putrescent, and this presented in part the usual fauna but nothing new. *Physetoporus grossulus* was especially abundant. There was one specimen only of *Xanthopygus cacti*, and of course I secured that. It is strange that there were no Rhynchophora in this stem, and the upper part of the latter with three huge branches was quite sound and still alive. I saw two other plants of the giant cactus still standing although quite dead and dry. I sifted the debris of one of these in the hope of finding Pselaphids but there was nothing but a few Poduras and Forficulas. There must be a fatal rot, which, like a tuberculosis, entering at some woodpecker hole lays low these giants. Evidently they take years in dying. There is a large yellow Polistes (*P. flavus* Cr.) which hangs its comb in some of these cavities, and I find not seldom the hibernating wasps. Besides the *Narnia femorata* mentioned before, several other large Heteroptera (*Sinea raptoria*, *Diplodus luridus*, *Dendrocorus contaminatus*, *Brochymena obscura*) are found hibernating in these cavities and some of these are probably feeding on cacti later in the season. I also found a colony of termites (*Termes flavipes*?) burrowing in the hard crust of the cactus in a woodpecker hole.

TUCSON, AR., April 22, 1897.

The entire mesa at the foot of the Sta. Catalina Mountains near Sabina cañon, about 18 miles northeast of Tucson, is covered for miles and miles with immense giant cactus, in one unbroken army, as thick as mullein stalks in an eastern cattle pasture. Out of these thousands of cacti I did not discover a single plant that was diseased or rotting, and only near the camp a few of the trunks had been overturned. This seems to me to indicate great longevity in the Cereus since among so vast an assemblage many dead and dying plants would be found if their period of life was not a long one. Also I think it gives weighty evidence as to the correctness of my surmise that disease and rot in this plant is started chiefly by the disorganization produced in the woodpecker holes by rain water acting on the dung of animals that lodge in these holes. In this vast forest of stalwart plants, woodpecker holes are of course comparatively rare since the plants outnumber the woodpeckers of this region very many times. Around Tucson where the cacti are far less abundant on the hill sides, a great many of the trunks are pierced with holes, and a comparatively large proportion die of this black rot, which

is aggravated by the attacks of insects. I have reexamined some of the fallen trunks which I visited last January and found several that were affected by rot and which had been cut down since I visited them at that time. The usual fauna was there but in less variety than I expected to find, and of the rarer species I did not observe a single specimen. I have reason to believe that when this black rot is once started it progresses quite rapidly and in the case of a fallen trunk it soon completely takes possession. On the other hand many fallen trunks not affected by the rot remain alive and sound for very many months and perhaps for one or two years, even if they are cut or split badly in falling, as is generally the case on stony hillsides. I visited one trunk which I myself had cut down in January last and which I had chopped and hacked into the very heart with a hatchet and in numerous places. The wounds which I had made and the deep splits made by the rocks among which the giant trunk had fallen, were all scarred over and cicatrized without a sign of decay, and not a single insect had effected an entrance. The flesh remained sound and fully alive.

TUCSON, April 29, 1897.

I examined the other day a big cactus trunk which I cut down and thoroughly inoculated with cactus rot when I was here before. This was the famous trunk with a rotten cavity from which I got my first introduction to this fauna on Christmas day. I found the trunk almost entirely consumed by the rot with which I had infected it. Other trunks which I had cut down about the same time without inoculation have not rotted and are still sound and green. This large rotten trunk is now in excellent condition and full of insects but they are for the most part of the commoner species only. *Belonuchus ephippiatus* was very abundant and also the smaller Maseocharas, *Hololepta yucateca* and the Hydrophilids. The large *Maseochara semivelutina* was not common as imago but its larva was there in considerable numbers. It is probable that many other species are now in larva also and the imagos are not common at this season. I found in this trunk, in the half dry flesh of the still standing stump, an abundance of *Apotrepus densicollis*, and among them I secured two more specimens of the new Cossonus; also *Alindria teres* and *Ulosonia marginata*, and finally a new member of this fauna, a small species of Platydema (*P. inquilinum* Linell) apparently undescribed and probably identical with the species I found in the nests of the Dasylirion rat (*Neotoma albigula*).

TUCSON AR. May 13, 1897.

Some of the Lampyrid larvae which I took in January from old and dry trunks of *Cercus giganteus* and which I kept alive ever since are now beginning to transform to greenish pupae, and one of those has disclosed the imago which proves to be *Lycaina discoidalis*. The other day I found a fresh

colony of the larvae in the same trunk and also a good series of imagos. Some of my larvae kept since January have shed so many skins that they are now only half the size they were at first. While I do not suppose that this Lampyrid is absolutely a cactus insect, it is as much so as many of the Staphylinidae. As I wrote before I have the larvae of *Maseochara velutina* or *opacella*; they are running free among the swarming insects in the rotten pulp, and I see no evidence of their inhabiting the puparia of the Volucellas.

The other day I tore to pieces a cactus stump that had rotted and dried up, and inside I found several cocoons of the large weevil *Cactophagus validus* that had no exit holes. I cut into one with my knife and found to my great surprise not only the chitinous fragments of the weevil larva but also about 90 specimens of a Colydiid beetle (*Bothrideres cactophagi* Sz. n. sp), all imagoes and all dead and more or less mutilated. Among them were 5 or 6 skins of a dermestid larva (*Attagenus hornii*) with a long thin pencil of hairs at the tail and long yellowish pubescence on the sides and beneath. There was no trace of the larva of the Bothrideres. I found on close inspection a small ragged hole at one end of the cocoon sufficient to pass out or in a Dermestid or Colydiid beetle. Another Cactophagus cell opened by me contained 55 species of the Bothrideres, a third 76 specimens, and still another cell contained a dead and moldy larva of the Cactophagus and only one dead imago of Bothrideres. Not a single specimen of Bothrideres in the whole lot is perfect. I would like to know what these Bothrideres are doing there in such numbers, as if they had been caught in a trap and died there.

APPENDIX.

Description of New Species of Coleoptera.

BY E. A. SCHWARZ.

Cryptopleurum cerei, n. sp. (family Hydrophilidae.)—Broadly oval, convex, shining, sparsely pubescent above, piceous black, antennae, palpi and legs pale testaceous, elytra either entirely or only at apex reddish. Head finely and rather sparsely punctulate, second joint of maxillary palpi moderately thickened at middle, not inflated. Thorax, when viewed from above, with the sides not rounded but obliquely narrowing from base to apex; the inflexed portion separated from the dorsal surface by a distinct ridge; angle of the true marginal line slightly behind the middle; base not margined; surface rather sparsely but evenly and finely punctulate, inflexed portion smooth. Elytral striae rather fine, not strongly punctured, distinctly impressed apically, less distinctly so toward the base, the two inner striae very fine, very finely punctulate and not impressed from the base to the middle; intervals flat, sparsely and finely punctulate. Prosternal area nearly opaque, moderately finely and quite densely punctulate; mesosternal area much longer than in *C. americanum*, coarsely but not very densely punctate; metasternum