SCARABS

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WITHIN THIS ISSUE....

Highlights of My Incredible 2,200 Mile Collecting Expedition for *Polyphylla*, Where I Collected One Specimen of *Polyphylla arguta*

by David Russell

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Construction and Deployment of an Inexpensive Light Trap

Part 1. Construction

by Delbert La Rue

In my pursuit of southwestern Scarabaeidae, I found it productive to construct and deploy a number of light traps which utilize a 15-watt blacklight tube as the attractant. For those unfamiliar with the method, the "classic" trap consists of a 15-watt blacklight tube suspended vertically between three or four flight intercept vanes. This unit rests on a large funnel attached to a bucket (Fig. 1). Simply stated, the beetles are attracted to the light source, bang against the vertical vanes and fall through the funnel into the bucket below. The hole in the bottom of the funnel is small enough so that it is virtually impossible for the beetles to fly out, thus, they are trapped. Easy enough?

Granted this method does not yield much in the way of biological information. It does, however, confirm the existence of a particular species in a given area (and to what extent), and will also be of valuable assistance in populational and faunistic surveys.

Keep in mind that there are probably as many variations of light trap construction as there are described *Serica* species. Since I and other workers in the Scarabaeidae have had great success with this method, I offer below my particular mutation which has worked extremely well and provided hundreds of specimens.

Part two, to be in *Scarabs* #11, will discuss trap deployment, which will include field set-up, maintenance, and troubleshooting.

It is hoped that this presentation will create a diversion so as to alleviate some of the disparagement that Dr. Evans, Ph.D. has received from his "Scarabs of California" checklist (C'mon, *Polyphylla arguta* in California??? Pleocomi**dae**??? Say it ain't so, Ma, say it ain't so!).

What You Will Need:

TOOLS

• Power drill with phillips-type screw driver bit, (and if drainage holes are preferred, the "appropriate" size drill bit - discussed in Section 1.)

• Tin snips (I use 14" red-handled Weiss; a saber saw with metal cutting blade could also be used. ALWAYS USE EYE PROTECTION!)

• Two or three "C" Clamps (preferably spring-type, although screw-type will work; vice grips will also do the job. A pair of "extended-jaw" type will be useful.)

• Household scissors

• Caulking gun

• Utility knife

• Large compass, or circle template

MATERIALS (for construction of one 15-watt trap)

• One piece 2 foot x 2 foot square, 26 or 28 gauge galvanized sheet metal (readily available at roofing supply houses, or in the roofing section of your neighborhood home center; if the optional rain hood is desired, get two pieces of the same dimensions)

• One piece 18 x 24 in., 1/8-inch thick, clear acrylic ("plexiglass")

• One piece at least 3 inches x 6 inches, approx. 1/16-inch thick, styrene (available at craft or hobby supply stores)

• One 15-watt AC or DC blacklight tube and ballast assembly (for hardwiring procedures see *Scarabs* newsletter #1 for DC, #3 for AC)

• One 2, 3.5 or 5 gallon bucket (each size will work)

• One 1 gallon plastic container with screw-on lid (used to store condiments, relishes, mayonnaise, mustard etc.; available at sandwich shops, delis, etc. for the asking)

•One package 12-inch nylon wire ties

• "Handful" #8 x 1/2-inch (or smaller, if preferred) self-tapping sheet metal screws

• One tube all-purpose sealant

Construction is Only Two Steps! (plus a few substeps)

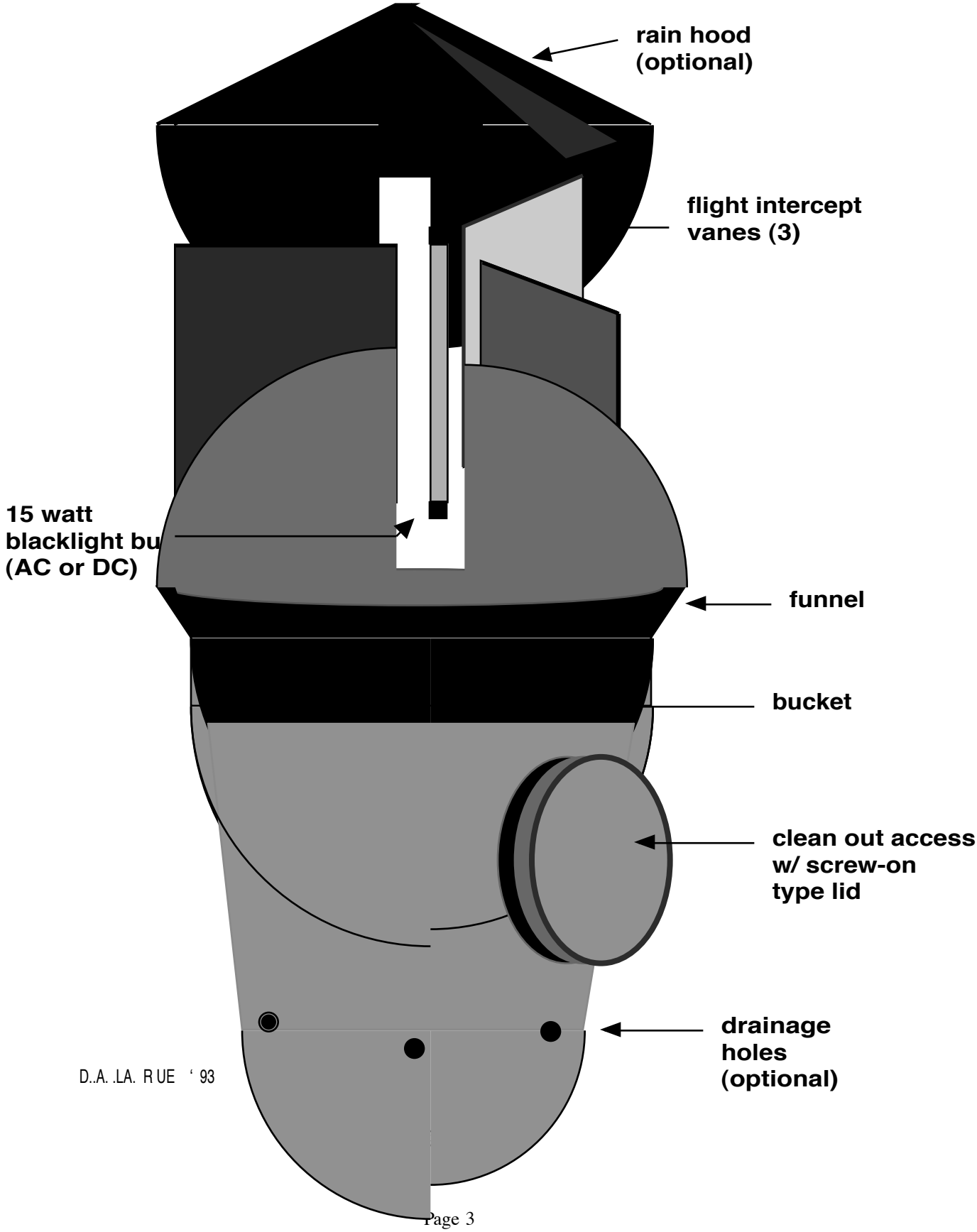
1. Begin with the construction and assembly of the funnel. To construct the funnel, I use 26 or 28 gauge galvanized sheetmetal. Anything of a lighter gauge, in my opinion, is too flimsy, and anything heavier is too hard to work with. Galvanized material is essential to prevent rust and prolong longevity of the trap. I suppose some type of pre-manufactured funnel in any of a variety of materials could be utilized, but I opted for making my own since it was cheaper. On the piece of 2 x 2 foot square sheetmetal, mark the exact center by scribing a line diagonally from corner to corner. Next, mark the circumference of a 24-inch diameter circle, and a three-inch circle using the same center point. With tin snips, or saber saw with metal cutting blade, cut out the larger 24-inch circle and save the scraps. Cut along one of the remaining diagonal lines to the center and remove the area of the three inch circle. Remember how we made those paper pilgrim hats at Thanksgiving in elementary school? That's right, overlap one end of the diagonal cut over the other and, "wah-lah," a funnel. Form a cone of approximately 16 to 18 inches diameter and clamp the top and bottom. A clamp with extended jaws works well here, because you can clamp and secure the center. Using a power drill and self-tapping sheet metal screws, secure the sheet metal to form the funnel; four to six screws evenly spaced apart will hold it adequately for our needs.

Obtain a bucket of whatever volume you prefer. I use a 2-gallon size, though the 3.5-gallon size may seem about right to you. Five-gallon buckets, in my opinion, are too tall and cumbersome. If you desire drainage holes, decide what diameter opening will best fit your needs. Remember, take into account the size proportion of the beetles that you plan to pursue. If need be, you could affix a small piece of fine screen material outside the bucket to keep the tiniest of beetles from escaping. I learned that lesson the hard way: In a trap I had set up to attract *Pleocoma*, I drilled holes of 9/16-inch. Now, to paraphrase one Arnold Schwartzenegger, "Big mistake." Upon checking the trap a few days later, I found a mass of beetle remains with all the heads missing. What happened was the drainage holes were just wide enough for the beetles to squeeze their head and part of the pronotum through and, evidently, birds, or some small rodent enjoyed quite a feast; it must have resembled one of those games at Chuck E Cheese. You'll also need the plastic condiment container with a screw-on lid which will be used as access to service the trap without disassembling, or uprooting, the entire unit. I prefer the screw-on type lid as opposed to the snap-on variations that you might find since the screw caps are far more secure. Remember, coyotes, foxes, skunks, etc. may also be interested in your quarry, and the snap-on lid could be popped off fairly easily, opening a virtual Pandora's box. The brilliant idea of a service access was "borrowed" from Alex Reifschneider, Los Angeles, CA. Here is where it gets confusing: first, cut the top of the condiment container about three or four inches down from the top and discard the remainder. Using a pair of household scissors, cut the raw edge of the condiment container to match the exact contour of the bucket exterior. Patience and trial and error work best here. Take your time. Once the lid assembly fits fairly close against the bucket without any large gaps, cut a round hole, about four or five inches in diameter, on the outside center of the bucket. With a caulking gun, put a fairly heavy bead (1/2 inch) of all-purpose sealant in the same configuration as the lid assembly around the hole that you cut in the bucket side. Still with me? Slowly press the container top w/lid into the sealant and allow to dry overnight. An alternate idea: Alex Reifschneider simply made several cuts along the bottom of the container top, bent these back, and riveted the whole unit to the side of the bucket. Pretty slick. If you decide to use the sealant method, don't skimp on the quality and price of the sealant that you purchase. Some of the cheaper house brands will not hold up under everyday climatic conditions no matter what the label or salesman says. I have had satisfactory results using Red Devil Clear.

2. Now, to make the flight intercept vanes: divide the 18 x 24 inch clear acrylic sheet into three equal pieces each measuring 8 x 18 inches. Other materials can be used for the flight intercept vanes: sheet metal, thin plywood, styrene, etc. Remember, to cut the acrylic, it's best to score both sides several times with a utility knife, then, holding the acrylic between your thumb and index finger on either side of the score line, snap it apart. Use a straight edge to score the material so that your finished edges will be clean and sharp. Any rough edges can be smoothed out with a piece of coarse to medium grit sandpaper. I understand that acrylic can also be cut with a saber saw, though I have never attempted it with such thin, brittle material.

On the piece of 3 x 6 inch styrene, cut out two circles, each with a diameter of three inches. Here is where it gets confusing and tedious: in the center of the three-inch circles remove a one-inch hole. This one-inch hole is just about the same

BASIC COMPONENTS OF A LIGHT TRAP



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diameter as the blacklight tube which will be inserted here later. I found tube diameters vary slightly, so this will be another trial and error fit. The disk should fit snugly on the glass portion of the tube, about 1 1/2 inches from either end. This will leave you with two pieces of styrene in the shape of a doughnut (as in Fig. 2). Divide the circumference of each circle into thirds and mark; at each mark, along the outer margin, use a sharp utility knife to cut narrow rectangular notches of about 1/2-inch length. The width of these notches will be the same thickness as the acrylic flight intercept vanes that you made above (1/8-inch). So cut a notch, and then test fit one of the vanes for a snug fit. Again, patience and trial and error are your best tools here. You will also have to make a small notch, approximately 3/16 x 1/8 inch, on the one-inch inner circle as well. NOTE: All notches must be in the

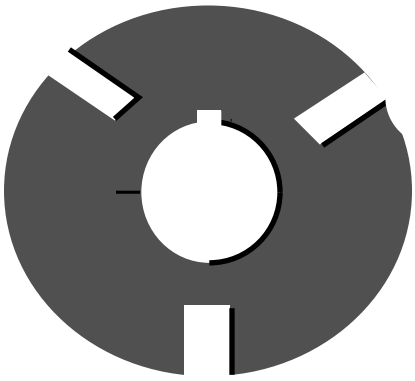


Figure 2.

exact place on both styrene disks (again, refer to Fig. 2). Now, the moment of truth: with your blacklight tube already hardwired (per *Scarabs* newsletter #1 or #3), slide the first disk onto the tube all the way down to the opposite end, about 1 1/2 inches from the bottom. The small notch you made on the inner circle will accommodate the wiring that should run along one side of the tube. Slide the second disk onto the tube about 1 1/2 inches or so from the top. Make sure the three notches you cut on the outer perimeter of the disk and the inner notch for the wiring all line up exactly. Insert one acrylic vane into each set of outer notches, at the top and bottom; put a small dab of all purpose sealant where both surfaces meet and allow to dry thoroughly. Use two or three small nylon wire ties to tidy up the wiring running along side the tube, between each disk. Use scissors or bull nippers to remove the excess nylon tie. Still with me? You're almost finished.

As I've said, the rain hood is optional. If you wish to construct one, it is the same procedure as in the funnel construction in Section 1. The only differences are a shallower funnel with a diameter of about 21 inches, and no center hole removed. The rain hood attaches to the top of the acrylic vanes with pieces of sheetmetal bent at 90 degrees (made from scraps from the funnel construction) and at an angle equal to the pitch of the hood, and secured with sheet metal screws. However you choose to connect your ballast assembly to the blacklight wiring is up to you of course. I usually run 12-inch nylon wire wraps through holes to secure the ballast housing under the rain hood, out of the elements. You could also utilize several types of wire connections, and simply plug both sections together, with the ballast assembly and power source in a remote container. Since I generally use several all-weather extension cords in additional to a myriad of timers, I wanted to eliminate as many connections as possible, thus, hopefully, eliminating the chances for electrical failure because of faulty connections or short circuits caused from moisture penetration.

There are innumerable (and easier) variations to light trap construction, and the above scenario is what has worked best for me. Perhaps the presentation of these musings will coerce other collectors to share their variations as well. Perhaps, once the novelty of "matrimonial bliss" subsides with Mr. Reifschneider, even he will share some of his trap construction techniques with the readership.

Lower Scarabs and Substrates

by Barney D. (Dead-Inside) Streit

Editors Note: Because this piece contains trivia and wild, unfounded postulations, Rich and Bill, who consider themselves legitimate coleopterists, demanded Barney take the entire blame. While collecting in the Algodones Dunes near Glamis, California on March 29, 1991, Rich Cunningham and I collected nearly two dozen specimens of *Pachyplectrus laevis* LeConte (Hybosorinae). They were found by searching the surface of the dunes at night.

It seemed unusual that the specimens of this seldom-collected species were found only in depressions left by dune buggy tires. Despite extensive searching in adjacent areas, no specimens were found on the smooth, undisturbed sand. It was not evident what was going on. Were the beetles simply disturbed by the vehicles, then emerged up through the tire tracks? Was a visual stimulus involved? In the moonlight, perhaps the depressions created shadows which simulated something (detritus?) to which the beetles would be attracted. Perhaps the depressions acted as simple pitfall traps.

A nice series of *Bolborhombus parvulus* Cartwright (Geotrupinae) were reportedly taken by unknown collectors at light on October 4, 1991 at La Burrea, Baja California. There were MV and BL lamps in several spots, connected by long extension cords from two generators. Strangely, almost all of the specimens were taken at two lights set on a sandy section of an open dirt road.

On March 29, 1992, six specimens of *Bolbocerastes regalis* Cartwright (Geotrupinae) were dug from burrows on a dirt road in the Yuha Desert of Imperial County, California. The road was sandy, and a vehicle had traveled it fairly recently. Five specimens were collected on a strip of road about 100 yards long, with another specimen taken several hundred yards up the road. Despite much searching, no burrows were located in the open desert floor.

What is going on here? It appears there may be a connection between the substrate and many of the more primitive (lower) scarabs. However, if there is a relationship, it may not hold true for all populations. For example, on the same trip which the *Pachyplectrus* were taken, we collected *Bolbocerastes regalis* about four miles west of the dunes. About half the specimens were collected at light. The specimens dug from burrows seemed to be located randomly over the desert floor, unlike the Yuha series. This is probably the result of a uniform sub-

strate. Further, the substrate was more of a fine, compacted, sandy loam.

It will be difficult to establish just what that relationship between bug and substrate is until we learn more of the life history of these beetles. The *Bolbocerastes* appeared to be in "resting burrows," but this is not known for sure. If the beetles from the Yuha Desert were simply "bedding down" for the day, why were they so particular about where they dug in? In no instance was more than one beetle found in the burrow. The beetles were found head down in moist sand. No evidence of any food material of any sort, including fungal mycelia or plant detritus, was found.
The assumption that all *Bolbocerastes* we dug from the ground were in so-called resting burrows (as opposed to nesting burrows) is strengthened by the fact that specimens attracted to blacklight, if left undisturbed, scurried off the sheet and dug a burrow with a push-up identical in every respect to the burrows in which we had collected specimens. Evidently, these beetles expend considerable energy to simply protect themselves from predators and moisture loss while in a quiescent state.

Why no burrows were located on the desert floor at this spot is a good question. We know that moisture is a triggering mechanism. Spring rainstorms activate these beetles. After the ground dries out a bit, the surface is left with a thin, crusty top. It was thought that perhaps the atmosphere above a disturbed dirt road has a slightly higher humidity because this crust has been broken. This appears unlikely because push-ups were later located in areas that had not been recently disturbed.

In his 1955 paper "Biology and Taxonomy of North American Beetles of the Subfamily Geotrupinae with Revisions of the Genera *Bolbocerosoma*, *Eucanthus*, *Geotrupes* and *Peltotrupes* (Scarabaeidae)," Henry Howden makes several references to substrate. Two criteria for suitable substrate are mentioned several times: open and sandy. It seems we have accumulated very little new biological information on these groups forty years after this original research was done. If anyone out there has any notes, or even shreds of evidence, send them in!
I will note here that this paper is an absolute "must have" for any serious worker in the Geotrupinae, especially the North American taxa. In my opinion, it is written in a wonderfully entertaining style while presenting much new data and research.

Editors Note: To quote a former presidential candidate, "...a large sucking sound, directed to the northeast, was reported by residents of Upland, CA as this paragraph was written."

Information on the habits of fossorial Scarabaeidae is fragmentary at best, or nearly non-existent at worst. If any of you have any collecting notes or observations, please send them to me at the address listed on page 1. Any notes will be published here at a later date, and will be much appreciated.

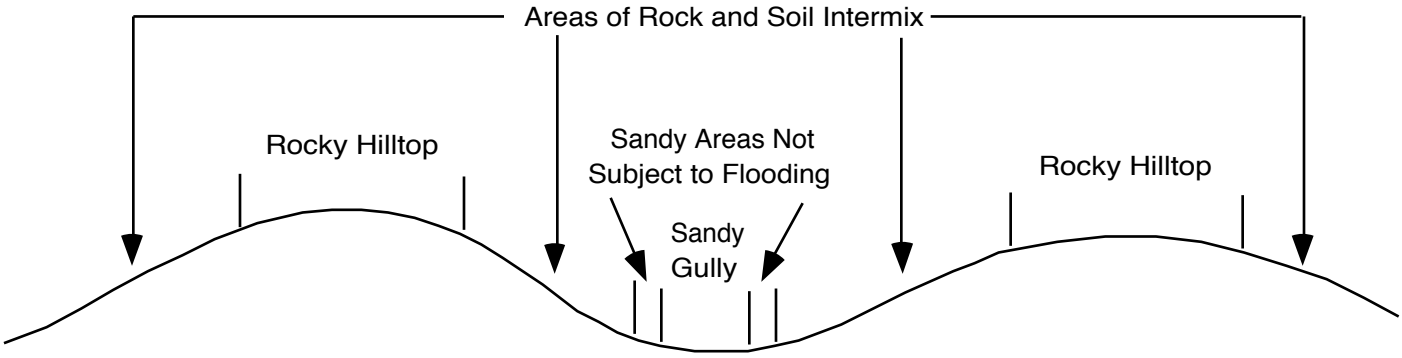
Collecting Hint

Bolbocerastes regalis burrows are relatively easy to distinguish. They may be readily located by looking for a push-up of soil. The push-up may be of variable size. The specimens collected in 1991 (a drought year) were in vertical burrows under tennis ball-size push-ups. The 1992 (a wetter year) specimens were under smaller push-ups, about golf ball size. One push-up was the size of a quarter. The shallower burrows were presumably because the damp sand was closer to the surface.

Bolbocerastes push-ups consist of distinctive ropes of soil approximately 3/8" wide. If you see a hole in the push-up, forget it—you are too late! This is an exit hole. We have dug up many of these and we have never once struck pay dirt. Next, wipe the push-up away with your hand. If you see a beetle-sized hole (3/8-1/2") going straight down, you are in luck.

The larger push-ups indicate the beetle is perhaps 12-15" down. Smaller push-ups suggest the beetle is only about 6" deep. It is best to dig a hole next to the burrow with a narrow-bladed shovel, then dig out your buried treasure.

On March 7, 1992, the Yuha Desert was again investigated with the idea of searching for open, sandy areas, then looking for the beetles. It had rained there recently, and three additional specimens were collected at the area previously mentioned. A long walk along the same road produced no specimens. The desert adjacent to the road where the beetles were found was again carefully searched. No push-ups were found,



Yuha Desert

Figure 3.

despite the presence of several sandy gullies. Sandy streambeds yielded negative results as well. Other roads with ideal-looking habitat produced no push-ups. One road had a small, open, fan-shaped sandy area next to it with three *Bolbocerastes* in burrows not ten feet from each other. Another road produced an isolated seventh specimen in a sandy area. Figure 3 on the previous page depicts the typical rolling-hill habitat of the Yuha Desert. *Bolbocerastes* were found in sandy areas adjacent to gullies which were high enough not to be subject to periodic flooding, or in high sandy areas.

Because these beetles have never been seen in streambeds or gullies, perhaps a third criteria should be added to sandy and open: that being areas of ground that are not subject to periodic flooding. A fourth criteria may be bare ground, with little or no plant growth, but this will require more research to verify.

On March 13, 1992, a third visit produced another aggregation of *Bolbocerastes regalis.* This one was larger than the others found so far, but almost every burrow found was open, with no beetle. All burrows were off the road in desert that had been disturbed by grading sometime in the past. In other words, open, with the sand possibly slightly more compacted. In several instances, three or four burrows were within a circle of six inches in diameter. It is possible that these burrows were exit holes of siblings.

Some specimens were teneral (distinctly yellowish) while others appeared older. The sex ratio of the specimens both dug out and collected at light was approximately 1:1. A mercury vapor light was set up on a high pole with a regular blacklight placed near the ground. It was warm, clear and still that night, yet initially no *Bolbocerastes* arrived at the sheet. After a couple hours several specimens did fly in.

In the early part of this year, several push-ups with adults under them were marked. On a trip back to the locality six months later, in September, the area was inspected. One marker was located and excavated. No sign of any burrow was evident. At a depth of three feet, the sand was damp, but noticeably warm to the touch. At a depth of five feet, the sand temperature felt neutral to the touch. The sand seemed loosely consolidated. It would appear that if larvae were located in the areas of adult push-ups, they must be very deep. If this is true, then it seems likely that the adults must provision the burrows, unless subterranean fungi occurs at depths beyond five feet.

This assumption was strengthened by an observation by Ron Alten. He related that adult *Bolbocerastes* he collected in Wonder Valley, San Bernardino County, California "reeked" of creosote smell. Indeed, *Larrea tridentata* seems to be a common denominator to all *Bolbocerastes* localities. Rich and I collected a large series one night in Nevada. About the only plant present was *Larrea.* When curating the specimens, we noticed that parts of *Larrea*, either leaves or flower petals, were compacted into the pronotal concavities of several individuals.

Why Do *Bolbocerastes* Possess Pronotal Concavities?

If form follows function, then one must assume than the pronotal concavity must be present for a reason.

The pronotal concavity is behind the anterior-most part of the beetle. Thus, I assume it is not used for digging. Indeed, one would think a smooth, evenly convex pronotal surface would promote optimum digging efficiency in a fossorial scarab. It seems most likely that the concavity is used like the concave blade of a tractor, except vertically. The adult beetles might be using this morphological character to direct food material (or perhaps just sand) along the burrow. The *Larrea* parts observed in this concavity may simply be coincidental. I cannot imagine *Larrea* parts getting stuck in the concavity as the beetle dug out of the burrow because there is nothing the push against. In all likelihood the fragments were caught in the concavity as the beetle burrowed downward.

If directing larval food-source material down a burrow is a function of the concavity, then both males and females may participate, since both have this feature.

Why Are Bolboceratini Globular?

Beetles of the tribe Bolboceratini are truly amazing for their round, ball shape. Again, if form follows function, what bizarre, arcane activity are these beetles engaging in that necessitates this incredible body shape?

A little philosophy: as with most things mankind does not understand, the most likely explanation is most often the most mundane and simple one. This is no exception. I believe these beetles are round for efficiency in turning around within their burrow, and nothing more.

Strongly fossorial in behavior, these beetles would be at risk from predators if they pushed the dirt out of their burrows, exited the burrow, turned around and went back in. To avoid this, they no doubt turn around under the push-up without leaving the burrow. At the bottom of the burrow, they obviously dig into the burrow bottom, and again turn around 180 degrees. This would be easy for them because of their body shape. Once this is accomplished, they can push the dirt plug through the burrow, where it takes on its ropy shape due to the compaction effect of the beetle pushing it.

A Biography of Henry Walter Bates

In the previous issue of *Scarabs*, we announced the reproduction of color facsimiles of the *Biologia Centrali-Americana* series. With this, it seems appropriate to publish the biography of Henry Walter Bates, who penned the Cerambycidae, Bruchidae; Cicindellidae, Carabidae and Scarabaeidae, Lucanidae, Passalidae volumes. Without a doubt, Bates was one of the great entomologists of the nineteenth century.

This piece was originally published, under copyright, by *The Entomologist*, Vol. XXV., April, 1892. No. 347. The *Biologia Centrali-Americana* series had just commenced publication at the time of his death. Thus, the author had no historical perspective when he wrote this piece, and mentions the *Biologia* in passing. The editors of *Scarabs* are indebted to Mr. G. G. Bentley, Registrar, Royal Entomological Society, London, England, for granting us permission to reproduce this biography in its entirety.

HENRY WALTER BATES, F.R.S.
(With Portrait.)

Henry Walter Bates, whose name is known over the wide world as that of the author of the 'Naturalist on the Amazons,' was born is Leicester, 8th February, 1825: he must have developed very early a taste for Entomology, for when only seventeen or eighteen years of age he published notes on Coleoptera in the 'Zoologist.' His natural taste was spurred by the spirit of emulation that so often moves young collectors. Edwin Brown was a neighbour, and somewhat a senior, and Bates was wont in after life to relate the determined efforts he made as a young man to find some of the rarer or more interesting species that his friend had secured.

Bates came of a mercantile family, and was himself destined for a career of this nature; but about the year 1845 he made the acquaintance of Alfred Russel Wallace, who was then an English master in a school at Leicester, and who was interested in Botany. Bates appears to have enlisted the interest of Wallace in the cause of Entomology, and, as we learn from Wallace himself, "the latter at once took up beetle-collecting, and after he left Leicester, the following year, kept up an entomological correspondence with his friend. Two years later, Wallace proposed a joint expedition to Para, in order to collect insects and other natural objects, attracted to this locality by the charming account of the country in Mr. W. H. Edward's 'Voyage up the Amazon,' a choice confirmed by the late Edward Doubleday, who had just received some new and very beautiful butterflies collected near the city of Para. The two explorers sailed from Liverpool in April, 1848, in a barque of 192 tons burthen, one of the very few vessels then trading to Para, and the results of the journey are well known to naturalists. They made joint collections for nearly a year while staying at or near Para, but afterwards found it more convenient to take separate districts and collect independently."

In 1848, as stated by Mr. Wallace, Bates arrived in the Amazons Valley, and in 1849 a series of letters from him commenced to appear in the 'Zoologist.' These letters are very interesting read-

HENRY WALTER BATES.

BORN, 8th FEBRUARY, 1825.

DIED, 16th FEBRUARY, 1892.

Aged 67 years.

LOVED AND RESPECTED.

ing. In those days steam travelling had not been commenced on the Amazons, and penetration far up the river was a matter of considerable difficulty. Moreover, the means at the disposal of the explorer were very small; he had in fact to support himself as he went on by the sale of specimens in Europe. Hence it is no wonder that he became somewhat disheartened; and we find from the letters in the 'Zoologist' that after he had been two or three years in S. America, he had determined to return to England. He did not do so, however, until the year 1859, fully eleven years after his arrival in S. America. During this period he underwent many hardships, and displayed much self-denial, his expenses, as he tells us in the letters we are drawing from, amounting to only about two pounds per month. Notwithstanding the difficulties he experienced, he persevered resolutely in the formation of collections of zoological specimens, and discovered a very large number of new species. The "exquisite pleasure," as he himself said, "of finding another new species of these lovely creatures supports one against everything." He also wrote several papers while traveling that were published in Europe, one among them being a very important contribution to the Natural History of the White Ants. How many species Bates actually discovered will probably never be known, as some portions of his collections have not yet been worked out. It was, however, stated in the five years from 1851 to 1856 he met with 5860 species of insects.

On his return to this country, Bates commenced the working out of his collections in an energetic and thorough manner. He published papers on various orders, but his attention was at first chiefly given to the Lepidoptera, especially to the butterflies. Thirty years ago the knowledge of butterflies was much less advanced that it is at present, and Bates contributed greatly to its progress by making a more satisfactory classification of the Rhopalocera than the one then in vogue. The system thus introduced by Bates still forms an important part of rhopalocerous taxonomy. It was, too, at this period that he published his famous paper in the 23rd vol. of the 'Transactions of the Linnean Society' calling attention to the resemblances between different species of Lepidoptera, and in fact founding the theory of Mimicry. When he had completed his work on the Butterflies, he parted with the material he had accumulated, selling it to Messrs. Godman and Salvin, of whose unrivalled collection it still forms an important part. In 1864, Bates became Assistant-Secretary in the Royal Geographical Society, and continued in this post to the great advantage of the Society till the time of his decease. This position he obtained, not by his own seeking, but on the suggestions of the prominent men of the Society; and he accepted it, I believe, only after his services had been rejected by the officials or rules of the British Museum.

After his appointment to the Secretaryship, his entomological work was necessarily curtailed. But he occupied himself in his leisure with diligent and detailed work at the Coleoptera, and described a very large number of new species of Cicindellidae, Carabidæ, Lamellicornia, and Longicornia. During the thirty-three years that elapsed between his return from the Amazons and his decease he became widely known as an entomologist, and his personal acquaintances amongst entomologists of repute were probably more numerous than those of any other individual. He was twice President of the Entomological Society of London.

As may well be expected, Bates was thoroughly appreciated by the Geographers. Lord Aberdare, an ex-President of the Geographical Society, has expressed the following true judgment about him:—"He was one of the rarest characters I had ever known. Considering the vastness and variety of his knowledge, it was astonishing to find a man so gifted, with such entire self-effacement and modesty. You may well believe that the office President . . . . is not merely difficult, but impossible without the assistance of the standing officials; and in Mr. Bates I found not only an ardent follower of knowledge, but one of the most sagacious of men. He knew men as well as he knew the butterflies, to seek which he made his acquaintance with the Amazons. He was a great reader of human nature, but he was more than that. We all of us in the course of our lives, I hope, have met many men who have commanded our respect, and also our regard: Mr. Bates was something more than that. It was impossible to associate with him without feeling not only regard, but personal affection."

Bates' magnum opus, 'The Naturalist on the River Amazons,' is known to all of us; its key-note is a profound love of nature, its mode of expression, simple truthfulness; that it should be permanently popular is a credit to our nation. Some have expressed a regret that, since his paper on Mimicry, he has favoured us with no further wide generalisations or ingenious suggestions. The reason of this is not perhaps far to seek. In one of his Presidential addresses to the Entomological Society he commented on the absence of generalisations from the works of descriptive entomologists, and attributed it in part to their knowing how immense is the work to be accomplished, and what comparatively small progress they have made with it. "Thus," he says, "our best working entomologists are led to abandon general views, both from lack of time to work them out, and the consciousness that general views on the relations of forms and faunas are liable to become soon obsolete by the rapid growth of knowledge." Thus there can be little doubt that Bates restricted his own work of late years to descriptive Entomology, because he felt that it is at present the form of entomological work that has most permanent utility.
The portion of the vast order of Coleoptera that was most carefully scrutinised by Mr. Bates was doubtless the Carabidæ. After the completion of his volumes of the 'Biologia Centrali-Americana,' he devoted considerable time to the development of an improved classification of his favourite family, and we may be allowed to indulge the hope that, when his entomological papers are examined, this one may be sufficiently far advanced to justify its publication. Some few months ago he was attacked by an aggravated form of the gastric catarrh from which he had suffered for many years, and when he became the victim of an attack of influenza and bronchitis he speedily succumbed. It will be long before death takes another entomologist who will be so widely and sincerely regretted as Henry Walter Bates. - D.S.