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in return for a copy of his late work, in two volumes, "Monographie des Phytophages," and also proposing an exchange of Coleoptera of North America for those of Europe.

From M. Fischer de Waldheim, dated Moscow, 1st May, 1849, acknowledging the reception of his notice of election as a Correspondent.

Mr. Cassin called the attention of the Society to the specimen of *Anas Rafflesii*, King, (Jard. and Selby, Ill. Orn. n. s., pl. 23,) presented this evening by E. Pilaté, M. D., of Opelousas, La. This, Mr. C. stated, is the first instance of the capture of this species within the limits of the United States, to the fauna of which it is an addition of the highest interest.

Dr. Pilaté, who obtained the present specimen in the neighborhood of his residence, represents it as the only one which has come under his observation. To this gentleman, who is ardently devoted to the study of Ornithology, the Academy is highly indebted for this valuable specimen.

August 28th.

Vice President MORTON in the Chair.

The Committee to which was referred the paper of Dr. Savage, on the Driver Ants of West Africa, reported in favor of its publication in the Proceedings of the Academy, with some additional observations by the Committee, suggested by the specimens sent by Dr. Savage with the paper.

The Driver Ants of Western Africa.

By THOMAS S. SAVAGE, M. D.

These remarkable and interesting insects have been, till quite recently, without their place in our systems of Natural History. Occasional, but very imperfect notices have been given from time to time of Smeathman and Afzelius to the present, of one or two annoying features in their economy; but till now, no regular description either of their entomological character or habits.

In 1845, the author of this article, after a series of observations, sent, in compliance with a promise, a detailed account of their habits, with numerous specimens, to J. O. Westwood, Esq., Secretary of the Entomological Society of London.*

Mr. W. dissected with that minuteness and accuracy for which he is so remarkable, individuals of the three classes into which they had been divided, and published the results with illustrations, supplementary to the account, in the Transactions of the Society.

The insect in its perfect state had not then been discovered. Neuters with larvæ and pupæ only were sent. The former only (neuters), it seems, arrived in a state for examination. This is the more to be regretted, since, soon after sending his account to London, the author left the locality for his health, without the prospect of returning.

* See Vol. 5, First Part, Transactions of London Entomological Society, for remarks of Mr. W., and the account of the habits of the insects, more in detail.

The statement in the *account* that the insect was without eyes, (*i. e.* the neuter,) was confirmed by Mr. Westwood, which fact renders certain features of their economy the more remarkable.

Mr. Shuckard gives, in the *Annals and Magazine of Natural History*, London, a new species of the Formicidæ, on which he founds the genus *Anomma*. To this Mr. Westwood assigns the Driver of West Africa, and describes it as a new species under the name of *arcens*, in allusion to the remarkable habit which has gained for it the significant name of *Driver*.

Since his communication to the Entomological Society of London, the author has discovered a second species, which he denominates the *Red Driver*, a description of which follows that of the black species.

Description.—Family Formicidæ (*Leach*); Genus *Anomma* (*Shuckard*).

Species 1. ARCEUS (Westwood).

Neutr.—Nigra, subnitida; antennis (articulo basali excepto), coxis, geniculis, tarsisque piceis; capite plus minusve oblongo-quadrato, in individuis maximis postice magis angusto, margine postico emarginato; clypeo, inter basin antenarum, bicarinato; antennis impressionibus duabus insertis, 11-articulatis; oculis obsoletis; mandibulis elongatis, gracilibus, falcatis, ante medium dente majori alteroque pone medium plus minusve distincto, interstitio serrato; maxillis labiis duobus apicalibus, externo ad apicem setoso; palpis maxillaribus brevissimis, et, ut videtur, 3-articulatis; labio magno carnosio striato, palpis labialibus longitudine labii 2-articulatis, thorace e segmentis duobus longitudine æqualibus constanti, prothorace infero, lateribus dilatatis tamen supra visis; meso-thorace antice latiore, meta-thorace parum compresso utrinque spiracula instructo, apice recte truncata; abdominis pedunculo elongato utrinque versus basin tuberculo minuto instructo; segmento sequenti pedunculo latiori semi-ovali, reliquis parum constrictis.

Long. corp. lin. 1½–5.

Habitat in Africa occidentali tropicali.

In Mus. Westw. Acad. et Nostr.

This species was captured at Cape Palmas, Lat. 4° 26' N., and is to be found throughout the West Coast; Cape Palmas, however, and a few hundred miles east and west, being its proper locality.

Species 2. A. RUBELLA, Savage.

Neutr.—Rubra, subnitida; antennis, coxis, geniculis tarsisque rubris, versus marginem diaphanis.

Long. corp. lin. 1½–4.

Habitat in Africa occidentali tropicali.

In Mus. Acad. et Nostr.

The neuters of *A. rubella* are less numerous than those of *arcens*, and, generally, of a smaller size. The mandibles are less falcate and pointed: their habits the same.

This species I discovered in the Mpongive District, a section of the west coast on the banks of the Gaboon river, near the Equator.

Habits—They are exceedingly ferocious. They have no permanent dwelling place, but wander about in search of prey. Shallow cavities and crevices in rocks, are adopted as their temporary habitations. The deepest cavity for this purpose discovered, did not exceed two feet. The interior exhibits no mechani-

cal contrivance for the depositing of food, or hatching of eggs; for these purposes, spaces between the stones, sticks, &c. found within, are adopted.

This absence of mechanical arrangement in their dwellings accords well with their known predaceous habits.

Their sallies are usually made towards night, and in cloudy days. Should they be detained abroad till late in the morning of a sunny day, they construct for their protection against the heat, arches over their path, of earth, agglutinated by a fluid secreted from their mouths. Should their course lie through thick grass or projecting substances, the arch will be wanting, or more or less imperfect, depending on the degree of shelter thus afforded.

That this arch is designed to protect them against the heat, may be inferred from its absence in cloudy or rainy days. Such is their extreme sensitiveness, that, when exposed to the direct rays of the sun, especially if the heat be increased by reflection from surrounding surfaces, they expire in the space of two minutes. Even with the arch, when far from their domicile, they will retire in the middle of the day to the thick grass, and there regale themselves in the shade till the decline of the sun, when their work is renewed with characteristic vigor.

In migrating, protection is afforded to their pupæ and young, by an arch constructed of the bodies of the larger class, or soldiers. Their mandibles and legs are so curiously locked and intertwined, that a complete and formidable covering is presented; at such times individual soldiers will be seen on the outside, acting as guards and scouts, while others of the same class are within, apparently performing the part of superintendents and commanders. In case of alarm the arch is instantly broken, and the soldiers are seen running about in the most confused and hurried manner, with their jaws extended and antennæ working in all directions, thus presenting a highly angry and ferocious aspect. Should the alarm prove false, the victory be won, or danger passed, the arch is quickly renewed, the main column brought again to order, and their march resumed in all the regularity of intellectual, military discipline. Their paths present a beaten appearance, with freedom from all moveable obstructions.

As to their relation sustained to the economy of the community, they may be divided into three classes. It is the office of the first, or largest, which may be called the soldiers, to defend the community, attack and disable the prey. Their mandibles have long and slender points, well adapted to penetrate, and by their strongly falcate shape, to hold fast the objects of attack.

The second class frequently act as aids to the first, but their chief office evidently is, to lacerate the prey and reduce it to a portable condition. Their mandibles are flatter than those of the first, sharp, and have their teeth more developed.

The third are comparatively of very small size, and have their mandibles developed in a manner similar to those of the second class. These sustain chiefly the relation of *carriers*, and, perhaps, *with the second class*, may be properly denominated *laborers*. This diminutive size of the laborers is seen also among the Termites, or White ants, while the soldiers are comparatively of gigantic form.

There is occasionally an interchange of offices among these different classes, as when an individual is found inadequate to accomplish his task; but it is very evident to an observer, that in general, they sustain the relation to the community above described.

As soon as the prey is disabled, preparations begin for its transportation. While the class, whose duty it is, are lacerating the flesh, and reducing it to a state proper for removal, others are engaged in clearing a path between the locality and their domicile; the whole under the conduct of individuals of the first class.

This stage of their operations is intensely interesting to the observer. The facility and rapidity with which these little creatures, without the aid of eyes, overcome mountain obstacles, is surprising beyond expression; the greater the difficulty, the greater their effort and perseverance. One is seen dragging along a straw or stick many times his own length and size; another grasping, rolling, then pushing along a stone far exceeding his own weight and bulk, and when his own power is not sufficient, calling in the aid of others, each knowing that a work is to be done, none idle, and every one doing promptly his part. At first, in the preparatory stage, there is apparently considerable confusion, the different classes commingled, running backwards and forwards, and many missing the direct way to their domicile. But soon the soldiers are seen moving about with great activity, evidently bringing the lines into order. After a while they arrange themselves at different distances, on both sides of the path. The laborers are then kept within, in two nearly right lines, one going and the other returning; while on the outside are guards and scouts, intent upon the approach of danger, and ready to give alarm.

The pupæ and prey are carried longitudinally under their body.

Their bite is severe, and differs from that of the soldiers among the Termites^s. The latter work their mandibles, which are flat, in a cross direction, like scissors. The former, with mandibles falcate, round and pointed, work them alternately from side to side, penetrating deeper at each stroke, till they meet beneath the flesh. So tenacious is their hold, that frequently it is broken only by a separation of the head from the body, and even, then the head will often continue to work its jaws beneath the flesh with undiminished force.

The degree of sagacity manifested by this insect in time of difficulty is very great. On one occasion, having been driven from their domicile by the application of fire, they congregated in vast numbers around and on the body of a neighboring tree. From the lower limbs, about four feet high, hung several chains or festoons of these insects, their jaws locked and their legs twined, one with another, till they reached the ground. One of these chains, on my arrival, was in the act of completion. Ant after ant descended gradually, lengthening it out till it reached the broad leaf of a plant (*Canna coccinea*) below. It then swung to and fro, in a breeze blowing strongly from the sea, which rendered it difficult for the terminal ant to secure his hold, and thus complete the desired communication. After a few unsuccessful trials, another ant of the same class (the soldiers) ascended the plant, and taking his stand on the leaf directly under the vibrating column, fixed his hind claws in the leaf, and raising his body on the apex of his abdomen, reached forth his fore legs, opened wide his jaws, and closed in with his fellow from above, thus completing the most curious ladder in the world. Another fact of great interest: should a stream of water of small extent, intercept their course, they will compass it, but if this be difficult, they will throw across a bridge of their own bodies, over which the main column marches with freedom and safety.

Another habit of equal interest may be here stated. A like assertion has been

made of another species of South American Formicidæ, but doubted by some "in-door" naturalist or compiler.

The seasons in West Africa are divided into "wet" and "dry," each making up about half of the year. During the former, violent and continued rains often occur, which, either directly, or from the rapid rise of the river, cause an overflow of the low grounds. As the Drivers delight in rather low situations, usually little above the base of hills, they are often exposed to inundations. In such emergency, they leave their domicils, throw themselves into a rounded mass, deposit their eggs, &c. in the centre, and thus float on the water, till a place of safety is reached, or the flood subsides. Even in situations beyond this overflow, so copious and incessant are the rains at times, that they must be deluged for days in their nests. Under such circumstances, one would suppose that they would perish. Many undoubtedly do, for all communities of animal existences are exposed to casualties. But in this case, as throughout the kingdom of nature, God has most graciously established a system of compensation, illustrating at once the minuteness of his Providence and his benevolence. As he has endowed this insect with a high degree of vitality, so has he given to it great tenacity of life and powers of endurance.

Individuals submerged in water have lived more than 24 hours; and when decapitated, 48 hours! The head separated from the body will bite for several hours after, apparently with as much force as when in all its natural connections.

They are decidedly aggressive in their habits. The dread of them rests upon every living thing. It is a statement literally true, that "they drive everything before them, capable of motion." Their entrance into dwellings is known by the simultaneous movement of rats, mice, lizards, roaches, &c. &c. with which they may be infested. Even man, styled "*Lord of creation*," bows to this, a more numerous foe; for let the Drivers enter one door and he quickly escapes at the other.

So intense is the bite by accumulation, that the largest animal, if confined, is overpowered and destroyed. The dread with which all animals are inspired, of this diminutive creature, may be inferred from the statement universally made by the natives on the coast, respecting their largest serpent, the *Python natalensis*. After disabling its prey by the fearful process of constriction, the Python, it is said, makes a wide sweep in the vicinity, to see if the Drivers are near; should they not be, he returns to the work of engorgement, but if near, he abandons his prey to their more numerous jaws.

Donkeys, on coming to them, crossing the road, will suddenly turn, and throw their rider to one side, and if urged onward will give a leap far over the line.

Dogs, rather than run the risk of a leap, will compass their track by going a long distance round.

The smaller snakes, lizards, &c., are disabled very soon after the attack. This easy victory seems to be accomplished by an early destruction of vision. The mandibles of the Drivers being long and sharp-pointed, penetrate with great ease the membranes of the eye. Domestic animals being generally confined at night, are often destroyed by them.

When they enter a dwelling their movements are characterized with a good degree of order. If they discover prey, they congregate upon it in vast numbers, when they may be easily destroyed by boiling water.

Their ascent into beds may be prevented by putting the feet of the bedsteads into vessels of vinegar, or some other uncongenial fluid. This will be successful

if the rooms be ceiled, otherwise they will drop from above, bringing along with them their noxious prey in the act of contending for victory.

For food they prefer fresh animal, or insectal matter. The larvæ of other insects, and the young of all animals, are obnoxious to them, hence all heaps of rubbish, and hiding places of such prey, when occurring in their route, are carefully explored. Hence, too, the Drivers, when returning from their predatory excursions, afford some of the rarest and finest of the smaller specimens of Entomology.

Newly expressed oils are also favorite articles of food, especially the vegetable, that obtained from the fruit of the *Elais guiniensis*—the Palm oil of commerce.

The Drivers, though often a great annoyance, are not without their uses in the economy of nature. They tend to keep down the rapid increase of noxious insects and smaller reptiles. They consume much dead animal and vegetable matter, which, constantly occurring in tropical climates, vitiates the atmosphere; and, which is not the least important, they compel the inhabitants to observe habits of comparative cleanliness in their dwellings and on their premises, as a filthy town or house is the sure object of frequent visits.

The natives of Africa dread their approach, for being almost naked, wearing a narrow piece of cotton around their loins only, they are the more exposed to their bites; but more especially, say they, "because they deprive us of two things we love most, poultry and sleep."

On the identity of Anomma with Dorylus, suggested by specimens which Dr. Savage found together, and transmitted to illustrate his paper on the Driver Ants. By the Committee to which it was referred.

In the letter transmitting his paper on the Driver ants to the Academy, Dr. Savage says, "In the small vial you will find specimens of *rubella*, with three very large individuals, which I consider the perfect insect. Now here is presented an interesting point of investigation, viz., the true relation of these larger individuals to the Driver ants." These specimens afford a solution to a problem which has engaged the attention of entomologists; namely, the relation of the Dorylides to the Formicidæ, since the large ones alluded to belong to the genus *Dorylus*. They are 13 lines long, and seem to be referrible to *D. nigricans*, and they had cast their wings. There is little to indicate an identity of species between them and *rubella*, as these want the holosericeous surfaces. The color and texture of the head and mandibles agree, however, and the medial and posterior coxæ present a narrow excavation superiorly (for the reception of the femora when elevated,) in place of the conspicuous cup-shaped one in the corresponding limbs of the male. The mandibles in this sex are slender and have the apex incurved, but not falcate, and they are without teeth. The femora are extremely compressed, and the abdominal peduncle is about as wide as the succeeding segment.

There are two forms, both of *arcens* and *rubella*, one of which includes the largest individuals, the mandibles of which are armed with one abrupt, erect medial tooth; the other and more abundant form is variable in size, and the mandibles have two slender teeth directed forwards. The labial organs and maxillæ are alike in both forms of both species. These organs cannot be compared in '*Dorylus*,' because, with the mouth, they are entirely wanting: the margins of the labium and labrum being solidly united.

The circumstances attending the capture of these insects are thus stated by Dr. Savage.

"In the month of April, 1847, I visited the mission of the Am. Board Com. For-Miss., at Gaboon, 15' north of the equator. Walking out at 7 o'clock on a cloudy morning, I saw a column of red drivers crossing the path. They consisted of two lines, as is always the case, one going, the other returning to their domicil. I stopped some time to compare them with the black species which abounds at Cape Palmas and that part of the west coast generally. They were not as numerous nor as large as *arcens*, but equally ferocious and offensive. Their arrangements and movements were the same. I soon discovered within the lines the large insects in question. I was here taken by surprise, as I had observed nothing like them in the economy of the Black drivers. The first idea presented to my mind was, that they were captives, but on observing further, they seemed to be no unimportant members of the community. Within a distance of about two rods I discovered ten of this class. I was soon convinced that they belonged to the drivers, and proceeded to test the truth of the conclusion. I took one or two from the lines to a distance of six and ten feet. They seemed at once to miss their companions, and manifested great trepidation, and made continuous efforts to find a way of return. At last they reached the lines and instantly resumed their places, displaying at the same time decided gratification. Nor were the lines thrown into any confusion by their entrance, as they would most surely have been in case of a foreign insect or body. On further watching their motions, I perceived that they did not continue on with the drivers, but after going a certain distance returned. This they repeated, going and returning. What office they performed I could not discover. My time was limited, not permitting me to trace them to their domicil. It was with regret that I left them; but from the observations made, it was evident that they were members of the driver community. I cannot doubt that they are the perfect state of the insect. Several natives recognized them as insects that flew about, and into their houses at night. This is altogether probable when they first attain their winged state. Similar insects closely allied to *Dorylus*, it is known, fly at night into houses at Cape Palmas, undoubtedly bearing the same relation to *arcens* or the Black driver."

The facts here stated are sufficient evidence that *Anomma Shuckhard* 1840, is another condition of *Dorylus* Latr. 1802, which must take its place among the *Formic-idæ*, agreeably to the views of St. Fargeau. For the sake of convenient reference, we may, with Dr. Savage, regard the larger form of the drivers (*Anomma*) as *soldiers*, the intermediate ones as *workers*, and the smallest as *carriers*.

In the same manner, Shuckhard's view of the identity of *Typhlopone* with *Labidus* is rendered probable, which would require the latter to be placed in the *Formic-idæ*, to which Mr. Westwood has shown that *Typhlopone* belongs. Thus not only will *Anomma* and *Typhlopone* be superseded, but the supposed family of the *Dorylidæ* will be suppressed.*

**Typhlopone pallipes* Hald., 1844, Proceed. Acad. 2, 54, does not belong to this genus, but rather to *Amblyopone* Er., Arch. Naturg., 1842, p. 260, pl. 5, fig. 7: with the characters of which it agrees, except that the mandibles are toothed from end to end, and the antennæ are 12-articulate, instead of 11 as required by his text, although his figure represents 12. The eyes are visible, although small and indistinct.