

**C. Phœniceus.\*** Culmen much arched; commissure arched; upper mandible not as deep as lower, and with grooves forward from the nostril, parallel with the curve of the culmen. Bill whitish-brown. Black patch restricted to the chin, its posterior outline deeply concave.

Crest feathers stiff and compact. No black above, or on lores; crest pure vermilion; rump light vermilion, much lighter than the back, which is without gray edges to feathers. Culmen, .75; gonys, .39; height of bill, .67; wing, 3.50; tail, 3.90; crest, 2.20. *Female.* Lining of wing buff; above ashy-olivaceous, becoming pure ash on head and neck, except their under side. Crest feathers vermilion with black shafts; no red tinge on wings, and only a slight tinge of it on tail. Fore part of cheeks and middle of throat white: rest of lower part deep ochraceous. Black around bill as in male. *Hab.* Northern South America, Venezuela; New Granada.

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## ON THE OVIPOSITION OF THE YUCCA MOTH.

BY PROF. CHAS. V. RILEY.

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To complete the natural history of *Pronuba yuccasella*, a description of the method of oviposition is necessary. In a former article on this insect occur the following sentences:—

“For want of sufficient time, I have been unable to catch the moth in the act of oviposition; but from careful examination, I am satisfied that the eggs are not deposited on the outside of the fruit. They are either thrust into it from the side or from the stigmatic opening, following, most probably, the course of the pollen tubes. I strongly incline to the latter view, for, though many Lepidoptera are furnished with extensile ovipositors, which enable them to thrust their eggs into crevices and other orifices, I know of none which actually puncture, nor have I been able to discover any trace of punctures leading to eggs.

Neither have I been able to discover the egg *in situ*; which is not to be wondered at, however, as when examined in the female abdomen it is found to be long, narrow, soft and flexible, and of the exact color of the flesh of the young fruit. The ovipositor is so very fine and extensile that it may be thrust into the most minute and narrow passage.”

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probably from latitude 20° as far at least as Nicaragua. North of 20°, and on the Tres Marias Islands, it is replaced by var. *igneus*, and on the Atlantic coast, from Tampico south to Honduras, is represented by the var. *coccineus*.

In the very long, stiff crest-feathers, and light red rump, this variety of *C. Virginianus* closely approximates to *C. Phœniceus*, but in other respects is very distinct.

\**Cardinalis Phœniceus* (Gould) Bonap. P. Z. S., 1837, p. 111; Consp., i, 501.—Scalzer & Salvin, Ex. Orn., Pt. viii, 1868, pl. xliii.

Analogy has proved an unreliable guide in this instance, as, indeed, it often does in natural science; while the curious ♀ *Pronuba* adds one more to the anomalies which belong to her. She *does puncture* the young fruit and convey her eggs into it from its side.

The yucca flowers are fully opened and perfect during a single evening and night only, and it is during this, the first night of blooming, that eggs are consigned to the somewhat prismatic pistil. The pollen grains are not so often expelled, to fall on the inside of the flower, as I had been led to suppose; but almost always remain in an entire lump on the contracted and curled anthers. The moth, consequently, has no difficulty in accumulating her little load of pollen, for a single anther furnishes nearly the requisite amount.

Once equipped with this important commodity, she may be seen either crawling over or resting within the flower. From time to time she makes a sudden start, deftly runs around and among the stamens, and anon takes position with the body between and the legs straddling some two of them—her head turned toward the stigma. As the terminal halves of the stamens are always more or less recurved, she generally has to retreat between two of them until the tip of her abdomen can reach the pistil. As soon as a favorable point is reached—generally just below the middle—the lance-like sheath of the ovipositor, which consists of four converging, corneous bristles, is thrust into the soft tissue, held there a few seconds while the egg is conducted to its destination, and then withdrawn by a series of up and down movements. So intent is she upon this work that after the ovipositor once penetrates the pistil the whole perigon may be detached, some of the encumbering petals and stamens removed, the insect brought within the focus of a good lens and all her movements observed to the greatest advantage, without disturbing her. In this way I have been able to watch the consignment of hundreds of eggs, and to admire the delicacy and elasticity of the ovipositor proper, which issues from the setaceous sheath in a silk-like thread, almost invisible to the naked eye and as long as the terminal abdominal joint; and which stretches and bends according as the body is raised or lowered.

No sooner is the ovipositor withdrawn into the abdomen than the moth runs up to the top of the pistil, uncoils her pollen-bedecked tentacles, thrusts them into the stigmatic opening, and

works her head vigorously as I have previously described—the motion being mostly up and down and lasting several seconds. This carrying of the pollen to the stigma generally follows every act of oviposition, so that where ten or a dozen eggs are consigned to a single pistil, the stigma will be so many times be-pollened. The ends of the tentacles, which are most setose and spiny, and which are always curled into the pollen-mass when not uncoiled, must necessarily carry a number of pollen grains each time pollination takes place; and I have noticed a gradual diminution in the size of the collected mass, corresponding, no doubt, to the work performed, which is indicated by the rubbed and worn appearance of the individual—the freshest specimens always having the largest loads.

While oviposition is generally followed (and not preceded as I formerly supposed) each time by pollination, yet the former sometimes takes place twice, thrice or oftener without the latter being performed; and I suspect that the converse of this is equally true.

Although often marking the exact point at which the puncture was made, it is so very fine and the fruit tissue so soft and succulent that I never succeeded in tracing the passage to the locus of the egg until I dipped the pistil in ink. If carefully done, without bruising the surface or allowing the ink to run in at the stigma, the fruit, by this operation, will be discolored only where the ink has followed the recent puncture, which may then be traced by means of a lens; though by extraordinary practice and manipulation it might doubtless be traced under the microscope, without such aid. The egg is very narrow and elongate, soft, flexile, rather translucent, pointed anteriorly and of the exact color of its surrounding. It lies curved in the ovarian cavity, always on the rounded side next the primary dissepiments (in the cases I have noticed) and with the anterior end for the most part close to the placenta. These facts are best ascertained a day or two after the fruit is plucked, when, in the ink-dipped specimens, a sunken black cicatrice forms around the mouth of the puncture, and the ovarian cavity enlarges by the shrinking of the adjoining tissues. I have little doubt but that the egg increases in bulk before hatching, under the influences of impregnation and endosmosis, and Dr. Engelmann tells me that he has been able to trace the embryo larva under the extremely delicate egg-covering and to observe it curled up at the anterior end of the egg which greatly enlarges.

This larva hatches on the fourth or fifth day after the laying of the egg, and usually commences feeding between two ovules, which, in consequence of its action, swell abnormally. Thus in making a longitudinal section of the fruit these swollen ovules often indicate the presence of the worm where it would otherwise be overlooked while very small.

While oviposition generally takes place in the manner described, the moth head outwards and straddling two stamens, an entirely opposite position must sometimes be assumed, since larvæ and punctures are not unfrequently found in the upper part of the fruit, especially where a single one is stocked with ten or a dozen larvæ, as is sometimes the case.\* As the fruit enlarges, the mouth of the puncture forms a slight, discolored depression, more noticeable in some varieties than in others; but the passage-way becomes obliterated.

My observations this summer might be extended much in detail. They have convinced me more than ever that *Pronuba* is the only insect by the aid of which our yuccas can be fully fertilized; for I have studied this fertilization diligently night after night, without seeing any other species go near the stigma. The stigmatic opening closes after the first night and I know of no crepuscular or nocturnal species which could collect the requisite amount of pollen and bring it so to bear on the stigma that each ovule would receive the influence of a pollen grain. The species already enumerated† as frequenting yucca are mostly diurnal and have nothing to do in the work; and wherever I have excluded the moth from the flowers, by enclosing the latter with netting, no fruit has been produced. I am therefore led to believe that the few rare instances of yucca-fertilization, in localities where *Pronuba* may be presumed not to occur, have been brought about by another insect accidentally, or by the stamens reaching an exceptional length, and the anthers being brought into contact with the stigma by the coniving of the closing petals. I have found the stamens of varying length in the flowers on the same panicle and in some instances almost as long as the pistil.

It is my intention to obtain a large number of cocoons this year and it will give me pleasure to distribute them among those who

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\* I have counted as many as twenty-one larvæ in a single capsule of what is apparently *Y. flaccida*.

† Trans. St. Louis Ac. Sc., iii, No. 1, p. 59.

grow the yucca in those parts of this country or in Europe where seed is not produced. The cocoons will be best sent in early spring and should be buried three or four inches beneath the soil at the foot of the plant.

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### REVIEWS AND BOOK NOTICES.

PREHISTORIC RACES OF THE UNITED STATES.\*—Had the so-called Indian never existed in North America, it would, we think, have been a more satisfactory undertaking to endeavor to solve, from existing data, the mystery of that forgotten people of this continent, now known as "Mound-builders." Careful as one may be, it is impossible to avoid uniting the traces of the two people, especially when describing stone implements, while professedly treating of but one of these races. Even among the many relics of the redman found in the Atlantic states, there are frequently gathered single specimens, that seem applicable to the mound-builder rather than to the Indian; so, judging from relics of this character only, there seems to be a closer tie between the two peoples than the learned author of the volume before us is disposed to admit. Such is the impression made by a careful perusal of that portion of the work which describes the stone implements found in and near the earthworks referable to the mound-builders; and it is the copper weapons and pottery that distinguish this people, studied only by the smaller relics that are found; for no stone implement occurs in the mounds, or is otherwise assignable to the mound-builders, that is not also characteristic of Indian "finds." When, on the other hand, we familiarize ourselves with the wonderful mounds, for temple sites, for sacrifice and sepulture, and with the long lines of an enclosure for defence and other purposes, then indeed, we see abundant reason for drawing the lines between the people who erected them and the ruder redmen; and admitting that "a broad chasm is to be spanned before we can link the mound-builders to the North American Indians."

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\* Prehistoric Races of the United States of America. By the late J. W. Foster LL.D. Chicago, S. C. Griggs and Co. 8vo, cloth. pp. 415. Illustrated.