NOTES ON DINAPATE WRIGHTII HORN (COLEOPTERA: BOSTRICHIDAE).

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The recent publication of a paper on *Dinapate* by Michelbacher and Ross (*8*) reminded the writer of some data in his own files. The present paper was largely written in 1930, and laid aside in the hope that further data would be obtained.

Since the discovery of the beetle *Dinapate wrightii* Horn by W. G. Wright and its description by Horn (*5*)[1] in 1886 several papers have appeared, each containing biological notes as well as collecting data, and each contributing a few facts to our knowledge of its life history and habits. These scattered papers were brought together in 1922, by Comstock (*2*), who quoted largely from the more important contributions up to that time and gave an excellent summary of the facts then known concerning the life history, habits, and distribution of the insect. The beetle is found boring in the fan palm (*Washington filifera* Wendl.) in the canyons on each side of the Colorado Desert, Calif. (formerly the upper end of the Gulf of California), and at least as far south as Catavina, Lower California, about 300 miles south of Palm Springs, Calif. The comparative inaccessibility of its habitat, the extreme size of its host, and its nocturnal habits all make the beetle difficult to observe in spite of its large size; and its roving disposition seemingly precludes the possibility of rearing it under ordinary artificial conditions. For this reason the biological notes in all the published papers are fragmentary. The present paper is no better in this respect, but certain hitherto unrecorded facts have come under observation and are here offered as a contribution to our more complete knowledge of the insect.

The distribution of *Dinapate* is not well known. The type material probably came from Palm Canyon, in the mountains on the northwestern border of the Coachella Valley near Palm Springs, Calif. The beetle also occurs in Murray, Andreas, and Taquitz Canyons, which are in reality branches from the Palm Canyon wash, and in Chino Canyon farther to the north. It is said to occur at Seven Palms, on the eastern edge of the valley, northeast of Palm Springs. It has been taken by the writer at Thousand Palm Canyon, almost due east of Palm Springs, and it was taken by W. Benedict in the hills northeast of Indio, approximately 5 miles south and 17 miles east of Palm Springs, on the eastern border of the valley. It is said also to occur in the canyons opening into the Borego Valley, some 40 miles south of Palm Springs. Hubbard (*6*) spoke of its presence in Lower

[1] Reference is made by number to the list of references cited.

California, but this seems to have been surmise only, one that was justified by the recent finding of the beetle by Michelbacher and Ross (*8*). There are no geographical barriers of importance and, according to Goldman (*4, p. 316, pls. 106, 107*), there are three species of *Washingtonia* palm indigenous to Lower California, as well as one or two closely related species any or all of which might serve as hosts for the beetle. In looking through the literature one gains the impression that this once extremely uncommon insect is becoming more abundant. In Palm Canyon, for example, Hubbard (*6*) in 1897 experienced great difficulty in finding a properly infested trunk. He apparently did not observe any exit holes in the living trees, and, writing on March 13, 1897, says "I am sure now that they [the beetles] do not oviposit in bare trunks or in healthy trees, although it is possible that the beetles kill the tree in which they oviposit.

In 1917, however, Garnett (*3*) notes that "A great many of the standing trees have exit holes visible in them, but usually only two or three per tree, most of them situated within ten or twelve feet of the ground, although a few were noted near the tree crown."

In May of 1928 young palms were not uncommon in the canyon, and these all appeared to be healthy, but almost all the older trees showed exit holes in the 10 or 12 feet below the crown, some of them seeming to be pretty well riddled, although still alive.

From 1917 to 1930 the beetle assumed the proportions of a minor pest in the village of Palm Springs. A number of large palms have been transplanted into the village and these were, of course, somewhat weakened in the process. In 1917 Wymore (*9*) wrote that 90 per cent of these trees had been injured by the attacks of the beetles, and that some of them had died. These trees have been attacked every year since that time. I have myself seen the results of the attacks of the beetles upon these trees, and have heard several accounts of attempted control. The most popular method of control employed about 1928, was to climb up to the bud with a ladder, clear the frass from the burrow with a wire, and pour in water. The beetle soon backed out and was killed by pulling off its head and thorax. The last-mentioned procedure is almost as painful to coleopterists who hear of it as it was to the beetles. It seems probable that the eggs may be laid in the burrows in the bud as well as under the fibers of the leaf bases as described by Hubbard, since in most of the fallen logs that have been seen by the writer the portion near the crown was reduced to coarse powder while the part farther down remained fairly solid. There is good authority for the fact that the beetle has attacked the date palms in the Coachella Valley. In any case, as remarked by Campbell (*1*), "Hubbard's fears that the insect was about to become extinct are quite

unfounded." In fact, it appears that there is far more danger of the host becoming extinct, at any rate in the vicinity of Palm Springs, especially since most of the fruiting palms are subject to the attack of a moth that bores into the fruit stems, cutting down the production of seed.

On May 13, 1928, in company with Mr. O. Petty of Fullerton, Calif., I made a trip to Palm Canyon. A fallen infested log was located without difficulty, and a number of living larvae and pupae and eight living adults were secured. This log was reduced almost to powder by the boring of the larvae, and about 6 feet of the top part could be pulled apart without difficulty with the hands. The larvae and pupae were placed in holes in fragments of the log and brought away. Adults developed and emerged later from all the pupae, and some of the larvae succeeded in pupating. Although we did not know it at the time, the officials in charge of the Indian reservation have forbidden collecting of any sort within the reservation in which Palm Canyon and the adjacent canyons are located. For this reason the next trip was made on June 2, 1928, to Thousand Palm Canyon, on the eastern side of the Coachella Valley and almost due east of Palm Springs. We arrived in the canyon about 5 P. M., located a fallen trunk that showed fresh emergence holes, and then made camp. From my field notebook I take the following: "1000-Palm Canyon, VI/2–3/28. This canyon is very different from Palm Canyon, being much more open. Very little water in it. There are very few young palms in this canyon at present, and some of these have been attacked. A few may be seen at the upper end of the wash. I saw few of the older palms that were not attacked by *Dinapate* near the tops, and some are dying. There are many dead palms, some not very old. The palms here have not been 'fired' as much as those in Palm Canyon, but some are badly burned." As is usual in this place, the wind was blowing so hard that it was impossible to sleep, so we attacked the log by the light of gasoline lanterns. A number of living larvae and pupae and about 30 adults were taken by 1.30 A. M., by which time we had worked into the basal part of the trunk, which was too tough and fibrous to be split with the axes and wooden wedges. A short search by lantern light discovered another trunk. This one was thoroughly dried out and was easily taken apart, the interior for 15 feet below the crown being for the most part nothing but a mass of frass. Three adults were taken from this log. The logs lying in the sun all day heat up even to the center, and the frass and tough fiber apparently act as insulating material to hold the heat. Even in the very early morning, when it had become unpleasantly cool, the interior of the logs was warm to the touch.

The larvae taken were all large with one exception, which

was about half the size of the rest. The pupae and larvae were packed carefully in boxes with frass about them. One pupa transformed about 6 A. M. After daybreak an examination of the first log showed that several adults had emerged from the basal part between 1.30 and 6 A. M. The beetles are fully hardened and colored upon emergence, and apparently take flight almost at once. On a later trip (August 4), a number of additional holes were seen in this log.

The larvae, pupae, and several newly transformed, uncolored adults were kept under observation for some time. As many as possible of the larvae were placed in burrows in fragments of palm log brought back from the canyon. A section of palm log about 2 feet in length was obtained, 3/4 inch holes bored in it, and the remaining larvae introduced. Most of these soon burrowed in out of sight, and could be heard at work within the log for some weeks, but all eventually died. Most of the pupae were able to complete development and a number of the larvae succeeded in pupating, but none of these finally transformed into adults.

The eggs of *Dinapate* have never been described. In such females as were chopped into in opening the logs and in a couple of injured ones that have since been dissected there were no eggs in the ovaries. It is probable that the females live free, feed for a time, and perhaps copulate before development of eggs takes place.

Little is known of the early larval stages of *Dinapate*. The mature larva was described by Horn, and Comstock gives figures of it and the pupa in his paper. When the larger larvae are healthy they are quite active. When chopped out of the trunk of the palm they wriggle about, and attempt to bite when picked up. When fully grown and preparing to pupate the larva is white, having voided the contents of the intestine. It rests in the pupal cell, becomes soft and flaccid, and finally is nearly inactive, moving with difficulty. The body becomes shorter and greater in diameter, and rather shapeless. All the larvae under observation went through the final stages of pupation late at night, and were not seen at this time.

The pupa, when first formed, is semiopaque, white, the sides of the abdomen slightly darker. After a few hours the eyes turn darker, and finally become nearly black. After about 6 days, the tibial spines, tarsal claws, and mandibles turn darker at the tips, and the darkening progresses from apex to base as the pupa grows older. Just before emergence the eyes and mandibles are black, the antennae light brown, the center of the meso- and metathoracic segments and the tip of the abdomen light brown, the apical third of the elytra along the suture light yellow brown, the tibial spines and tarsal claws dark brown, and the tibio-femoral joints brown. The remainder of the pupa is a light

golden yellow. The pupae are fairly active, wriggling when disturbed. At emergence the pupal skin splits along the dorsal midline and is slipped back off the body. The pupal stage is probably rather short—from 4 weeks or less to 6 weeks under normal conditions. One pupa collected in Thousand Palm Canyon was apparently newly formed, having but slight traces of color. This one finished pupation on June 13, 10 days later.

The newly emerged adult is rather light in color. The eyes and mandibles are black, the head light brown in front of and between the eyes and light yellow back of the eyes. The thorax is dark brown, the elytra light creamy yellow with a faint brownish tinge on the humeri and along the apical fifth of the suture. The abdomen is yellow, brownish at the sides and apices of the segments. The tibiae and femora are edged with brown, the tibial spines dark brown. The wings are not folded for the first few days, and protrude from beneath the elytra. After about 24 hours the elytra have turned brown, and the insect becomes gradually darker until, in from 1 to 4 weeks, it is fully hardened, and dark mahogany brown, nearly black. One specimen was fully colored in 3 weeks, but still rather soft. Another was fully hardened in about a month, but never attained the dark, rich color of the others. For the first week after emergence from the pupa the beetles are quiet, but after that they become quite active, working upon the exit hole, especially at night. The snip of their mandibles is distinctly audible for 10 or 12 feet.

Our experience with the adult beetles was about the same as that of Martin (7), who says "They at once begin trying to fly and spend their strength against the wire netting of the cage, the sexes paying no attention to each other, from which I surmise that they seek mates from some other brood. When daylight comes they try to hide, putting their head into any dark corner, where they remain all day without motion." Several adults were kept alive in a box with fragments of palm log. During the day they put their heads into some corner, or beneath something, and remained quiet. If disturbed they wriggled from side to side with a rolling motion. If disturbed further, they would back rapidly for several inches and immediately return to their original positions. At night they became active, walking about and attempting to chew their way out of the box. Two specimens succeeded in doing so, starting in the corners where their mandibles could get a purchase. As there were only four corners in the lower, darker part of the box there was some competition, resulting in the loss of one or more legs by three specimens. The beetles attack one another at times seemingly without reason and regardless of sex. Their strong mandibles are capable of snipping off the leg of another beetle with very little effort. Sometimes the beetles would attempt to bite when picked up. Most of them

were helpless when turned upon their backs. Only one was observed to attempt to right itself by opening the elytra, and even this one had a great deal of difficulty. No attempt at feeding was observed, but it is possible that had proper food been available they would have eaten it. When placed upon a palm log the beetles paid not the slightest attention to one another but roamed aimlessly about, snapping the mandibles, until they found a hole or depression, into which they would crawl head first and remain quiet. The clicking of the mandibles seems to be produced by placing the points together under tension and suddenly releasing one side, when the other side flies to its closed position with a click that can be heard for 15 feet or more. Immature beetles in pupal cells that had been opened down one side for observation have been observed to make this sound. What its function may be other than a manifestation of the habitual "ill temper" of the insect is not known.

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