M. neumoegeni stephensi. We do not expect to find any of these species in Mexico. We do expect to find the following: *Mgathymus yuccæ arizonica* and perhaps *martini.*

We wish to give our thanks to Dr. C. L. REMINGTON for his assistance in preparing this paper. Our thanks also go to Dr. C. D. MICHENER, WILLIAM D. FIELD, Dr. F. H. RINDGE, KENT WILSON, Dr. T. ESCALANTE, the Plant Quarantine Branch of the Agricultural Research Service of the United States and the Secretario de Agricultura y Ganaderia of Mexico for their assistance and cooperation.

Caldwell, Kansas, U. S. A.

MEGATHYMUS YUCCÆ IN NORTH CAROLINA

by ROBERT B. BUTLER and CHARLES V. COVELL, JR.

After a long period of apparent neglect, much attention has been given to the Giant Skippers of the genus *Megathymus* lately, as witnessed by recent articles in the *News* on important observations concerning that genus. It was on one of our regular collecting trips in the Southern Pines, N. C., area that we first became interested in *Megathymus yuccæ* Boisduval & Leconte. On 21 April 1951, BUTLER noticed an unfamiliar butterfly dart out of a laurel bush and alight on a fallen pine cone in a hilly area characterized by sandy soil, long leaf pines, scrub oak, and an occasional *Yucca filamentosa* Linnæus. Upon capturing the specimen, he found it to be a battered female *M. yuccæ.* There were no subsequent captures and interest in the species faded for the next three years. BUTLER gave his lone specimen to the North Carolina Division of Entomology in Raleigh.

In 1955 while attending the University of North Carolina, COVELL met JOHN P. KNUDSEN, a collector who had taken *M. yuccæ* in Georgia. It was from him that COVELL learned more about this interesting genus and how to find and dig out the larvæ and pupæ. With this information we began searching for the gray-brown tent-like structures constructed by the larvæ at the center of the rosette of each inhabited yucca plant. On 9 April 1955 COVELL found a *M. yuccæ* pupa but the adult failed to emerge. In June of that year we found several *Y. filamentosa* whose central leaves had been eaten, and in which were ensconced some pink caterpillars. In August, BUTLER dug up six of these plants, keeping them in pots and bushel baskets until the following Spring. Two *Megathymus* emerged.

In January 1956, six more plants were dug up and potted. All of these plants were found within a radius of three miles. In the early part of February 1956, we found a large number of infested plants, all grouped in one colony. BUTLER dug up about twenty plants one Sunday afternoon, and on March 23 COVELL and BUTLER got about thirty more at the same place. This colony is situated about two miles west of Southern Pines, and covers about three acres. Most of the yucca plants were under large pines and as a rule were small, young plants with small leaves or, usually, no leaves at all. These were the result of shoots sent up from the great network of roots that runs through the particular section where the colony is located. Those yielding *M. yuccæ* were often dead or invisible under pine straw. Some of the tents were so well camouflaged by the mat of pine straw that the only way we could find them was to lie on the ground and hunt with the eye at ground level.

We found that it was not necessary to take a clump of dirt when digging the plant, but it should be noted that care must be taken to cut the root as far down as possible to avoid injury to the pupa and to prevent its escape to the bottom of the larval tunnel, in which case it is almost impossible to retrieve after the root has been cut. Since the larvæ had stopped feeding by the time we dug out our plants in late February, we took only the tent and root containing the tunnel. We wrapped them in "Kimpak" which is a soft, blanket-like cellulose material manufactured by Kimberly-Clark. The bundles of tents were put in buckets and sprinkled with water about once a week. This season we discovered that sprinkling is unnecessary, as will be shown later.

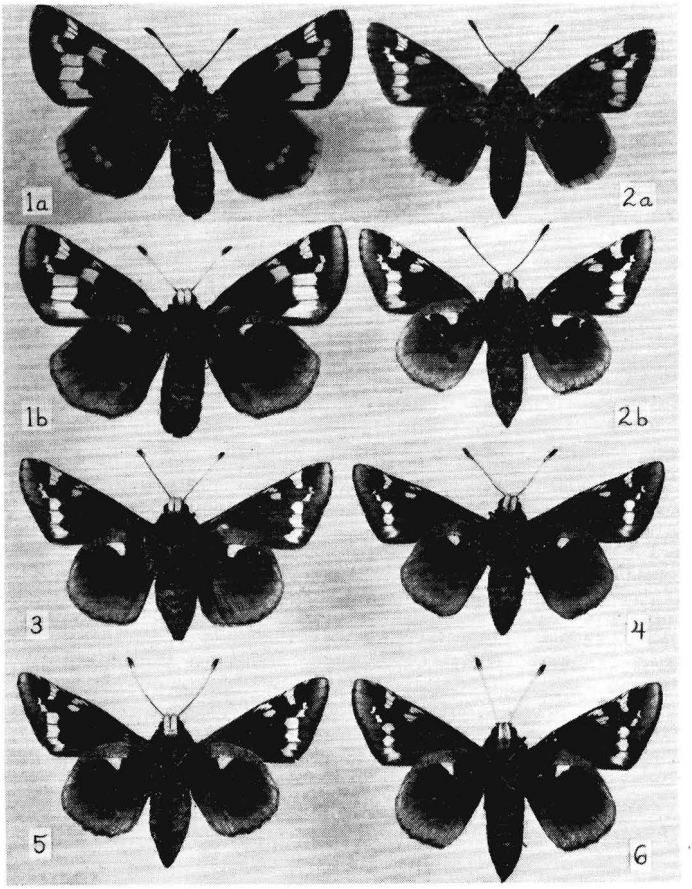
The tents with pupæ were kept outdoors in Southern Pines until it was warm enough to keep them in an open window in the house. This was about the last week of March. They were then kept in a dormitory room at N. C. State College in Raleigh, where they emerged over a range of two weeks. These were subjected to natural temperature conditions at all times since the room in which they were kept was not heated after the time they were taken inside. The males began to emerge 23 March 1956 and the females began on 29 March. Most of the 15 females emerged an average of six or seven days after the 16 males. In 1956 we collected about fifty pupæ, ninety percent of which emerged successfully. Only four or five of the pupæ were parasitized.

Nine tents were dug up by BUTLER the last week in January 1957, in Southern Pines, and were taken to New York. They were kept in a shoe box, bone-dry. All 9 hatched by 18 March, 5 males and 4 females. These were kept inside all the time after digging. Pupation in this case occurred the first week in February and the first male emerged on 8 March, five weeks later. The last female emerged on 18 March.

On the other hand, COVELL dug up eighteen *M. yuccæ* on 22 February 1957. Sixteen of these were already in the pupal stage. COVELL'S pupæ came from the same area in which we found them in large numbers in 1956, whereas the ones dug by BUTLER were from the area where he found the female in 1951. COVELL'S adults emerged during the two middle weeks of March, with the males coming first, as is usually the case. These tents were kept with little or no plant attached and were wrapped in heavy cloths.

A few comments can be made based on preliminary comparisons between North Carolina, Georgia, and Florida *M. yuccæ.* The material used in the comparison consisted of a sample of twenty males and nineteen females from North Carolina, one male and two females of *M. yuccæ yuccæ* from Stone Mountain, Georgia, and ten males and sixteen females of *M. y. buchholzi* Freeman from various localities in Florida. The Georgia and Florida material is in the Yale collection, and the North Carolina material is in BUTLER'S collection.

First, it should be pointed out that the series of North Carolina *Megathymus* fed on *Y. filamentosa,* as did those from Georgia. However, the ones from Florida fed on *Y. smalliana* Fernald and *Y. aloifolia* Linnæus.



Megathymus yuccæ, all from Southern Pines, N. C., showing the range of variation. Figures 1a and 1b are of one ♀; figures 2a and 2b are of one ♂; the other four insects are ♂ ♂. Figures 1a and 2a show uppersides; the others show undersides. (Photographs by D. P. MUHONEN.)

The first notable characteristic of the North Carolina *Megathymus,* discovered by Dr. C. L. REMINGTON in March 1957, is in the more basal of the two white spots on the underside of the hindwing of the males. It is sharply truncate caudad, whereas most males from elsewhere have this spot ending in a sharp point. Later comparison showed that 70% of the N. C. males have this distinctly truncate spot, the vein R_s being the end point of the spot just before M_1 branches off (see figs. 2b and 3). In three of the remaining six males the spot has the more typical sharply pointed end, whereas the other three have the spot convex toward the body and straight on the outer side forming a bluntly pointed spot (see fig. 4). Five of the twenty N. C. males have the second outer spot of the hindwing underside fairly well developed (see fig. 2b). These five all have the large spot truncate caudad. Two males have only a few scales at the most for the smaller spot (see fig. 3) and thirteen have only the large spot, the small outer one being absent (see figs. 4, 5, and 6). These facts, as are the following ones, were brought to light later as a result of comparison of the N. C. specimens with specimens at Yale.

In the Georgia male the second or outer spot is absent, and the large spot is truncate. Most of the Florida males have the sharply pointed large spot with the smaller one being present to a varying degree. It is interesting to note that though the character of the large spot varies, it is always found to end at the same vein as mentioned above.

We found N. C. females to differ consistently from Georgia and Florida females in several ways. The yellow discal spot on the upperside of the forewing of the female is roughly rectangular in shape. This spot has a caudad spur extending along the discal cell toward the body. In the N. C. females this spur is half again as long as the main spot, but is sometimes even longer. This spur is well developed in fifteen of the nineteen N. C. females. The other four N. C. females are like the Florida females in that they have a spur less than one-third the length of the main spot, or very little spur at all. Only one of the Florida females is like the majority of the N. C. females, but both Georgia females have the spur. The most posterior outer yellow spot on the upperside of the forewing of all the Georgia and Florida females extends much farther toward the body medially than cephalad or caudad. In fact, its shape is very much like that of a broad arrowhead pointing toward the body. This spot on the N. C. females extends farther toward the body caudad, the spot being comparatively wide posteriorly and narrowing anteriorly (see fig. 1). The outer edge of the spot tends to be straighter than on the Georgia and Florida females. This is true in seventeen of the North Carolina females. The remaining two are like the Georgia and Florida examples.

Another interesting characteristic of N. C. females reared on *Y. filamentosa* is their tendency to dark, solid fringes of the forewing, especially the caudad area of the radial veins (see fig. 1a). Florida females reared from *Y. smalliana* also have this same tendency. However, *Megathymus* females from Georgia, reared on *Y. filamentosa,* and Florida specimens from *Y. aloifolia* all show checkered fringes, *i.e.,* dark around the vein tips and light between the veins.

Although the several differences in material from various localities as cited above are very interesting, this is not yet the time to draw any conclusions about names. Larger series from various localities, especially from the Southeast, should be compared and studied, and more work on foodplants is required. Only after assembling sufficient data and viewing the problem from every angle will we be ready to draw conclusions as to subspecies, clines, etc.

So far, we have found *M. yuccæ* in N. C. only at Southern Pines. *Y. filamentosa* is native to that area and is found with other yuccas eastward to the coast. Along U. S. Highway 1 just south of Sanford, N. C., there are a few clumps of yucca plants, but no tents have ever been found there. A few miles west of Raleigh, N. C., on the same highway, there is a large field of yucca plants but we found no evidence of *Megathymus* in that area. It is probable that a search would yield *M. yuccæ* south of Southern Pines toward South Carolina and eastward to the coast and around Wilmington. The plants are not uncommon in that part of North Carolina.

Incidentally, we extend a word of caution to those who may not have had experience with yucca plants: the juice of the plant may be poisonous to the skin, causing a bad rash followed by large blisters. We both had trouble with this, BUTLER being covered from elbows to fingertips with blisters as a result of uprooting the plants with bare hands. Gloves eliminate the hazard.

It is interesting to note that the records of the Division of Entomology of the N. C. Department of Agriculture contain nothing with regard to *M. yuccæ,* except for the female captured in 1951 by BUTLER. This is believed to be the first record for the state. It is also interesting to note that the late JOHN BOYD collected extensively in Moore County for a number of years and his records contain no mention of *M. yuccæ.* In the *Field Guide to the Butterflies,* KLOTS does not include North Carolina in the range of this species.

It seems to us that much remains to be done in the realm of the genus *Megathymus.* Their rapid flight and the fact that they do not feed as adults puts the collector at a disadvantage unless he finds the larval workings. Due to these facts there are undoubtedly areas where *Megathymus* does occur but has not yet been found. We collected in Southern Pines three years before we were aware of the presence of *yuccæ.*

In view of the facts presented in the preceding paragraphs, we feel safe in saying that we have established a new northern extension of the range of *M. yuccæ* in the Southeast, as well as a new North Carolina record. Perhaps diligent hunting will reveal it in other parts of the state, possibly along with other species — namely *M. cofaqui* Strecker and *M. harrisi* Freeman.

The writers wish to express their gratitude for aid in the comparison of material used and preparation of this paper to Dr. C. L. REMINGTON, of Yale University, and to Dr. D. L. WRAY, of the North Carolina Department of Agriculture, Division of Entomology, for making available the state records and those of the late JOHN BOYD.

(RBB) Box 89, Southern Pines, N. C., U. S. A.,
(CVC) St. Anthony Hall, Chapel Hill, N. C., U. S. A.