ON THE AUTECOLOGY OF *MEGATHYMUS YUCCÆ* IN FLORIDA, WITH NOTES ON FOODPLANT SPECIFICITY (HESPERIOIDEA)

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The megathymids are of special interest to evolutionists in their strong development of foodplant specificity, which appears to have resulted in one of the most elaborate complexes of foodplant sibling species known in the animal kingdom. They also have the usual attractions of organisms which are biologically extremely specialized and set apart from their nearest relatives. C. V. RILEY, in the preamble to his pioneer work on megathymids (1876), wrote: "The study of aberrant forms [*i.e.*, groups] in Nature is always interesting. . . . . They baffle the systematist and constantly remind him of the necessarily arbitrary nature of his classificatory divisions." And among the megathymids, *Megathymus yuccæ* (Boisduval & Leconte) in the Southeastern States is interesting in being rather different from all other known members in the degree of diversity of *Yucca* species on which it can thrive. This paper is a progress report on cintinuing studies of *M. yuccæ* and includes the results of a small foodplant test.

In the spring of 1954, during a brief stay at the Archbold Biological Station in Highlands County, Florida, I discovered a breeding colony of *Megathymus yuccæ*. A few days earlier I had been introduced by J. PETER KNUDSEN and LUCIEN HARRIS JR. to the characteristic larval "tents" of *M. yuccæ* and of the then unnamed *M. harrisi* H. A. Freeman. Both species were in or beside plants of *Yucca smalliana* (= *filamentosa* auctt.) near Atlanta, Georgia. Mr. HARRIS and Mr. KNUDSEN were acquainted with most details of the life histories of these two species and of *M. cofaqui* (Strecker) near Sarasota, Florida, and they generously passed on to me the benefits of their experience and representative specimens of "tents", pupal shells, parasites, and even some living pupæ. I was thus immediately able to recognize the "tents" when I chanced on them soon afterward at the Archbold Station. Since then I have been back to the Station studying *Megathymus* and other insects for a few weeks just after Christmas of 1955, 1956, and 1957. The *M. yuccæ* population on the Station grounds has been treated as an experimental lot on which detailed observations could be made with continuity from year to year. Most pupæ collected in order to rear museum study series of imagines were taken outside the Station boundaries, particularly from an area near Childs. The once large *Yucca smalliana* colony there has recently been destroyed by preparations for a new citrus grove. Since 1954 I have also found *M. yuccæ* larvæ or tents near St. Augustine, Florida, in Athens, Georgia, and with the guidance of ROBERT B. BUTLER at Southern Pines, North Carolina.

FOODPLANT SPECIFICITY

The so-called subspecies of *Megathymus yuccæ* are scattered over a wide geographical range, being known from North Carolina and Florida in the east to California in the west, and from Colorado in the north to Tamaulipas in the south. The characteristic foodplant pattern for the forms found in the U.S.A. west of the Mississippi River is that each tends to be restricted to one species of *Yucca,* and if there is more than one host plant, it is closely related to the others. In particular, in any one locality each *Megathymus* tends to be restricted to one *Yucca* species even though others may be present.

In Florida, and probably in Georgia and South Carolina, at least, there is no such specificity. RILEY (1876) reported "positive proof of its working in *aloifolia, gloriosa,* and *filamentosa*" in South Carolina and Florida. In Highlands County, Florida, I have found at least two dozen pupæ and prepupal larvæ in *Yucca smalliana* Fernald and over 100 in *Y. aloifolia* L. *Y. aloifolia* is not native at the Station, but many have been planted along the road and are now very large and full of young shoots. The greater number of "tents" in *Y. aloifolia* seems to be due to the abundance and location of the plants. *Y. smalliana* is native to the sand scrub all over Highlands County, but it rarely forms large clumps. A few isolated plants are scattered through the scrub on the Station, and the proportion which have "tents" is about the same as for *Y. aloifolia.* In the extinct colony at Childs, in early April of 1954 nearly 50% of the plants younger than flowering age bore a recently vacated "tent." On the other hand, several miles away, along the highway near Sebring, there is a new colony of over 1,000 plants of *Y. smalliana* in ideal condition for *Megathymus* attack, and not one "tent" was present in January 1958. Probably no wandering female had chanced on this colony. We expect to re-examine the site from time to time.

Yucca smalliana is said (Fernald, 1950) to be found from Florida to Louisiana, north to North Carolina and Tennessee. FERNALD reports the very similar *Y. filamentosa* L. to be a Coastal Plain species found from Georgia to southern New Jersey. Both are often cultivated and are said to become established farther northward, but in Connecticut I have been able to recognize only *Y. filamentosa* in gardens and in feral populations. I have not seen plants in flower in Georgia or North Carolina, but vegetatively the plants I have seen harboring tents of *Megathymus yuccæ* and *harrisi* in those two states seem to me indistinguishable from the *Y. smalliana* of central Florida. I know of no unquestionable records of *M. yuccæ* on FERNALD's true *Y. filamentosa*; RILEY was of course unaware of the possibility of two species of *Yucca.*

Yucca aloifolia is a huge, arborescent species with a small flower stalk and fleshy, gummy seed pods. *Y. smalliana* has only the rosette of leaves above the ground, its flower stalk is long, stiff, and persistent, and the seed pods are dry capsules. Each has several more or less similar relatives, and the two are surely very far apart taxonomically and presumably chemically. Nevertheless, ovipositing females of *M. yuccæ* readily lay on both species, and

the larvæ develop well on both. In the colonies at Southern Pines, North Carolina, and near Atlanta and Athens, Georgia, I have seen only *Y. smalliana*. On the seaside sand dunes near St. Augustine, Florida, where I found several "tents" of *M. yuccæ*, I saw only *Y. aloifolia*. In these *M. yuccæ* is of course obliged to be monophagous. The seaside colonies of *Y. aloifolia* near Sarasota, Florida, surprisingly seem to lack *M. yuccæ* completely, although this is the best known place for *M. cofaqui*. In early January of 1956 I examined several hundred stalks of *Y. aloifolia* on Cape Sable, at the southern tip of Florida, and there were no *Megathymus* "tents" present, nor did I find any *Yucca smalliana*. DON B. STALLINGS gave me a very large preserved larva of *M. yuccæ* labeled as from *Yucca flaccida* Haw. and taken at Pensacola, Florida, probably by Dr. and Mrs. R. C. TURNER. If the foodplant determination is correct, here is a third suitable *Yucca* known for *M. yuccæ* in Florida. Southeastern *M. yuccæ* seem to be limited in their foodplants only by the number of *Yucca* species present where they fly.

In 1954 I took advantage of the abundance of wild eggs of *M. yuccæ* and set up a small foodplant experiment. Eggs were taken from the Archbold Station to my laboratory at Yale University. When the larvæ hatched, five were placed in the greenhouse on five potted plants of *Y. filamentosa* which I had grown from seeds collected from feral plants in Connecticut. Each larva webbed and fed on one of the small, new leaves in the rosette and then began feeding in the center of the plant. They were left undisturbed, and the "tents" and expelled fecal pellets increased gradually in size. Late in the winter of 1954-55 all five tents produced dwarfed but normally marked and colored imagines, with a sex-ratio of 3 : 2. From this experiment we can conclude that *Y. filamentosa,* which is not considered a possible native host of central Florida stocks, is suitable food for the entire larval development of Florida *M. yuccæ*. I have no evidence on the question of nutritional sterility but can note that the females contained well-developed eggs. The extreme dwarfing of all five imagines is probably due to the small size of the caudices in the potted *Yucca*. This was not the first time a megathymid had been reared in confinement from egg to imago. RILEY (1877) was successful with *M. yuccæ,* and COMSTOCK and DAMMERS (1934) reared *M. yuccæ martini* S. & T. from eggs.

My most remarkable and suggestive find with the *M. yuccæ* at the Archbold Station was the discovery of a "tent" about two-thirds normal maximum size jutting from the center of a small plant of a giant species of *Agave*. This Century Plant, which we have been unable to identify, had been planted among the *Y. aloifolia* several years previously. A few plants had flowered and were surrounded by younger plants developed from bulbiform seeds. No larva or pupa, living or dead, was present in the plant, which I dug up and examined. It was clear that the larva had not completed development in the *Agave,* but it had eaten out a hole in the center of the plant, of about the usual diameter of a normal burrow in *Yucca*. The hole went to the bottom of the *Agave*. *Agave* does not produce an underground caudex. Presumably the larva left the plant when no acceptable food remained. There was no

indication of the larva having fed in the large fleshy leaves in the manner of larvæ of ægialines; undoubtedly *M. yuccæ* is not adapted for such a different method of feeding. The indications from this single observation are: a) that *Agave* has a chemical similarity to *Yucca* sufficient to stimulate the plant-finding chemoreceptors of ovipositing *M. yuccæ*; b) that the newly emerged larva finds *Agave* acceptable enough to cause it to start normal burrowing and "tent" construction; and c) that the *Agave* is adequate food to allow the larva to grow to a considerable size (the "tent" was of the size normal for an early fourth instar larva). COMSTOCK and DAMMERS (1934) confined a larva of *M. yuccæ martini* on *Agave deserti* Engelm.; it "worked for some time between the surfaces of opposing leaves, but was not able to reach the heart of the plant, and finally died." *Agave* is a member of the Amaryllidaceæ, whereas *Yucca* is in the Liliaceæ. In view of the strong foodplant specificity characteristic of the megathymids, it is curious that they accept *Yucca* and *Agave* (and a near relative, *Manfreda*), but are not known to feed on other Liliaceæ or Amaryllidaceæ.

There is, however, a close relative of *Yucca* growing in Highlands County: *Nolina brittoniana* Nash. Mr. L. J. BRASS and I have fruitlessly searched *Nolina* near the Childs *Yucca* bed for signs of *Megathymus* larvæ. I have a luxuriant row of this *Nolina* growing beside the yuccas in my experimental garden at the Station; evidence of *M. yuccæ* has never appeared here, although larvæ have developed to maturity on the *Y. aloifolia* and *Y. smalliana* in the garden, the offspring of wandering wild females.

LARVAL FEEDING SITES

The large majority of *M. yuccæ* larvæ studied in Florida, Georgia, and North Carolina were living in young shoots of the *Yucca,* but usually with the deepest part of the burrows in old underground caudices from which the young shoots have grown. Probably a first instar larva survives best on the young, mild tissues of the growing point of the plant, but as the larva matures it can utilize the older tissues. The long-established guide for collecting *Megathymus* anywhere is to concentrate the search on small plants, especially those away from the densest parts of a *Yucca* patch. There are exceptional larvæ on older plants. For example, we have found a few full-sized "tents" several feet above ground level on *Y. aloifolia,* and we have taken "tents" containing pupæ or prepupæ from four large *Y. smalliana* which had flowered while larvæ were inside. Two of these "tents" were actually attached an inch or two above the base of the flower stalk.

While there is usually one successful larva in any one *Yucca* shoot, about one-sixth of the occupied shoots have two or three "tents" protruding from the rosette side by side. In the case of three (only in *Y. aloifolia*), nearly the entire shoot and its caudex are hollowed out, but the silk-lined tunnels are absolutely exclusive, often with only silk for walls where the tunnels touch each other. We have never found more than two "tents" in one rosette of *Y. smalliana.* There may be some larvicide committed by newly-hatched

larvæ, but apparently larger larvæ do not attack each other. COMSTOCK and DAMMERS (1934) reported that only one *M. yuccæ martini* can be accomodated in a single shoot of *Y. brevifolia.*

The great burrows may extend more than two feet into the plant, but the deleterious effects on the plant seem to be surprisingly small (compare *M. ursus* on *Y. schottii;* Stallings & Turner, 1956). Almost never is even the shoot of the *Yucca* killed by the boring. The growing point is destroyed, but most plants bud out a new shoot beside the old rosette, and many plants of *Y. aloifolia* produce more than one healthy shoot in place of the ravaged one. Plants are often found in which successive *Megathymus* larvæ have developed to maturity three different years on the same caudex, each new larva occupying a new side shoot which appeared after the preceding attack. I have the impression that the infested *Y. aloifolia* plants eventually develop more flowering branches than they would have with no *Megathymus* attacks. Certainly the plants produce more of the vigorous young rosettes the year after an attack than they would have otherwise; thus the feeding of a larva actually improves the potential food supply for the next year's *Megathymus* crop. This is partly because a sprout of *Y. aloifolia* in its first year is preferred for *Megathymus* oviposition over a second or third year sprout and is presumably better fare for young larvæ.

OVIPOSITION

Wild females of *M. yuccæ* were not seen ovipositing. Usually only one egg is found on a single shoot, but two or more are not unusual, and in the *Y. smalliana* patch at Childs I found two plants with seven eggs each. I have never found eggs on a plant or material other than *Yucca;* however, the "tent" on *Agave* described above is evidence that the egg was laid there (young *Megathymus* larvæ are ineffective travellers, they rarely if ever leave the *Yucca* shoot on which they hatch, and the nearest *Yucca* plant was several feet away). RILEY (1877) recorded eggs of *M. yuccæ* which had been laid on dead oak leaves that had accumulated around *Yucca* plants.

In 1958 R. W. PEASE JR. caught a wild female at the Archbold Station and confined her in a box, where she readily laid many eggs. COMSTOCK and DAMMERS (1934) obtained several fertile eggs of *Agathymus stephensi* from a captive female.

ENEMIES

Most, of not all, species of megathymids are sometimes heavily parasitized. A tachinid fly takes a large toll of *M. yuccæ* larvæ in the Southeast, but the outbreaks seem not to be synchronous from place to place. In early 1954 LUCIEN HARRIS JR. found that tachinids infested more than 50% of the overwintering prepupæ of *M. yuccæ* at Stone Mountain, near Atlanta, Georgia, but not one parasitized larva was found in about 20 "tents" I examined at the Archbold Station that year. Nor have I found a parasitized

larval in Florida in the three later years. I reared 14 ♂♂ and 3 ♀♀ flies from 12 to 14 April 1954 from three parasitized prepupæ of *M. yuccæ* collected at Stone Mountain by Mr. HARRIS, and at least one other fly was unable to escape from its dead host larva. RILEY (1876) first reported the tachinid on *M. yuccæ* in South Carolina, and WILLISTON named it *Phorocera comstocki*. ALDRICH and WEBBER (1924) redescribed it and placed it in *Neopales*, which they regarded as a subgenus of *Phorocera*. They reported the same parasite from: *Cossula magnifica* Strecker, a species of Cossidæ with boring larva; *Pyrausta penitalis* Grote, a pyralidid with a larva boring in aquatic plants; and *Lophyrus* sp., presumably a diprionid sawfly; so it is by no means restricted to *Megathymus* and its relatives, although it tends to attack boring larvæ. The 17 from Stone Mountain agree well with the 1924 redescription; my specimens are in alcohol and show a character not mentioned by ALDRICH and WEBBER: the females all have a distinct reddish-brown cast to the cuticle, whereas the males are much blacker.

In recent years the classification of the Tachinidæ has been extensively revised, and the nomenclature and affinities of *comstocki* are affected. If the 1800 Meigen fly names are rejected, a homonym of one of them, *Pales* Robineau-Desvoidy, becomes available and takes precedence over *Neopales* Coquillet. *Pales* is now considered a distinct genus and has been placed in the Tribe Eryciini of the Subfamily Goniinæ, whereas *Phorocera* is in the Subfamily Tachininæ (van Emden, 1954). *P. comstocki* runs to *Pales* in VAN EMDEN'S keys.

RILEY (1881) named as *Apanteles megathymi* a new braconid wasp which was reared from *M. yuccæ* in South Carolina. Like some other *Apanteles*, several larvæ emerge from a single host and spin their cocoons in a cluster in the burrow. In California COMSTOCK and DAMMERS found *M. y. martini* "heavily parasitized by *Apanteles megathymi* and by a Tachinid" and *A. stephensi* "heavily parasitized by *Apanteles megathymi*."

In April 1954 I found a single egg of *M. yuccæ* with a lateral exit hole matching perfectly the holes left by an eupelmid wasp in eggs of *M. streckeri* Skinner in Colorado (Remington, 1959). Of about two dozen eggs of *M. yuccæ* examined at that time, all others had only the much larger, mid-dorsal exit holes typical of hatching *Megathymus* larvæ. Presumably the Florida parasite was also an eupelmid (genus *Anastatus*?) but was much rarer than was the Colorado parasite found in 1957. Other writers have reported parasites of these three families on additional megathymids.

How do parasites get at megathymid larvæ? It seems likely that the "tent" or trap-door constructed over the burrow exit by every known species other than *M. streckeri* and *M. texanus* is an adaptation to parasite and predator pressures. RILEY remarked on the exceptionally long ovipositor of *A. megathymi*, so it is not unlikely that the parasite attacks small *M. yuccæ* larvæ through the "tent" made on a leaf prior to penetration of the *Yucca* caudex. Most species of Tachinidæ produce either a) "microtype" eggs scattered over the foodplant and ingested unnoticed by feeding host larvæ, or b) "macrotype" eggs glued directly to host larvæ, or c) active small larvæ

deposited nearby which move onto the host. Type a) seems to be prohibited to parasites of megathymids except possibly for a very brief period after hatching. To investigate b) I inspected the skins of the three dead Georgia prepupæ under a stereoscopic microscope and could find none of the persistent egg-shells which are reliable indicators of "macrotype" tachinids. Should the host molt before dying, these egg-shells would of course be lost with the exuviæ; Prof. G. C. VARLEY, who has carried out extensive studies of Tachinidæ and other parasites of Lepidoptera for many years, informs me that with the "macrotype" tachinids known to him the eggs are present on the host at its death. Type b) seems most improbable from every aspect. Perhaps the female *P. comstocki* are viviparous and place their larvæ just inside the "tent", where they can attach themselves to a *Megathymus* as it comes up to defecate. An English species of *Pales* has the "microtype" eggs, but it is possible that other species may be of type c), in view of the fact that a related genus, *Zenilla,* has both a) and c) types among its species.

One "tent" at the Station contained on 1 April 1954 a full-grown but dead larva of *M. yuccæ* from which protruded the long, stout filaments of a large entomophagous fungus, as yet undetermined. This fungus resembles published photographs of species of *Hirsutella,* a genus of the Fungi Imperfecti. It (like many named *Hirsutella*) may prove to be the immature stage of a *Cordyceps* or some related Ascomycete. This larva has eight long filaments on the metathorax and abdominal segments 2 to 4 (the longest about 43 mm.), and 4 short filaments and 3 stubs on abdominal segments 2, 3, 7, and 8. Before dying the larva had reached the stage of producing white wax characteristic of normal megathymids.

I have never found a definite predator of a megathymid, but occasionally I have found a dead larva in a burrow in Florida, possibly a victim of a predator or of a viral or bacterial disease.

Another class of enemy of a *M. yuccæ* could be its fellow larvæ. I have noted (above) the presence of as many as seven eggs on each of two small rosettes of *Yucca smalliana* but never more than two "tents" in one shoot of this species. Obviously some larvæ do not survive in multiple infestations. RILEY (1877) suggested that the tent constructed by the first larva to hatch may exclude the establishment of larvæ hatching later.

TAXONOMY

A study of wing characters in a large series of *M. yuccæ* from about six well-separated localities in central and eastern Florida and in a smaller number from North Carolina and Georgia convinces me that the geographic differences are too slight to warrant separation of named subspecies in the Southeast. The results of my comparisons, made with R. B. BUTLER, have been reported elsewhere (Butler & Covell, 1958); the material I have seen since then fortifies the conclusion that visible differences are always slight and are absent in many individuals of pairs of populations from even the most

remote eastern localities. I lean toward the view that it would be best to drop latin subspecific names entirely, in all Lepidoptera, using informally the name of the locality or larger area whenever a regional designation is useful (see the excellent discussion by GILLHAM, 1955). Nevertheless I do not object strongly to the retention of the present system of subspecific names, AS LONG AS THE GEOGRAPHIC POPULATIONS DIFFER CONSPICUOUSLY. (Species differences in dead specimens may of course be extremely subtle in some instances, since the definition of species is based on biological criteria.) This practical requirement for subspecies is necessarily subjective, but under any interpretation the geographic differences in the Southeastern *M. yuccæ* are trivial at best. On these grounds I believe the name *buchholzi* H. A. Freeman for the Florida *M. yuccæ* must fall into the synonymy. FREEMAN has already sunk his name *alabamæ*.

I further believe that the differences are so great between *M. yuccæ* of the Southeast and some or all of the populations west of the Mississippi Valley, that the western forms may eventually prove to be separable from *M. yuccæ* as full species. These differences include the wing shape, size, color, and pattern, as well as a number of larval differences which I am describing in a paper on the larvæ of Megathyminæ now in press. STALLINGS and TURNER have long believed that some or most so-called subspecies of *M. yuccæ* may prove to be distinct species. Hybridization experiments would provide some of the data required in making a species judgment. As preparation for prospective crosses, in 1956 I attempted to obtain captive pairings of Florida *M. yuccæ* by the hand-pairing method, but with no success. Possibly cage pairings will not be difficult under suitable conditions, and I believe that hand-pairings will eventually be obtained when the special idiosyncrasies of the Megathyminæ are discovered. The experiences (see above) of PEASE and of COMSTOCK and DAMMERS show that egg production should not present serious difficulties in carrying on megathymid breeding.

SUMMARY

1. Field studies of *Megathymus yuccæ* were carried out during four seasons, primarily at the Archbold Biological Station in Highlands County, Florida.

2. *Megathymus yuccæ* in the southeastern U. S. A. feeds on a wider variety of *Yucca* species than do other Megathymidæ. Wild food plants include *Y. aloifolia, Y. gloriosa, Y. smalliana, Y. flaccida,* and perhaps *Y. filamentosa.* A larval "tent" found in central Florida showed that one *M. yuccæ* developed to large size on an *Agave.*

3. In a foodplant experiment five Florida *M. yuccæ* were reared from egg to imago without mortality on potted *Yucca filamentosa,* a species (or subspecies with *Y. smalliana*) not present in Florida.

4. Young shoots of *Yucca* are the usual oviposition sites for *M. yuccæ.* As many as three larvæ can mature normally in one shoot.

5. The shoot is not usually killed by the larva but sprouts one or more

new rosettes beside the riddled rosette. Probably the feeding of a larva increases the number of potential sites for the next year's larvæ.

6. Wild females of Megathyminæ oviposit in captivity, but hand-pairing attempts have not yet been successful.

7. The known insect parasites of Southeastern *M. yuccæ* are *Apanteles megathymi* (Braconidæ) and *Pales comstocki* (Tachinidæ) on the larvæ and probably a species of Eupelmidæ on the eggs. The mode of attack by the tachinid is not understood; the larval "tent" appears to be an anti-tachinid device.

8. A larva was found which had been killed by a large fungus, possibly a species of *Hirsutella.*

9. When several eggs are laid on a single plant, as often occurs, there is probably competition for survival among the larvæ, but no direct attack on one larva by another.

10. The known taxonomic differences between *M. yuccæ* populations in various parts of the Southeast are so slight that there are insufficient grounds for separating subspecies among them; *buchholzi* H. A. Freeman is dropped into the synonyny of *M. yuccæ yuccæ.*

11. It is suggested that some or most of the so-called subspecies of *M. yuccæ* found west of the Mississippi Valley may prove to be distinct species.

ACKNOWLEDGMENTS

This study is part of a research program supported by generous grants from the National Science Foundation and the Higgins Fund of Yale University. It is a pleasure to acknowledge the very great assistance of RICHARD ARCHBOLD, Director, and LEONARD J. BRASS, Botanist, of the Archbold Biological Station in Highlands County, Florida, in making available the superb facilities of the Station and in joining me in the field on many occasions. LUCIEN HARRIS JR., J. PETER KNUDSEN, ROGER W. PEASE JR., ROBERT B. BUTLER, and ERIC E. REMINGTON also gave valuable aid in the field, and the late OTTO BUCHHOLZ kindly presented several specimens of Florida *Megathymus,* including paratypes of *buchholzi.* Professor GEORGE C. VARLEY of Oxford University and DON B. STALLINGS gave appreciated advice. This paper was written in the Hope Department of Entomology at Oxford University, of which Professor VARLEY is director. Some of my specimens were examined there, and I used the Department's fine library for the literature review.

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POSTSCRIPT

After this paper was completed, I was surprised to discover, in browsing through recent books on plant classification, that our knowledge of foodplants of the megathymids had been offering a reliable hint on plant phylogeny long before botanists found the answer. Reference to my comments above on *Agave* as food for *M. yuccæ* will show the view prevailing even now in most books on taxonomy of American flowering plants, namely that *Yucca* and *Nolina* are Liliaceæ, whereas *Agave* and *Manfreda* are Amaryllidaceæ (see the new northeastern floras: Fernald, 1950, and Gleason, 1952; and recent state floras: Deam, Indiana, 1940; Jepson, California, 1951; Kearney & Peebles, Arizona, 1951.) I now find that J. HUTCHINSON, in his extensive reclassification of the higher plants (*The families of flowering plants. II. Monocotyledons;* Macmillan & Co., Ltd., London; 243 pp., 107 figs.; 1943), concluded that some characters used for defining the families Liliaceæ and Amaryllidaceæ were not valid. His revision separated a discrete family Agavaceæ "intermediate between the orthodox Liliaceæ and the Palmæ", including both *Yucca* and *Agave* as well as several other genera. S. D. MCKELVEY and K. SAX had anticipated this new grouping (*Journ. Arnold Arboretum* 14: 76-81, pl. 55; 1933) on the basis of chromosomal studies. They showed that both *Yucca* and *Agave* have a remarkable haploid complement of 5 large and 25 small chromosomes, a character not shared with other Liliales. E. B. GRANICK (*Amer. Journ. Bot.* 31: 283-198, 2 pls., 2 figs., 1944) extended the knowledge of chromosomes in HUTCHINSON's Agavaceæ and concluded that the unusual chromosomal complement typifies the members of HUTCHINSON's tribes Yucceæ, Agaveæ (except *Doryanthes*), and Polyantheæ, but not the Dracæneæ or Nolineæ. A comparative study of independent characters in the embryo, mainly by WUNDERLICH, showed again that *Yucca* and *Agave* and their near relatives are extremely similar and differ from any other plants. On this basis M. S. CAVE (*Chronica Botanica* 14: 140-153, 2 figs.; 1953) eliminated *Phormium* and *Doryanthes* from the Agavaceæ. The best present classification appears to be the following:

Family Agavaceæ

Section A

Tribe Yucceæ — No. & Central America(*Yucca, Hesperaloe, Hesperoyucca, Clistoyucca, Samuela*)

Tribe Agaveæ — No., Central, and So. America (*Agave* incl. its subgenera *Manfreda, Runyonia, Beschorneria, Furcræa*)

Tribe Polyantheæ — mainly Mexico (*Polyanthes,* etc.)

Section B

Tribe Nolineæ — No. & Central America (*Nolina,* etc.)

Section C

Tribe Dracæneæ — Old World tropics (*Dracæna, Sansevieria,* etc.)

Section D

Tribe Cordylineæ — Old World, exc. 1 So. American sp. (*Cordyline*).

This grouping now gives us all the foodplants of the Megathyminæ in a single family. It also suggests a few additional American plant genera to be searched for new megathymids and a few others to use in future foodplant experiments.

C. L. R.

YALE MUSEUM POST FOR S. A. HESSEL

The administration of Yale University has recently appointed SIDNEY A. HESSEL Research Associate in Entomology of the Peabody Museum of Natural History. For several years he has worked with me on the Lepidoptera collection of the Museum and has been in charge of the North American "Macroheterocera" other than the Geometridæ, Saturniidæ, and Sphingidæ. He has recently completed the over-all arrangement of the families under his care.

Dr. PETER F. BELLINGER similarly curated the Geometridæ before he moved to California. JOHN G. COUTSIS has arranged several of the families of butterflies, KENELM W. PHILIP the Theclinæ, and WARD B. WATT is working on the Hesperiidæ.

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