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A REVISION OF THE GENERA OF THE MEGATHYMIDÆ, WITH THE DESCRIPTION OF THREE NEW GENERA

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For a number of years I, as well as STALLINGS and TURNER, have been aware that a revision of the Megathymidæ was necessary. While STALLINGS and TURNER (1958) present very fine evidence concerning biological differences in the various groups and species, I would like to point out basic morphological differences that will place all the known species in this family into five distinct genera. The three of us, after many hours of careful study, have reached an agreement as to all of the evidence herein presented. Morphological differences can easily be seen that readily separate the five genera; however, the biological differences are even more pronounced. Previously all of the known species were included under the genus *Megathymus* except *Ægiale hesperiaris* (Walker). After we had reared a number of *Agave* and *Yucca* feeders we came to the conclusion that certainly two genera were represented there, and then *Megathymus mejicanus* Bell did not fit into the group that was represented by the *Agave* feeders morphologically any more than *Megathymus smithi* Druce and *Megathymus maculosus* Freeman fit into the group that constructed tents like the *Yucca* feeders. With the discovery of *Megathymus hazelæ* Stallings & Turner by the authors another link in the chain was placed where it belonged, as here was another species in the group with *mejicanus*. Since we did not have complete information of the life cycle of *mejicanus,* the life cycle of *hazelæ* helped in the final generic conclusions of those two species. To sum this all up we found that there were five genera in the family Megathymidæ instead of the three that we at first were sure of. Following this are complete descriptions of the five genera with two keys, one to the morphological differences and the other to the biological differences.

ÆGIALE Felder

Ægiale Felder, 1860. *Wiener Ent. Monats.* 4: 110.
Teria Blasquez, 1870; *La Naturaleza* 1: p. 282.
Acentrocneme Scudder, 1875. *Proc. Amer. Acad. Arts Sci.* 10: 100.

Generotype:—*Ægiale kollari* Felder (synonym of *Castnia hesperiaris* Walker).

Head moderate, somewhat broader than one-half the width of thorax. Eyes prominent, large, rounded; no ocelli. Antennæ set wide apart and ex-

tending to outer edge of cell spot, with distinct locklet or hair pencil at base, rigid, scaled; antennal club long, slender, drawn out apically to a short, abruptly bent point. Palpi appressed, upturned, not attaining front, first joint roundish, second joint long, cylindrical, third joint conical, clothing rough, consisting of scales and many long hairs. Tongue well developed, brown, clearly visible from front of head. Squamation of thorax, pectus, and base of legs hairy, rough. Tibiæ spined, fore tibiæ with small conical epiphysis, mid and hind tibiæ each with a single pair of terminal spurs; tarsi strongly spined, first tarsal joint long, about equal to the remaining four joints, claw segment with large semi-circular pulvillus, finely spiculate; paronychium bilobed, both lobes narrow and somewhat ribbon-like. Wings hairy at base. Primaries 12-veined; vein SC reaching beyond middle of costa; R_1-R_5 separate, equidistant, R_5 from apex of cell; M_1 from a point with or very slightly separate from R_5; M_2 from well below center of discocellular, curved at base and approaching M_3; M_3 from lower angle of cell; Cu_1 from midway between M_3 and Cu_2; Cu_2 from below center of cell, well removed from base of wing. Secondaries with subcostal spur and small intercostal vein; vein R from cell below apex; M_1 from apex of cell; M_2 slightly curved downward at base, from just below center of discocellular; M_3 and Cu_1 from around lower angle of cell; Cu_2 from well beyond middle of cell. The male clasper is divided into a blade and lobe, the blade considerably longer than the lobe and bent upward, with the apical portion rather blunt; dorsal margin slightly dentate and practically parallel to the ventral margin of the whole clasper. Alæ of female vaginal plate broad, not terminating in a sharp process, but having a somewhat rectangular distal process. The female glues her eggs on the *Agave* leaf. The larvæ do not powder the burrow previous to pupation. The cremaster of the pupa is "spoon-bill" shaped and has hooks by which it entagles itself with silken threads in the burrow prior to the time that the adult emerges.

So far as is known there is but a single species in this genus, the generotype. From the known information concerning this species, it is restricted to Mexico.

AGATHYMUS Freeman, new genus

Generotype:—*Megathymus neumoegeni* Edwards

Head moderate, somewhat broader than three-fourths the width of the thorax. Eyes prominent, large, rounded; no ocelli. Antennæ set wide apart, extending to cell spot, with hair pencil at base, rigid, scaled; antennal club moderately stout, white at base, remainder black, terminating in a blunt point. Palpi stout, appressed, and upturned; first joint rounded, broader than second; second joint stout, evenly oval; third joint small, one-fourth width of second, slightly pointed at the tip in some species; whole palpus clothed thickly with flat scales and a trace of dark hair. Tongue brown, well developed, visible from front of head. Squamation of thorax and base of secondaries thickly clothed with rather rough hair and hair-like scales. Tibiæ spined, fore

tibiæ with small epiphysis, mid and hind tibiæ with an apical pair of spurs; tarsi strongly spined, first tarsal joint equal to length of remaining joints, claw segment well spined ventrally and bears numerous fine hairs laterally; the pulvillus is reduced to either a short, conical, or truncate tubercle; paronychium a very narrow ribbon-like band without lobes. Wings with only a few hairs at the base; venation of wings similar to that of *Ægiale,* especially in the way in which Cu_1 originates basad from the cell spot and Cu_2 near the center of the cell; primaries with the outer edge of the discal band of spots in line, reaching vein *A* well before the termen. In the male genitalia the clasper is divided into a blade and lobe, the blade is considerably longer that the lobe, and is bent upward, with the apical portion terminating in a point; dorsal margin heavily dentate and practically parallel to ventral margin of whole clasper. Alæ of female vaginal plate short and terminating in a sharp process. The female flicks her eggs into the *Agave* plant singly. The larvæ powder the burrow previous to pupation. The larva does not put out frass for some time prior to the construction of the sericin-like door over the opening to the tunnel. The cremaster of the pupa is triangular, with minute bristles or none, and has no hooks. All species emerge during the late summer or fall.

There are a number of complexes into which the species in this genus fall:

Neumoegeni complex: *neumoegeni* (Edwards), *carlsbadensis* (Stallings & Turner), *florenceæ* (Stallings & Turner), *judithæ* (Stallings & Turner), and *mcalpinei* (Freeman).

Juliæ complex: *juliæ* (Stallings & Turner), *chisosensis* (Freeman), and *hoffmanni* (Freeman).

Baueri complex: *baueri* (Stallings & Turner) and *aryxna* (Dyar).

Belli complex: *belli* (Freeman) and *evansi* (Freeman).

Mariæ complex: *mariæ* (Barnes & Benjamin), *stephensi* (Skinner), *comstocki* (Harbison), *remingtoni* (Stallings & Turner), and *estelleæ* (Stallings & Turner).

Polingi complex: *polingi* (Skinner).

Alliæ complex: *alliæ* (Stallings & Turner).

Indecisa complex: *indecisa* (Butler & Druce).

Rethon complex: *rethon* (Dyar).

These complexes are as defined by Stallings & Turner (1958), except that *indecisa* is separated from the *baueri* relatives on the basis of its distinctive antenna and maculation.

This genus differs from *Ægiale* Felder in the following ways: there are only a few hairs at the base of the wings; the second palpal segment is not slender and elongate; the vestiture of the palpi is composed of many flat scales and only a very few long hairs; the antennal club is abruptly clubbed and not elongated with an apiculus; the pulvillus is minute; the paronychium is not bilobed; the blade of the clasper is curved upward, terminating in a sharp point instead of being somewhat rounded at the apex; the alæ of the female

vaginal plate terminate in a sharp point instead of being blunt; the female flicks eggs singly into the plant instead of glueing them on the leaf; the larvæ powder the tunnel prior to pupation; the cremaster of the pupæ is differently shaped, without hooks.

TURNERINA Freeman, new genus

Generotype:—*Megathymus hazelæ* Stallings & Turner.

Head moderate, slightly broader than three-fourths the width of the thorax. Eyes prominent, large, round; no ocelli. Antennæ set wide apart and reaching beyond the cell spot, with prominent hair pencil at base, rigid, scaled; antennal club elongated, tapering gradually from base to tip. Palpi stout, directed slightly forward instead of upward; first joint roundish, of about equal width as the second joint; second joint long, stout, evenly oval; third joint about one-third width of second; whole palpus clothed thickly with intermixed scales and hairs. Tongue brownish, well developed, visible from front of head. Squamation of thorax and base of secondaries thickly clothed with rough hairs and scales. Tibiæ weakly spined; fore tibiæ with small epiphysis; mid and hind tibiæ with a rather small pair of apical spurs; first four tarsal joints fairly strongly spined, first joint nearly equal in length to remaining joints; claw segment showing only the slightest indication of ventral spines; pulvillus large and rounded, somewhat like that in *Ægiale;* paronychium bilobed and rather broad. In the males Cu_1 originates beneath the inner edge of the cell spot and Cu_2 at about the center of the cell; primaries have the outer edge of the discal spots in interspaces 2 and 3 in line, the spot in interspace 1 is out of line, directed inward basally. In the male genitalia the clasper is not apically divided but terminates in a rounded apex, somewhat flattened on top and weakly dentate, behind which there is a small excavation and the dorsal edge is produced into a short flange over it. Alæ of female vaginal plate long and terminating in a sharp process, the base of the entire plate more narrow than the upper portion and the length of the plate greater by one-third the width. STALLINGS and TURNER indicate that the female of *hazelæ* glues a single egg on the upper side of the *Agave* (?) leaf near the tip. There is little if any powder placed in the tunnel by the larvæ prior to pupation. Cremaster of pupa triangular with a squarish knobbed tip, which has a few hooks and bristles. The two known species emerge in September and October.

So far there are but two known species that belong in this genus, *mejicanus* (Bell) and *hazelæ* (Stallings & Turner).

This genus differs from *Ægiale* Felder in the following ways: the antennæ are longer, extending beyond the cell spot; the antennal club is without an apiculus; the second palpal joint is long but not slender; the tibiæ are weakly spined; the tarsal claw has only a trace of ventral spines; there are only a few hairs near the base of the wings; Cu_1 originates below the cell spot; the discal spot in interspace 1 is out of line, slightly basad; the clasper is not divided into a blade and lobe; the general shape of the vaginal plate is

elongate, with the alæ pointed and long and slender; the cremaster of the pupa is triangular with few hooks and bristles. It differs from *Agathymus* Freeman in the following ways: the antennæ are longer, extending beyond the cell spot on the primaries; the antennal club is long and slender; the second palpal joint is longer; the vestiture of the palpi is intermixed flat scales and many long hairs; the tibiæ are weakly spined; the tarsal claw has only a trace of ventral spines; the pulvillus is well developed; the paronychium is bilobed and fairly broad; Cu_1 originates below the cell spot instead of basad; the clasper is not divided into a lobe and blade; the vaginal plate is differently shaped, being more elongated and with the alæ longer and more pointed; the female apparently glues the eggs onto a leaf; the larva does not powder the burrow or else there is only a trace of this powder; the cremaster of the pupa is triangular, with knob and hooks and bristles, which are lacking in *Agathymus.*

MEGATHYMUS Scudder

Megathymus Scudder, 1872. *Rep. Peabody Acad. Sci.* 1872: p. 83.
Generotype:—*Eudamus? yuccæ* Boisduval & LeConte.

Head moderate, somewhat broader than one-half the width of the thorax. Eyes prominent, large, rounded; no ocelli. Antennæ set wide apart and not extending to the cell spot, with hair pencil at base, rigid, scaled; antennal club moderately stout, somewhat variable as to length, tapering to a short point. Palpi moderately stout, appressed, upturned; first joint somewhat bluntly heart-shaped, not as broad as widest part of second joint; second joint elongate oval, slightly tapering at anterior end; third joint has slender connection with second joint, width one-half that of second joint; whole palpus clothed thickly with intermixed flat scales and hairs. Tongue tan, poorly developed, not visible from front of head. Thoracic clothing appressed and rather sparse; the males of some species with basal half of wings covered with long hairs. Tibiæ and tarsi as in *Agathymus;* claw segment like that of most other members of the family, except in *M. ursus* which has only poorly developed spines; pulvillus variable, being usually conical drawn out to a point apically, somewhat better developed than in *Agathymus;* paronychium usually bilobed and somewhat broader than in *Agathymus.* Cu_1 and Cu_2 originate nearer the base than the center of the cell; the primaries have the outer edge of the discal band of spots in interspace 3 and 2 directed to or beyond the end of vein A, and the lower spot in interspace 1b is angled inward. In all of the species the male genitalia are characterized by the clasper being divided into a blade and lobe, the blade blunt and not upturned. Alæ of female vaginal plate long and terminating in a rather sharp point. The females glue the eggs singly on the leaves of various species of *Yucca,* with each species of *Megathymus* showing a decided preference for a specific *Yucca.* The larvæ are feeders on solid tissue in the caudex of *Yucca* plants (except *M. beulahae,* which feeds on a strange *Agave* that resembles a *Yucca*) and construct a silken tent over the tunnel entrance during the time that they are feeding on

the plant, and before pupation they line the greater part of the tunnel with a white powdery material. The cremaster of the pupa is spatulate, with bristles. The adults emerge during the spring or summer months, depending on the species.

There are three main complexes in this genus, as follows:

Yuccæ complex: *yuccæ yuccæ* (Boisduval & LeConte), *yuccæ buchholzi* Freeman, *yuccæ alabamæ* Freeman, *yuccæ stallingsi* Freeman, *yuccæ wilsonorum* Stallings & Turner, *yuccæ coloradensis* Riley, *yuccæ navajo* Skinner, *yuccæ martini* Stallings & Turner, and *yuccæ arizonæ* Tinkham.

Cofaqui complex: *cofaqui* (Strecker), *harrisi* Freeman, *streckeri* (Skinner), *texanus texanus* Barnes & McDunnough, and *texanus leussleri* Holland (*albocincta* Holland is nothing but a dwarf form of either *texanus or leussleri*).

Ursus complex: *ursus* Poling, *violæ* Stallings & Turner, and *beulahæ* Stallings & Turner.

This genus differs from *Ægiale* Felder in the following ways: the antennæ are shorter, not reaching the cell spot; the antennal club is blunt in all species except *ursus* and *violæ;* the second palpal joint is not long and slender; the vestiture of the palpus is clothed with flat scales and only a few hairs; the tongue is poorly developed; the thoracic clothing is appressed and sparse; the pulvillus is poorly developed; Cu_1 and Cu_2 originate nearer the base than the center of the cell; the primaries have the outer edge of the discal band of spots in interspaces 3 and 2 directed to or beyond the end of vein A; the blade of the clasper is blunt and not upturned; the alæ terminate in a long, sharp process; the larvæ feed on the caudex of *Yucca* plants (except *beulahæ,* see above); the larvæ powder the tunnel prior to pupation; the cremaster of the pupa is spatulate, with bristles, instead of having a rounded knob with hooks and bristles; the adults emerge in the spring and summer. It differs from *Agathymus* Freeman in the following ways: the antennæ are shorter, not reaching the cell spot; the third palpal joint is better developed; the tongue is poorly developed; the squamation of the thorax is appressed and rather poorly developed; Cu_1 and Cu_2 originate nearer the base than the center of the cell; the primaries have the outer edge of the discal band of spots in interspace 3 and 2 directed to or beyond the end of vein A; the blade of the clasper is blunt and not upturned; the alæ terminate in a long, slender process; the females glue the eggs singly on the leaves of *Yucca* plants, instead of flipping them into *Agave* plants; the larva feeds on solid tissue instead of plant juices; the larva makes a silken tent instead of a trap door over the tunnel in which it has been feeding; the cremaster is spatulate instead of triangular; the adults emerge during the spring and summer, instead of during the fall. It differs from *Turnerina* Freeman in the following ways: the antennæ are much shorter; the club of the antennæ is more blunt; the second palpal joint is not as well developed; the tongue is not as well developed; the vestiture of the palpus is mostly flat scales; the tarsal and tibial spines are much better developed; the squamation of the thorax is sparse; the pulvillus is

much smaller; Cu_1 and Cu_2 originate nearer the base of the wings; the primaries have the outer edge of the discal band of spots in interspaces 3 and 2 directed to or beyond the end of vein A; the general shape of the clasper is different; the general shape of the vaginal plate is very different; the larva is a tent builder and lines the tunnel with white powder; the cremaster of the pupa is spatulate instead of triangular with a knob; the adults emerge in the spring and summer, instead of the fall.

STALLINGSIA Freeman, new genus

Generotype:—*Megathymus maculosus* Freeman.

Head moderate, slightly broader than three-fourths the width of the thorax. Eyes prominent, large, rounded; no ocelli. Antennæ set wide apart and reaching the cell spot, with slight trace of rigid hair pencil at base; antennal club moderately stout, with a distinct apiculus. Palpi moderately stout, only slightly appressed, upturned, first joint evenly rounded, and nearly as broad as second joint, second joint elongated (three times the length of the first joint), third joint narrow and connected to second joint by a fine point; whole palpus clothed thickly with intermixed flat scales and hairs. Tongue tan to sordid white, very poorly developed. Thoracic clothing appressed and fairly heavy. Tibiæ and tarsi as in *Agathymus,* but the spines somewhat better developed; pulvillus well developed as compared with *Megathymus;* paronychium bilobed, fairly broad and slightly oval in shape. Cu_1 and Cu_2 originate near base of wings; primaries have the outer edge of the discal band of spots in interspaces 3 and 2 directed toward vein A well before the termen, as in *Agathymus.* In both of the known species of this genus the genitalia are extremely simple; in the males there is only a slight difference between the blade and the lobe, the blade is rounded, without teeth, and not upturned; in the females the vaginal plate is generally shaped somewhat like a thick V with the alæ present as only a sharp tooth on each side. The remarkable simplicity of the genitalia of this genus characterize it.

Specific generic characteristics are exemplified by the life history of the two species. STALLINGS and TURNER point out the unique method of constructing the tent only after the larvæ have used a temporary trap door during the second and third instars. The fact that *maculosus* is double brooded presents another point towards its generic validity. Most likely *smithi* will also prove to be double brooded after we have sufficient specimens for study.

There are two known species in this genus, *smithi* (Druce) and *maculosus* (Freeman).

This genus differs from *Ægiale* Felder in the following ways: the apiculus of the antennal club is even better developed than in that genus; tongue is poorly developed; Cu_1 and Cu_2 originate nearer the base of the wing than the center of the cell; the disposition of the discal band of spots is slightly outward, nearer the outer margin of the wings;; the blade of the clasper is blunt and not upturned; the vaginal plate is differently shaped and the alæ terminate in a short, sharp process; the larvæ feed on solid tissue of *Man-*

freda plants; the larvæ powder the tunnel prior to pupation; the cremaster of the pupæ is spatulate with bristles; the adults emerge in the spring and fall. It differs from *Agathymus* Freeman in the following ways: the antennal club has a distinct apiculus; the second joint of the palpus is better developed; the tongue is poorly developed and differently colored; Cu_1 and Cu_2 originate nearer the base than the center of the cell; the blade of the clasper is blunt and not upturned; the vaginal plate is entirely different in shape; the larvæ feed upon solid tissue instead of juices; the larvæ construct a silken tent prior to pupation; the cremaster is spatulate instead of triangular; the adults are double brooded. It differs from *Turnerina* Freeman in the following ways: the antennæ are shorter; the antennal club has an apiculus; tongue not as well developed; tarsal and tibial spines better developed; Cu_1 and Cu_2 originate nearer the base of the wings; the general shape of the genitalia is different in both sexes from that of *Turnerina;* the larvæ are tent builders and line the tunnel with a white powder prior to pupation; the cremaster of the pupæ is spatulate instead of triangular with a knob; the adults are double brooded. It differs from *Megathymus* Scudder in the following ways: the antennæ reach the cell spot; there is a distinct apiculus on the antennal club; palpi differently shaped; thoracic clothing better developed; pulvillus better developed; paronychium bilobed and differently shaped; the disposition of the discal band of spots on the primaries is directed slightly inward from where they are located in *Megathymus;* the genitalia are more simple and differently shaped; the larvæ construct a temporary trap door prior to the time that they make their silken tent over the burrow in the *Manfreda* roots; the cremaster of the pupæ is spatulate like *Megathymus,* but the base is differently shaped and there are a few more bristles present; the adults are double brooded.

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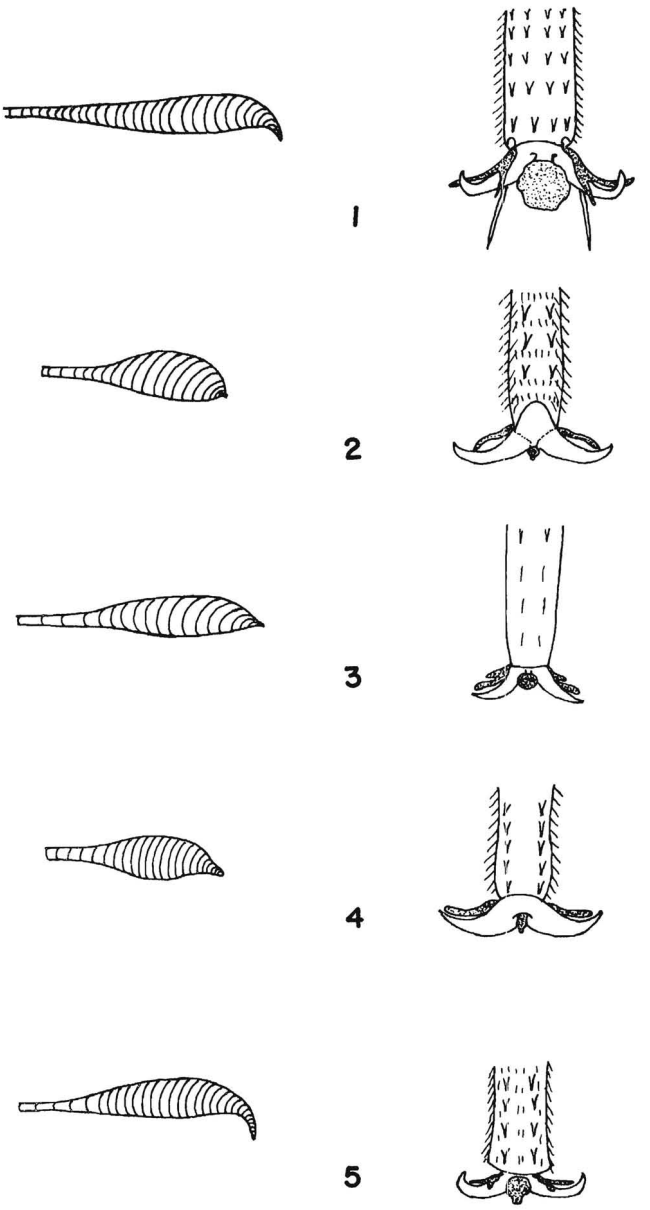
MORPHOLOGICAL KEY TO THE GENERA OF THE MEGATHYMIDÆ

1a. Antennal club with an apiculus 2
1b. Antennal club without an apiculus 3
2a. Antennæ extending to outer edge of cell spot; pulvillus well-developed; paroychium bilobed, both lobes narrow; tongue well-developed; genitalia complex; pupal cremaster narrowly spoon-billed, with many hooks ..... *ÆGIALE*
2b. Antennæ extending to inner edge of cell spot; pulvillus moderately developed; paronychium bilobed, short and broad; tongue poorly developed; genitalia simple; pupal cremaster barely spatulate, not depressed in center, and no hooks ..... *STALLINGSIA*



Antennal club and hind tarsi: 1. *Ægiale hesperiaris* Walker; 2. *Agathymus neumoegeni* (Edwards); 3. *Turnerina mejicanus* (Bell); 4. *Megathymus yuccæ* (Boisduval & LeConte); 5. *Stallingsia maculosus* (Freeman).

3a. Antennæ do not reach cell spot 4

3b. Antennæ reach beyond cell spot; spot in interspace 1 out of line with other two above, being directed inward basally; pulvillus well-developed; paronychium bilobed and broad; claw segment without spines; tongue fairly well-developed; genitalia simple in males, complex in females; pupal cremaster broadly spoon-billed, with few hooks ..... *TURNERINA*

4a. Thorax thickly clothed with scales and hair-like scales; pulvillus poorly developed; paronychium not bilobed, narrow and ribbon-like; tongue well-developed; primaries have outer edge of discal band of spots in line, reaching vein A well before termen; genitalia complex; pupal cremaster usually pointed and without hooks ..... *AGATHYMUS*

4b. Squamation of thorax appressed and rather sparse; pulvillus moderately developed; paronychium usually bilobed and fairly broad; tongue poorly developed; primaries have outer edge of discal band of spots in interspaces 3 and 2 directed to or beyond end of vein A; genitalia fairly simple; pupal cremaster spatulate, with depressed center and no hooks ..... *MEGATHYMUS*

BIOLOGICAL KEY TO THE GENERA OF THE MEGATHYMIDÆ

1a. Larvæ trap-door builders; food plant *Agave* 2

1b. Larvæ tent builders; food plants not *Agave* (except *M. beulahæ*) 4

2a. Burrow powdered ..... *AGATHYMUS*

2b. Burrow without powder 3

3a. Larvæ tunnel directly to base of leaf to form larval chamber ..... *ÆGIALE*

3b. Larvæ tunnel in irregular pattern to base of leaf to form larval chamber ..... *TURNERINA*

4a. Tent constructed as larvæ feed; typically *Yucca* feeders ..... *MEGATHYMUS*

4b. Tent constructed in last stages of larval feeding; *Manfreda* feeders ..... *STALLINGSIA*

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