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A further contribution to the knowledge of the male genitalia in the Mymaridae (Hymenoptera: Chalcidoidea)

Abstract – The male genitalia of 25 species, included in 15 genera, are described and illustrated. The new findings confirm the taxonomic importance of these structures and provide new elements for evaluating the present delimitation of the genera, based only on extragenital characters. In general, the basic structure of the male genitalia remains quite constant among members of the same genus, but remarkable variations around a well-defined ground plan may occur. For a reliable characterization and discrimination of the species the male genitalia cannot be ignored or approximately described.

The placement of the genera *Allanagrus* Noyes et Valentine, *Ceratanaphes* Noyes et Valentine, *Ischiodasys* Noyes et Valentine, *Paracmotemnus* Noyes et Valentine and *Stenogaster* Noyes et Valentine in a suprageneric classification, based on the features of the male genitalia, is discussed.

Furthermore because of the peculiarity of the male genitalia, the new tribe *Australomyarini* n. tr. (Subfam. Mymarinae) has been erected to include the genera *Australomyar* Girault, *Acmotemnus* Noyes et Valentine and *Scleromyar* Noyes et Valentine.

Key words: *Australomyar*, *Australomyarini*, *Myrmecomymar*, *Omyomymar*, *Stomarostrum*.

INTRODUCTION

In previous papers (VIGGIANI, 1970, 1973, 1987, 1989, 1991, 1994), the author pointed out the taxonomic importance of the variations found in the male genitalia of the Mymaridae, which appear rather similar to those observed in other Chalcidoidea (Trichogrammatidae and Aphelinidae) (VIGGIANI, 1971; VIGGIANI & BATTAGLIA, 1984) and proposed a preliminary suprageneric classification of the family based on the characters of these structures. Further

data have been accumulated on the male genitalia features of 25 species, belonging to 15 genera of Mymaridae, which are illustrated in the present paper.

MATERIALS AND METHODS

Dried and in alcohol material was used to make permanent slides in phenol-balsam mixture, after the dissection of the male genitalia. For the description of these structures the nomenclature reported in previous papers was followed (VIGGIANI, 1973,1989).

DESCRIPTONS OF MALE GENITALIA

Gen. *Acmopolynema* Oglobin

This genus includes about 35 species, mainly distributed in South and North America (FIDALGO, 1989). The first illustration of male genitalia in *Acmopolynema* is reported by VIGGIANI (1987). FIDALGO (1989) illustrated the genitalia of *Acmopolynema commune* Fidalgo, which show the same general features reported for the aforementioned species.

Acmopolynema hervali Gomes

Phallobase very narrow (Fig. I, 1), about 6.5 times as long as parameres; the latter triangular, about 4 times as long as wide; aedeagus with very long apodemes, about 1.5 times as long as its body, which is distally rather enlarged. Length: 0.23 mm.

Material examined. 1♂, BRASIL: Recife, VIII.1976, coll. P. Guagliumi.

Acmopolynema varium (Girault)

Same shape as in *A. hervali* (Fig. I, 2), but phallobase shorter, 3 times as long as parameres; the latter very narrow, about 6 times as long as wide; aedeagus with body about as long as apodemes, distally pointed. Length: 0.55 mm.

Material examined. 1♂, NORTH AMERICA: MexiaTex, 29.IX.1905, on *Sideranthus ruginosus*.

Gen. *Alaptus* Westwood

The genus includes about 60 species, which are among the smallest insects. Previous information on the male genitalia of *Alaptus* species is only reported by VIGGIANI (1989).

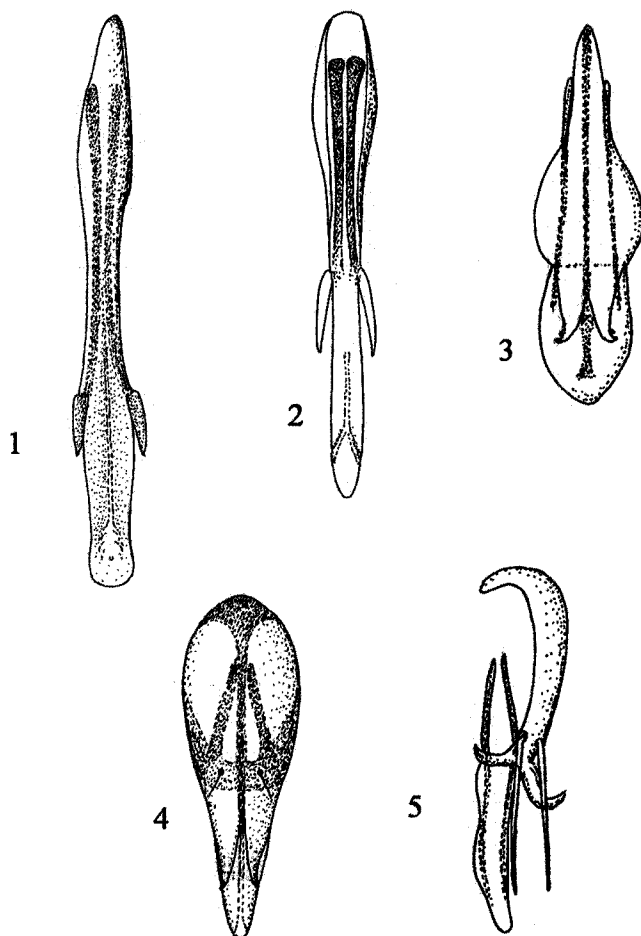


Fig. I - Copulatory organ of: 1. *Acropolynema hervali* Gomes. 2. *Acropolynema varium* (Girault). 3. *Alaptus fuscus* Haliday. 4. *Alaptus pallidicornis* Foerster. 5. *Alaptus priesneri* Soyka.

Alaptus fuscus Haliday

Phallobase proximally very narrowed (Fig. I, 3), without parameres; volsellar digiti developed with one hooklet; aedeagus with a wide but short body, 0.75 times as long as apodemes. Length: 0.06 mm.

Material examined. 1♂, ITALY: Portici, 18.VIII.1967, in yellow trap, coll. G. Viggiani.

Alaptus pallidicornis Foerster

Phallobase suboval (Fig. I, 4), not pointed at base; aedeagus with body elongate, subconical, 1.6 as long as apodemes. Length: 0.08 mm.

Material examined. 1♂, ITALY: Portici, 17.II (sic !), ex uova Psocidi, coll. F. Silvestri.

Alaptus priesneri Soyka

Phallobase boat-shaped (Fig. I, 5), with rather long and narrow volsellar digiti; near their base two long and robust setae reaching nearly end of aedeagus are inserted; body of aedeagus about 1.4 as long as apodemes. Length: 0.06 mm.

The male genitalia of *A. priesneri* show some characters, namely phallobase shape and predigital setae, very similar to those found in *Litus cynipseus* Haliday (VIGGIANI, 1973).

Material examined. 1♂, ITALY: Portici, 25.XI.1982, ex eggs of Corrodentia on olive leaves, coll. G. Viggiani.

Comments. The variations of male genitalia in *Alaptus* spp. appear remarkable at species level.

Gen. *Australomyar* Girault

This genus includes one described species from Australia, but several undescribed species are known from the Neotropical region and various parts of S.E. Asia (NOYES & VALENTINE, 1989). The male genitalia are unknown.

Australomyar sp.

Phallobase boat-shaped (Fig. II, 1), with parameres and volsellar digiti; margin of dorsal opening distally with a knot-shaped protuberance (Fig. II, 2); volsellar digiti subtrapezoidal, with three hooklets; aedeagus narrow and tubular, with apodemes 0.39 as long as its body. Length: 0.247 mm.

Material examined. 2♂, CHILE: Alto de Vilches, 70 km E. Talca, 20.II.1985, coll. S. & J. Peck.

Comments. The structure of the male genitalia of *Australomyar* sp. appears of the same type described for *Acmotemnus* Noyes et Valentine and *Scleromyar* Noyes et Valentine (1989). This confirms the affinity between these genera based only on extragenital characters.

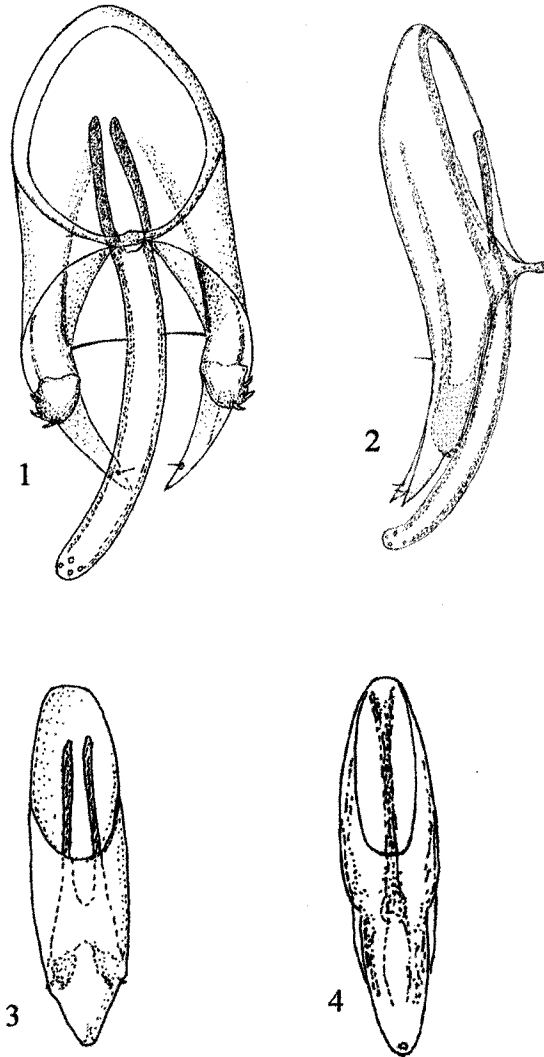


Fig. II - Copulatory organ of: 1. *Australomyrmar* sp., from above. 2. The same, side view. 3. *Cleruchus subterraneus* Viggiani. 4. *Dicopus* sp.

The genera *Australomyrmar* Girault, *Acmotemnus* Noyes et Valentine and *Scleromyrmar* Noyes et Valentine are here grouped into the new tribe Australomyrmarini, which in the classification based on the male genitalia characters proposed by the present author (VIGGIANI, 1989) is to be placed into the subfamily Mymarinae, near the Erythmelini. From the latter tribe the Australomyrmarini are distinguished mainly by the plate-shaped volsellar digiti provided with at least 3 hooklets and the tubular aedeagus without a middle sclerotization.

On the basis of male genitalia type, the genera *Ceratanaphes* Noyes et Valentine, *Ischiodasis* Noyes et Valentine, *Paracmotemnus* Noyes et Valentine and *Steganogaster* Noyes et Valentine, which have been included in the *Australomyrmar*-group by NOYES & VALENTINE (1989), can not be placed in the tribe Australomyrmarini. Their placement will be discussed later on.

Gen. *Cleruchus* Enock

About 20 species are included in this genus. The male genitalia are known for only 2 species (VIGGIANI, 1973).

Cleruchus subterraneus Viggiani

Very similar to *C. bakkendorfi* Debauche and *C. pluteus* Enock (VIGGIANI, 1973), but with body of aedeagus markedly shield-shaped, distally pointed (Fig. II, 3). Length: 0.099 mm.

Material examined. 1♂, SWITZERLAND: Besazio, 20.VIII.1975, coll. C. Besuchet.

Gen. *Dicopus* Enock

The male genitalia remain unknown for the 10 species included in this genus.

Dicopus sp.

Phallobase boat-shaped (Fig. II, 4), ventrally with a median sclerification, without parameres and rather long, but not well-sclerotized digiti, apparently without hooklets; aedeagus 1.2 times as long as apodemes, which are fused. Length: 0.05 mm.

Material examined. 1♂, GUATEMALA: Finca S. Antonio, 1.800 m., VI.1987, coll. G. Mauger.

Comments. The extremely small size and the very limited available material does not allow definitive conclusions on the male genitalia in *Dicopus* sp. However it seems that its general structure remembers that of *Alaptus* spp. Probably also the male genitalia features will confirm the affinity between the two genera.

Gen. *Gonatocerus* Nees

This large genus includes more than 250 species, mostly very poorly known. It has been divided in some groups (DEBAUCHE, 1948, 1949; MATTHEWS, 1986; HUBER, 1988).

The male genitalia of some species of this genus have been figured by VIGGIANI (1973, 1987, 1989), but only those of *G. longicornis* Nees (under *Lymaenon terebrator*) have been illustrated in details (VIGGIANI, 1991).

Gonatocerus bifasciatus Girault

Rather similar to those of *G. prope populi* Viggiani (VIGGIANI, 1987), but distinguished by the shape of genital lobes (less pointed), narrower internal projections and body of aedeagus as long as apodemes (about 0.7 shorter in *G. prope populi*) (Fig. III, 1). Length: 0.171 mm.

Material examined. 2♂, USA: Mo Woyneco, Williamsville, VIII.1987, coll. J.T. Bechev.

Gen. *Mymar* Curtis

The genus includes about 13 species. The male genitalia are known only for *Mymar pulchellus* Curtis (VIGGIANI, 1973).

Mymar sp.

Very similar to *M. pulchellus*, but dorsal opening of phallobase 1.2 as long as parameres (in *M. pulchellus*, 1.7) and aedeagus body twice as long as parameres (*M. pulchellus*, 1.3) (Fig. III, 2). Length: 0.095 mm.

Material examined. 3♂, NIGERIA: Oyo State, Ibadan, XI.1987, coll. J.S. Noyes.

Gen. *Myrmecomymar* Yoshimoto

The genus is monotypic.

Myrmecomymar masneri Yoshimoto

Phallobase in the basal half very narrow and then gradually enlarged (Fig. III, 3); parameres present, twice as long as volsellar digiti; the latter provided with two hooklets. Aedeagus rather short, with narrow apodemes, twice as long as its body. Length: 0.150 mm.

Material examined. 3♂, CANADA: Ontario, Mer Bleu, 14-28.VIII. 1981, coll. S.J. Miller; 1 ♂, same data but, 16-22.VIII. 1982.

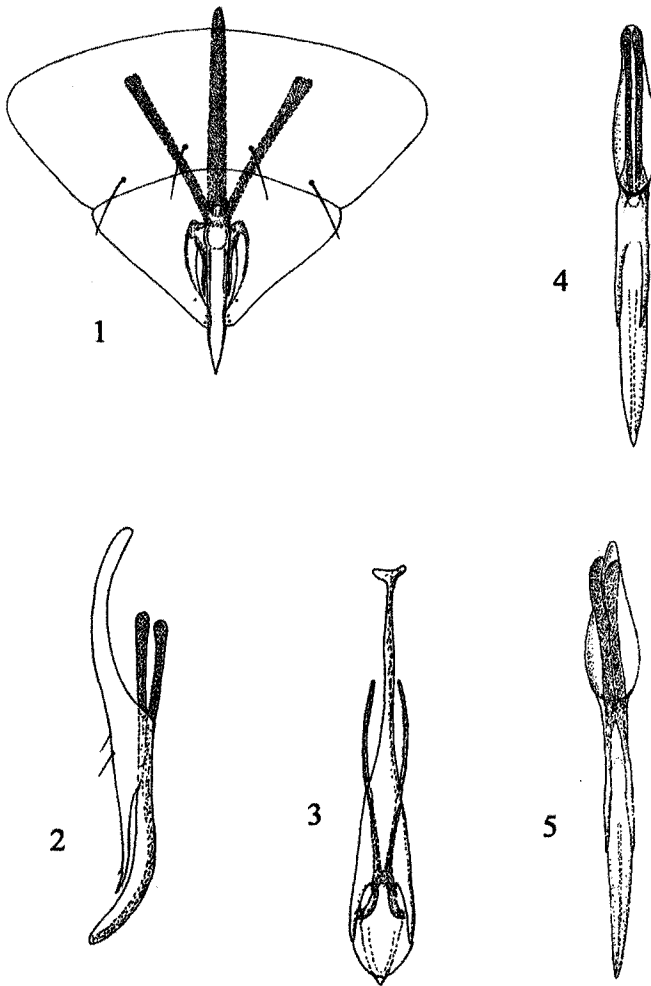


Fig. III - Copulatory organ of: 1. *Gonatocerus bifasciatus* Girault. 2. *Mymar* sp. 3. *Myrmecomymar masneri* Yoshimoto. 4. *Neomymar* sp. 1. 5. *Neomymar* sp. 2.

Gen. *Neomymar* Crawford

Very few species (3) have been described in this genus. The first illustration of the male genitalia in a species of *Neomymar* has been reported by VIGGIANI (1989).

Neomymar sp. 1

Phallobase very narrow and tubular (Fig. III, 4), without volsellar digits, but with stylet-shaped parameres; body of aedeagus about 1.4 as long

as bacilliform apodemes; distance from distal margin of dorsal phallobase opening to base of parameres, about as long as one half of a paramere. Length: 0.17mm.

Material examined. 1♂, MEXICO: Guerrero, 4 mi. W.Chilpancingo, 15.VII.1984, coll. J.B.Woolley.

Neomymar sp. 2

Same structure of *Neomymar* sp. 1, but phallobase wider at level of the distal half of dorsal opening and distance from distal margin of the latter to base of parameres as long as length of a paramere (Fig. III, 5). Length: 0.28 mm.

Material examined. 1♂, USA: Hopk. U.S. Mammoth L. Diat., Inyo, N.F. Cal., 22.VII.1958, coll. R.C. Hall.

Comments. The male genitalia features confirm the affinity between *Neomymar* and *Mymar*, based on extragenitalic characters (SCHAUFF, 1984).

Gen. *Omyomymar* Schauff

In this genus 4 species are included. The male genitalia of the first species of the genus was illustrated by VIGGIANI (1989).

Omyomymar sp. 1

Phallobase short (Fig. IV, 1) and tubular, without volsellar digiti, but with stylet-shaped parameres reaching the end of aedeagus; body of the latter 1.4 as long as apodemes. Length: 0.09 mm.

Material examined. 1♂, VENEZUELA: Miranda Guatopa Nat. Park, Aqua Blanca, 3-10.VI.1987, coll. S. & J. Peck.

Omyomymar sp. 2

Phallobase rather long (Fig. IV, 2), tubular; parameres triangular not reaching the end of aedeagus; body of the latter very narrow, about 2.5 times as long as apodemes. Length: 0.13 mm.

Material examined. 1♂, VENEZUELA: Miranda Guatopa Nat. Park, Aqua Blanca, 3-10.VI.1987, coll. S. & J. Peck.

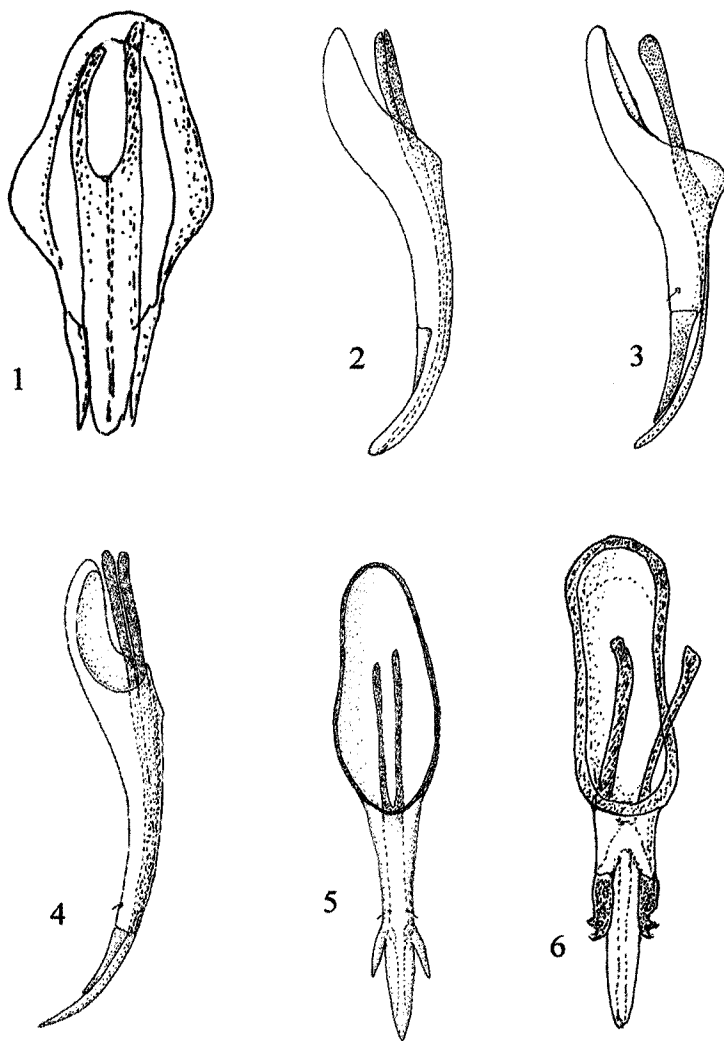


Fig. IV - Copulatory organ of: 1. *Omyomymar* sp. 1. 2. *Omyomymar* sp. 2. 3. *Omyomymar* sp. 3. 4. *Omyomymar* sp. 4. 5. *Platyfrons helavai* Yoshimoto. 6. *Polynema* sp. prope *pratensiphaga* Gahan.

Omyomymar sp. 3

Very similar to *Omyomymar* sp. 2, but with shorter phallobase and longer parameres (Fig. IV, 3). Length: 0.133.

Material examined. 1♂, CANADA: Ontario, Hamilton, 31.VIII-7.IX.1987, coll. M. Sanborne.

Omyomymar sp. 4

Similar mostly to *Omyomymar* sp. 2, but with longer phallobase; its distal part beyond dorsal opening about twice the length of the latter (Fig. IV, 4). Length: 0.19 mm.

Material examined. 1♂, CANADA: Ontario, Hamilton, 31.VIII-7.IX.1987, coll. M. Sanborne.

Comments. According to SCHAUFF (1984) the genus *Omyomymar* «is most closely related to *Erythmelus* and *Anaphes*». This assumption, based on extragenital characters, is not confirmed by the structure of the male genitalia. In fact, *Omyomymar* shows a genitalia type very similar to those of other genera included in the Mymarinae Mymarini (VIGGIANI, 1989).

Gen. *Platyfrons* Yoshimoto

The genus includes only the type *P. helavai* Yoshimoto (1990).

Platyfrons helavai Yoshimoto

Phallobase tubular (Fig. IV, 5), with a very large opening as long as half of the entire length of the copulatory organ, with triangular volsellar digiti and without hooklets. Aedeagus very long and narrow, with apodemes one-third shorter than the entire length. Length: 0.21 mm.

Material examined. 1♂, ECUADOR: Largo Caicochi 18000, 12 km W. Catocache, 12.II.82, coll. A. Borkent.

Gen. *Polynema* Haliday

This genus includes over 250 species. The male genitalia have been described for four species (VIGGIANI, 1973; VIGGIANI & JESU, 1987).

Polynema sp. prope *pratensiphaga* Gahan

Very similar to *P. straticorne* Girault, but with parameres shorter 3 times as long as wide (Fig. IV, 6) (5 times as long as wide in *P. straticorne*), plate-shaped, apparently with typical volsellar digiti as in many Chalcidoidea. Length: 0.13 mm.

Material examined. 1♂, ITALY: Papiano (PG), VI-VII.1985, on sunflower, coll. F. Bin.

Gen. *Schizophragma* Ogloblin

This genus, considered as a subgenus of *Patasson* Walker by ANNECKE & DOUTT (1961), was recognized valid by HUBER (1987).

Schizophragma bicolor (Dozier)

Phallobase short, boat-shaped (Fig. V, 1), with large dorsal opening, distally fused with the body of the aedeagus; parameres sword-shaped, almost reaching the end of aedeagus; volsellar digiti lacking; aedeagal apodemes 0.75 times as long as body of the aedeagus. Length: 0.120 mm.

Material examined. 1 ♂. WEST INDIES: Trinidad, Curepe, Santa Margarita, Circular Road, 9-23.II.1974, coll. F.D. Bennett; 1 ♂, same data, but 29.IV-25.VI.1974; 1 ♂, AZ, Pima, Co., Corona National Forest, Tanque verde, 24.VIII.1982, coll. J. La Salle.

Schizophragma sp. 1

Very similar to *S. bicolor*, but phallobase 1.9 as long as body of the aedeagus (in *S. bicolor* slightly longer) (Fig. V, 2). Length: 0.09 mm.

Material examined. 1 ♂, GUATEMALA: Depto Zacapo, San Lorenzo, 17.VII.1986, coll. L. Le Sage.

Schizophragma sp. 2

Very similar to *S. bicolor* and *S. sp. 1*, but parameres about 0.6 shorter than body of aedeagus and basally with a small, internal protuberance, bearing a short seta (Fig. V, 3). Length: 0.1 mm.

Material examined. 1 ♂, COSTARICA: Penas Blancas, III.1986, coll. A. Forsyth.

Schizophragma sp. 3

General ground plan completely different from the previous species. Phallobase long, tubular (Fig. V, 4), without parameres, but with plate-shaped volsellar digiti bearing one hooklet; aedeagal apodemes 2.5 times as long as body of aedeagus. Length: 0.13 mm.

Material examined. 1 ♂, WEST INDIES: Trinidad, Curepe, Santa Margarita, Circular Road, 26.V-8.VI.1974, coll. F.D. Bennett.

Comments. According to the male genitalia features, the position of sp. 3 in the genus *Schizophragma* is questionable.

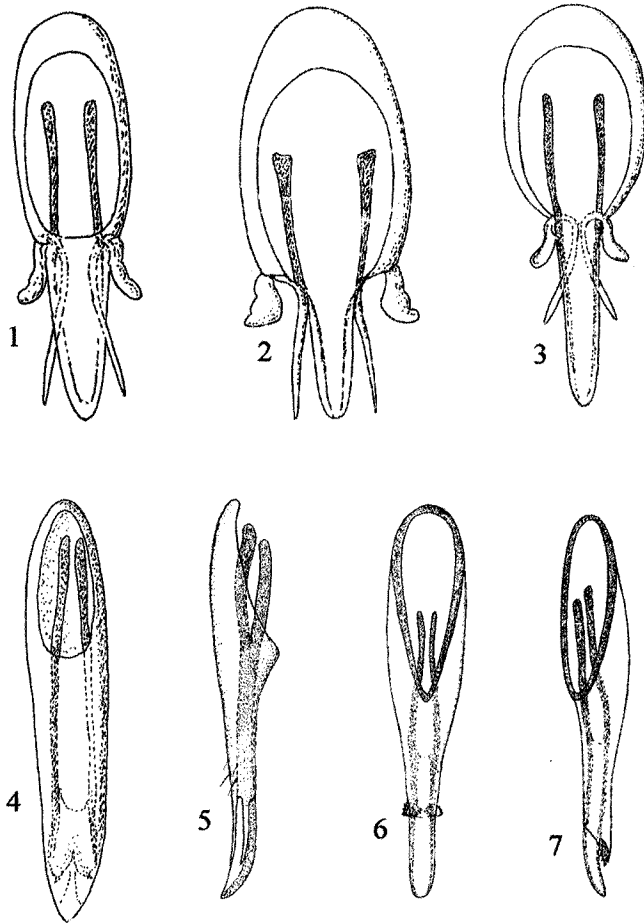


Fig. V - Copulatory organ of: 1. *Schizophragma bicolor* (Dozier). 2. *Schizophragma* sp. 1. 3. *Schizophragma* sp. 2. 4. *Schizophragma* sp. 3. 5. *Stephanodes* sp. 6. *Stomarotrum prodigiosum* Yoshimoto, Kozlov et Trjapitzin, from above. 7. The same, side view.

Gen. *Stephanodes* Enoch

This genus includes about 10 species. The male genitalia have been described only for *S. similis* (Förster) (VIGGIANI, 1973).

Stephanodes sp.

Very similar to *S. similis*, but with longer parameres, 10 times as long as wide (6 times in *S. similis*) (Fig.V, 5). Length: 0.15 mm.

Material examined. 1♂, CANADA: British Columbia, 4-15.VII.1987, coll. C.A. Gisey.

Gen. *Stomarostrum* Yoshimoto, Kozlov et Trjapitzin

This genus is monotypic.

Stomarostrum prodigiosum Yoshimoto, Kozlov et Trjapitzin

Phallobase tubular (Fig. V, 6-7), without parameres; volsellar digiti rather short, plate-shaped, with 3 small hooklets; body of aedeagus slightly shorter than apodemes. Length: 0.152 mm.

Material examined. 2♂, JAPAN: Fukuoka, Mt. Tacibanajama, 12.VIII.1988, coll. C.M. Yoshimoto.

Comments. The shape of the male genitalia in *S. prodigiosum* remembers that of *Anagrus* spp. (VIGGIANI, 1973).

CONCLUSIONS

The male genitalia described in the present paper confirm the presence of surprisingly interspecific and intergeneric variations in the Mymaridae. Some of them constitute peculiar types of male genitalia (see in *Gonato-cerus*, *Stethynium*), which are unique among the Chalcidoidea and allied superfamilies.

In general, as pointed out by VIGGIANI (1970, 1973) and confirmed by SCHAUFF (1984) the basic structure of the male genitalia remains quite constant among members of the same genus. Remarkable variations around a well-defined ground plan, retained intrageneric according to the traditional definition of a given genus, should suggest a revision of that genus concept.

Allied species show rather similar male genitalia. Moreover the intraspecific stability of their characteristics, as shown in a recent study of *Anaphes flavipes* (Förster) (VIGGIANI, 1994), can not be ignored for a reliable species characterization and discrimination.

Male genitalia of members of several genera were illustrated by NOYES & VALENTINE (1989), but their characteristics were not used to distinguish « some groups of possible monophyly » proposed by the same authors. In the classification of the Mymaridae by VIGGIANI (1989), *Allanagrus* Noyes et Valentine, *Ceratanaphes* Noyes et Valentine and *Paranagroidea* Noyes et Valentine fit in the Mymarinae Anagrini; *Ischiodasys* Noyes et Valentine and *Steganogaster* Noyes et Valentine into the Mymarinae Anaphini.

In a revision of the genus *Agalmapolynema* Ogloblin, FIDALGO (1988) has illustrated the male genitalia of *A. mirabile* Fidalgo, which confirm the affinity with *Acmopolynema* Ogloblin.

The genitalic capsule of a species of *Dicopomorpha* Ogloblin (*D. ech-*

mepterygis Mockford), a genus including a few very small Mymaridae, has been described by MOCKFORD (1997). The illustrated features suggest that the genus should be included in the Mymarinae Alaptini (VIGGIANI, 1988).

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