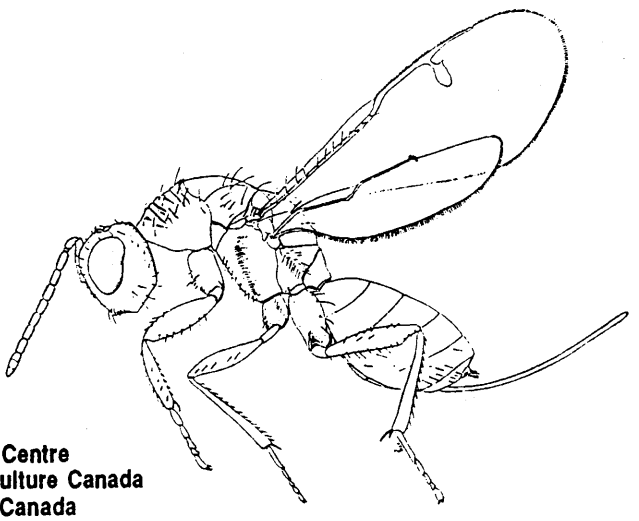
CHALCID FORUM

A Forum to Promote Communication Among Chalcid Workers

No. 14 July 1991



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EDITORS' NOTES

Weeeeeeer're back! With this issue of **Chalcid Forum** the boys from the Systematic Entomology Laboratory (USDA) regain control of the fabulous forum. The previous 3 years have been well handled by Gary Gibson and John Huber and we thank them profusely for freeing us up during that time. Now that we are back, we will strive to return to the days of the twice-yearly mailing — once in July and once in January, but this will, of course, depend upon the amount of material we receive. If there is not enough we will simply wait until the next regular mailing date to put out an issue. The literature search provided by John Huber is especially welcome. We have cross-checked this against our own literature search and can verify that the list provided by John is exceptionally complete. It is a valuable service that he provides to all of us, and it saves an enormous amount of time for other tasks.

The masthead for this issue is *Megastigmus floridanus* Milliron (Torymidae) rendered by EEG.

RESEARCH NEWS

John Huber (Ottawa, Canada): "I attended the 3rd International *Trichogramma* and Other Egg Parasitoids symposium in San Antonio, Texas, at the end of September 1990. It was a very successful conference attended by 77 participants from 22 countries. The talks lasted for 2.5 days and 1 day was devoted to a bus tour of the city including visits to museums, historic sites and a barge cruise on the river. The food was excellent and no doubt helped to promote some lively discussion in the evenings. One evening was used for small working group discussions and another for a poster session.

Most of the talks were on *Trichogramma* but about 10 dealt with other egg parasitoids such as *Telenomus* (Scelionidae), *Anastatus* (Eupelmidae), *Anaphes* (Mymaridae) and others, or general topics relating to egg parasitoids. I take this opportunity to extend my thanks and appreciation to the organizers, Dr. S. B. Vinson and W. C. Nettles, Jr., for an enjoyable and well run symposium. The symposium was sponsored by the IOBC global working group on *Trichogramma* and Other Egg Parasitoids. Drs. S. A. Hassan (Germany), G. A. Pak (Netherlands) and E. Wajnberg (France), the co-chairmen of the working group, all attended the symposium and gave very interesting talks on rearing, behavior and genetics of *Trichogramma* and led some interesting and fruitful discussions about further international cooperation on mass rearing and quality control in *Trichogramma*.

As with previous *Trichogramma* symposia the proceedings (abstracts and papers) will be published by Les Colloques de l'INRA. For those wishing to buy a copy about 30 are available from Dr. S. B. Vinson, Dept. of Entomology, Texas A & M University, College Station, TX 77843-2475, USA for about US $25-30. Anyone wishing to receive "*Trichogramma* News" should write to Dr. S. A. Hassan, BBA, Institut fur Biologische Shadlingsbekampfung, Heinrichstr, 243, D-6100, Darmstadt, Germany. Five issues of the newsletter have already been published."

T. C. Narendran (Kerala, India): "Mr. K. Anil is working for a doctorate degree under my supervision, on Indian eupelmids. His address will be the same as mine." He also writes that P. M. Sureshan has left research and is now working as a school teacher.

J. P. Parkman (Gainesville, Florida): "My research interests have shifted to the biological control of mole crickets and away from the identification and utilization of chalcids. We are in the early stages of developing a biocontrol database and library in our department."

Karsten Schonrogge (Silwood Park, England): "I worked in Kiel (Germany) during my Masters project on the biology of Hymenoptera on the leaves of oak and of their parasitoids. Therefore I was looking for sawflies, which includes the leaf-mining species *Profenusa pygmaea*, and for cynipid leaf-galls. I've recently begun my work here in Silwood Park towards

the PhD. The main subject of our project is a gall wasp named *Andricus quercusalicis*. We are more interested in community structures and relationships than in taxonomy, but even so on one hand we have to identify the species we are working with and on the other we're looking for galls in regions where not too much work has been done."

Peter Bonde Jensen (Aarhus, Denmark): "These months I am busy with a project entitled: 'The effect of pesticides on parasitoids related to insects on and in the agricultural ground." I find this job extremely interesting, and I love the challenge dealing with so many different parasitoids. In this job I have to find the more common parasitoids that occur in numbers so they may be treated statistically. So I spend my time looking for conspecific specimens. This is actually precisely the kind of job I hoped to get for the Center I established last year (Center for Applied Parasitoid Taxonomy) so now I have a good chance to show that I can do what I claim I can do."

John Heraty (College Station, Texas): "I have just finished my dissertation on the classification and evolution of the Eucharitidae at Texas A&M University. In the new year, I will be starting a two-year postdoctoral program at Carleton University. This will give me ample opportunity to bother Gary, John and all of the other Hymenopterists at BRC. I will be returning to my original research project (a revision of the New World Orasema) and hopefully getting out the publications on the Old World Oraseminae that I have been working on. My new address will be at the Department of Biology, Carleton University, Ottawa, Ontario, Canada, K1S 5B6. Collections of eucharitids (adults and immature stages) are always welcome."

FORUM

ANELLUS vs. ANNELLUS
by George C. Steyskal
(Washington, D.C., USA)

"In response to Menke, et al., there is nothing wrong with 'anellus,' as in Collins, the great Harper Unabridged, and many other dictionaries. Harper has *'anellus* (not ann-)...' and *'annellus*,v. anellus.' Apparently the misspelling with a double -n- has a long, if not honorable, history. Furthermore, 'catalogue' is still 'correct' in British English and has been in American English until 'catalog' came to be considered 'correct' in some quarters. Neither anellus nor annellus is in Webster III; it must be considered a strictly Latin anatomical term. The nomenclatural term Annellida is another matter."

SEGMENT, ETC.
byGeorge C. Steyskal:

"Now a word or two on segment, etc. I get an excruciating pain in the anellus every time I run up against this brouhaha about segment and all those -meres. 'Segment' is a perfectly good English word for a definite part of anything, even time. Nothing is simpler to understand, even by non-morphologically or sophisticated-anatomically oriented laymen, than '1st, 2nd, 3rd, 5th, 50th, etc., antennal segment' and nothing is lost in accuracy. If we are going to be prissy about antennomere, flagellomera, etc., we should recognize that -mere is from Greek, not Latin, and ceratomere and mastigomere would be better than antennomere and flagellomere, and for the sake of consistency we should also talk about gastromeres, etc. etc."

YET MORE ON SEGMENTS
by G. C. Steyskal:

"Mohammad Hayat's comments on the use of the good old English word 'segment' (Chalcid Forum, Sphecos 13:7) strikes a responsive chord. I still think it is both logical and good morphology to refer to segments whenever you find them on the abdomen, legs, antenna, a time scale, anything, as long as you indicate what it is a segment of (? or 'of what it is a segment!). There is no advantage to adding segments of words to -mere; I have yet to hear of 'abdominimere,' or should it be 'gastromere?' Abdominal segment I is equal to telomere IV, just as antennal segment III is equal to flagellomere I. It is all mere quibbling.

And on the subject of spelling, we barbaric Americans prefer 'catalog' and 'analog' to spellings with unheard 'ue' added; we also like to uphold our honor and vigor with adding 'u's to them.. Mohammad ought to be spelled Muhammad because the name is of Arabic origin and in that language 'o' is only a variant of the letter "waw." Steyskal is Czech and if we worry about the 'correct' way to spell it, it should be Stejskal (unpronounceable in English)."

Some More Words on Chalcidoid Classification: Torymidae and Agaonidae.
by *Eric Grissell*
(Washington, DC, USA)

In Chalcid Forum No. 13, John Noyes and Gary Gibson each gave us "a word on chalcidoid classification." Actually it was many, many, many words but then who's counting? It is interesting to note the two opposing approaches to systematics, in one case the "trust-me-I-think-I-know-what-I'm-doing" approach (i.e. intuitive) and in the other the "confounding-with-hordes-of-obfuscating-details-and-hypotheses-until-they-drop" approach (i.e., cladistics). As one of the generation of systematists that bridges both approaches it is difficult to accept either methodology without question. In my opinion both approaches rely upon the human propensity for self-deception and are thus, both open to skepticism.

For years I have been beating myself over the head in an attempt to reconcile "intuitive" chalcidoid phylogeny with "cladisitic" phylogeny in the Torymidae. For this reason, and since Noyes and Gibson have started a phylogenetic diatribe, I would like to lend my voice to the arid wilderness of the imponderable. Gary specifically requested some resolution on the torymid/agaonid relationship problem and, sensing a call for help from a distressed colleague, I will present some preliminary findings of my own on the matter.

Unfortunately it was never my intention to study anything other than the "Monodontomerinae." I soon became mired in a stew of red-herrings which included not only other torymid subfamilies (e.g., Thaumatotoryminae, Megastigminae, Toryminae) but also sycophagines and agaonids and the odd group *Echthrodape* (which John Noyes also brought up in his discussion).

Below I present a discussion from the phylogeny section of my nearly completed manuscript on the phylogeny and classification of "most of the torymids" and hope that some of my knowledgeable colleagues will

correct or confirm some of my observations. I regret that I cannot provide illustrations for all of this, but they will be included in the final manuscript. (In case you were wondering, the manuscript, which I hope to finish by January 1992, will include an annotated catalog to world species (excluding *Megastigmus*, but with only a checklist of *Torymus*), a phylogeny of non-megastigmine torymids, a key and discussion of world genera, and host-parasite lists.)

MONOPHYLY

The question of monophyly in the Torymidae has been a long-standing one even if it was not couched entirely in the words of modern systematics. The elements that have been unstable for over a century generally revolve around the following taxa or groups of taxa: the fig wasps, including directly Sycophaginae (sometimes called Idarninae) and indirectly the Agaoninae (sensu Boucek 1988); Podagrioninae (placed variously as its own family, a subfamily of Torymidae, or a tribe of Monodontomerinae); and Ormyridae (placed as a subfamily of Torymidae, a subfamily of Pteromalidae, or its own family). These taxa are generally considered to be "phylogenetic units" (i.e., monophyletic), but they have been moved "up or down," or "in or out," of heirarchical schemes because their placement is open to speculation.

Alternatively, the presumed monophyletic units that have consistently been included in the family for over a century are the Megastigminae, the Toryminae, and the Monodontomerinae. These latter 3 taxa and the podagrionines are the ones I have studied in some detail and are the ones upon which I can speak from first-hand knowledge.

Character evidence supporting monophyly: Based upon my study I can define the monophyly of Torymidae exclusively only upon a single synapomorphy: the placement of the cerci on metasomal tergum 8: each cercus is situated on the membranous area at the lateral margin of MT8. A secondary synapomorphy that is present in the majority of Torymidae is that MT8 is partially divided longitudinally, or if not divided then sharply folded. Rarely, in some podagrionines, MT8 is simplified but this does not impinge upon the placement of the cerci which still remains as the defining synapomorphy. It is possible that the divided or folded condition of MT8 is a synapomorphy for the family, but I discovered this condition so late that I was not able to survey all taxa for its presence.

Of secondary concern are two characters that previously have been used to define Torymidae, but that appear to have arisen more than once in the development of chalcidoids. One character is that metasomal tergum 9 (MT9) is a freely articulated, flaplike sclerite often called an epipygium. The second is the elongation of cerci on MT8. All members of the family Torymidae have these characters, but expressions of them may be found in some taxa believed to be non-torymid or at least of questionable lineage. In the following discussion, I summarize my findings on these 2 characters.

Epipygium: There is some question whether MT9 is a true, separate segment or is a secondary divison of MT8. Either way the points I make next remain valid. In torymids MT9 is a distinct, "flap-like," sclerite separated from MT8 by a membranous area (in the majority of torymids it actually arises from between two lateral projections of the longitudinally subdivided 8th tergum). The flap-like condition of MT9 is also rarely found in some putative pteromalid taxa such as Chromeurytominae (2 genera placed in the Pteromalidae by Boucek 1988), Ditropinotellinae (1 genus placed in Pteromalidae by Boucek 1988), Ceinae, and the putative eucharitid genus *Echthrodape* (placed in Eucharitidae by Boucek 1988).

In Chromeurytominae, *Chromeurytoma* has a large, well-developed MT9 that fits closely with MT8 or is even fused for its length (*Asaphoideus*) with MT8. In both these genera, MT8 is a single, narrowed strip dorsally (not from longitudinally divided or folded as in Torymidae) and the cerci arise from the tergal surface itself (not membraneous regions along the edge of the tergum). In the genus *Cea* MT 9 appears as for *Asaphoideus*. *Cea* is a rare group, however, and I have only examined one specimen. In Ditropinotellinae there is an exceptionally long apparent "MT9," but as best I can determine this is merely a posterior extension of MT8 and not separated at all from it. In *Echthrodape* MT9 is enlarged as in *Chromeurytoma* but the cerci are not elongated and they arise from small extensions of MT8.

In past classifications both *Chromeurytoma viridis* (Girault), described as *Amonodontomerus viridis*, and *Ditropinotella compressiventris* Girault were placed in Torymidae, but I agree with Boucek (1988) that they are not Torymidae as defined by the synapomorphy of the modified MT8. I do not know enough about the pteromalids to know if that is the correct placement for them. If the modifications of MT8 in the Torymidae are apomorphic, as they appear to be, then the pteromalids appear to be pleisiomorphic for this character.

Relationships of Sycophaginae (Agaonidae, sensu Boucek 1988) to Torymidae are discussed below based upon characters found in the head, but considering MT8 alone, at least in *Apocryptophaga*, *Eukoebelea*, and *Sycophaga*, its structure appears to be the same as the condition found in Torymidae even to the extent of the partial longitudinal division. If this is correct, then MT8, itself, supports monophyly of Torymidae + Sycophaginae. The abdomen of Agaonidae (s. str., Agaoninae sensu Boucek 1988) is relatively difficult to study and interpret but MT8 appears to me to be differently structured. Copland and King (1973), who call this the "outer ovipositor plate" state that it "differs in a number of respects from those in other families." This needs further study.

Gibson (1989) pointed out that in *Metapelma* and *Eusandalum* both Eupelmidae) there is a separated MT8 and MT9 but these taxa appear to have nothing to do with Torymidae and the characters are even considered independent, secondary reversals within differing clades of the Eupelmidae. This information is reported simply for completeness sake. Torymidae would seem to have little to do with Eupelmidae in any phylogenetic analysis.

Exserted Cerci: Exserted cerci are sometimes cited as a distinguishing characteristic of Torymidae. While it is true that all torymids have exserted cerci, the condition rarely may be found in some Pteromalidae (e.g., *Cea*, Chromeurytominae) and Eulophidae (e.g., *Entia*), but I do not consider this to be a serious contradiction to the monophyly of Torymidae. Of more interest is the

occurrance of the cerci in at least Agaoninae and Sycophaginae (sensu Boucek 1988; I do not know the condition in the remaining subfamilies of Agaonidae sensu Boucek).

To dispense with the pteromalid/eulophid groups first, it must be stated that the occurrance of exserted cerci in these groups is rare. In the case of *Entia*, which has no known relationship to the Torymidae, the elongation of the cerci certainly must be the result of convergent or parallel evolution. The same may be said for its occurrance in *Cea*, but in this case the relationship of Torymidae to Pteromalidae is not as distant as that with Eulophidae. This may even indicate a sister-relationship with that taxon. In Chromeurytominae (Pteromalidae) all species apparently have the exserted cerci, and this again indicates a possible sister-group relationship. Alternatively the exserted cerci may be parallel in development. Unfortunately we know very little about morphology or phylogeny in these groups. Both *Cea* and Chromeurytominae have MT8 and MT9 modified and different from most other pteromalids, but, as explained above, the condition is also different from torymids. Obviously more study is required to assess the relationship of torymids to pteromalids.

In Agaoninae and Sycophaginae all taxa appear to have exserted cerci and thus it can be argued that these taxa are hypothetically part of the torymid clade. That is, exserted cerci are the ground plan for Torymidae + Agaonidae (sensu Boucek 1988). This agrees, in part, with evidence from MT8 and 9 as discussed above (and with data from the head as discussed below).

Character evidence not supporting monophyly:

Having discussed the character(s) that define monophyly in the Torymidae, I should discuss the characters used in previous "classifications" that do not provide evidence for monophyly. The enlarged hindcoxae, for example, are not a synapomorphy that defines Torymidae. Not only are normal-sized hindcoxae found in the Megastigminae and many of the primitive groups of Toryminae (e.g., *Liodontomerus, Microdontomerus*), but one also finds enlarged coxae in Chalcididae, Ormyridae, and Leucospidae and Eulophidae. Wing venation, although characteristic for many torymids, cannot define the family because relatively similar venation is found in many pteromalids. Lengthened ovipositors, long held to be an indication of relationship in the Torymidae, are found in some species of almost all families, and so cannot be used to establish monophyly.

The presence of an occipital carina, as used by Boucek (1988) to help define Torymidae, may indicate monophyly, but more likely, may help establish the sister-relationship of Torymidae to one of the few branches of the Pteromalidae that has the carina (e.g., Chromeurytominae). Coincidentally the presence of the postgenal bridge, used by Boucek (1988) to separate Torymidae and Agaonidae from Pteromalidae may prove to be the synapomorphy that establishes the monophyly of Torymidae + Agaonidae (sensu Boucek 1988; see ensuing discussion under Sycophaginae) and ultimately that of one branch (of several) currently included with the Pteromalide (e.g., Ditropinotellinae, Chromeurytominae). This awaits further serious study.

Sycophaginae:

At the inception of my study this subfamily was considered a monophyletic clade of Torymidae (Hill 1967). It was an enigmatic group of fig-associated wasps consisting of 6 tribes and 34 genera (10 of which were unplaced as to tribe). This group was not part of my original study for two reasons: 1) Although purportedly monophyletic its synapomorphies had never been defined. Hill's classification (1967) was completely unsupported by evidence and no definitions of taxa were given (except for the new subfamily Epichrysomallinae and the new tribe Sycoecini). 2) Whether monophyletic or not, the "subfamily" appeared to be a highly derived group of taxa, irrelevent to my study of the presumably more basal forms of "Monodontomerinae." Of course this was a subjective assessment. If I could resolve the more basal groups I expected to be able to later include the apomorphic groups without difficulty. My study of these basal groups has proven extremely difficult in itself, and has become such a large project, that I have not been able to study the Sycophaginae with any degree of completeness.

Since Hill's classification in 1967, 4 of the 6 tribes were elevated to subfamilies, 2 placed as tribes within the subfamilies, and all transferred to the family Agaonidae (Boucek 1988). Thus, theoretically, Sycophaginae should be of no further concern to my study. But this classification raises the much larger question of the monophyly of both Torymidae and Agaonidae (sensu Boucek 1988). According to Boucek the limits of these two families "can now be settled by the presence [Torymidae] or absence [Agaonidae] of the horseshoe-like occipital carina." There are, however, other interpretations of the data, and I feel it is necessary to discuss the implications suggested by the data. Because of the problems involved with recognizing Agaonidae as Boucek does (i.e., a monophyletic unit composed of 6 subfamilies) I will first discuss the situation in relation to Sycophaginae and Agaoninae (sensu Boucek 1988). The other subfamilies are much more poorly known to me and will be discussed only marginally at the end of this section.

First there is the question of the occipital carina and hypotheses derived from its presence or absence. It is true that in almost all Torymidae (as defined by this study) the occipital carina is present and that in Sycophaginae and Agaoninae it is absent. As I will demonstrate in the final draft of this manuscript, I believe that the presence of an occiptial carina is the groundplan state for Torymidae. Boucek (1988:157) agrees at least with this viewpoint. A loss is hypothesized to be a reversal from this state based upon my data. Under this hypothesis it is possible that the Sycophaginae and Agaoninae represent derived clades within the torymids. This is the simplist interpretation of data derived from the occipital carina, and would also support the thought that fig wasps are highly derived.

If, on the other hand, one accepts the absence of the occipital carina to be a plesiomorphic state (shared with Pteromalidae) then the hypotheses needed to explain putative relationships of any kind become more complicated. Two possibilites would exist:

1) Sycophaginae and Agaoninae are plesiomorphic groups of Torymidae. This hypothesis agrees

with Boucek's suggestion (1988:157) that the agaonids arose from a seed-feeding ancestor because it places them near the plesiomorphic Megastigminae, a torymid group nearly exclusively seed-feeding in habit. But all megastigmines have the occipital carina so that the only hypothesis that would fit the statement being made, i.e., that the absence of a carina is plesiomorphic rather than derived, is that agaonids retain the primitive state (no carina) with respect to the megastigmines and thus are the sister group to them. Based upon biology this might seem unlikely because megastigmines feed phytophagously on relatively more primitive plants (e.g., conifers, rosaceous plants) whereas agaonids are all confined to the more derived types of figs. This, however, may be more an indication of adaptive radiation within a new host niche than indications of wasp phylogeny.

2) Sycophaginae and Agaoninae are derived from some group other than Torymidae. This hypothesis, although worthy of further study, is problematical in that there seems to be little evidence to derive the lineage from any other group except possibly the Pteromalidae. Even this line of evidence is fairly weak if we expand the discussion to include characters other than the occipital carina. Boucek (1988) discovered that both Torymidae and Agaonidae (sensu Boucek 1988) share a similar structure of the back of the head, namely the presence of a postgenal bridge, which unites them and separates them both from the Pteromalidae which does not have the bridge. Unfortunately this character is not wholly unique for Torymidae and Agaonidae. It also occurs in *Ditropinotella* and *Chromeurytoma* (which Boucek 1988, placed as pteromalids) and another pteromalid, *Cea*. Thus, the ramifications of this character will remain unclear without further analyses.

Another factor is that one of the synapomorphies shared by all Torymidae, the exserted cerci on metasomal tergum 8 (Copland et al. 1973, and personal observation), is found also in Agaoninae and Sycophaginae but again only rarely in a few genera currently placed as Pteromalidae (i.e., *Chromeurytoma, Cea*).

A final character, often used as a synapomorphy to unite Torymidae is the freely hinged, or flap-like, metasomal tergum 9. I have not been able to assess the state for all the agaonid subfamilies (sensu Boucek 1988). The terminal segment appears to free at least in some sycophagines (e.g., *Apocryptophaga, Sycophaga*) but not in agaonines (based upon examination of examplars of genera, as well as discussions and illustrations by Wiebes 1966, Copland and King 1973, and Gordh 1975), but a rigorous morphological study needs to be undertaken.

If one accepts that the postgenal bridge and exserted cerci are synapomorphies essentially unique to the Torymidae + Sycophaginae + Agaoninae, (even ignoring metasomal tergum 9) then this group is again monophyletic (as suggested by evidence from the occipital carina) and not easily derived from some member of the Pteromalidae.

The hypothesis that Torymidae and Agaonidae are each monophyletic taxa (Boucek 1988) produces more questions than it answers. Neither clade can be independently defined by potential synapomorphies such as exserted cerci or the presence of a postgenal bridge because both clades have these characters (and possibly also the freely hinged epipygium but this needs to be checked). And if each clade is defined by the presence (Torymidae) or absence (Agaonidae) of the occipital carina, then the hypothetical evolution of the carina almost requires that the group be monophyletic. The hypothesis that fits the evidence presented by both Boucek and me (on the occipital carina) suggests that Torymidae + Agaonidae are a monophyletic group with at least the Agaoninae and Sycophaginae derived from within the clade.

In addition to the many imponderables already raised, a primary difficulty that arises with the preceding discussion is that the non-Sycophaginae + Agaoninae subfamilies are not included. This is partly due to the fact that these groups are essentially unknown to me. But if one accepts the hypothesis that the Agaoninae (Agaonidae of authors) are monophyletic, as most authors (including Boucek 1988) have done, then the placement of additional presumptive subfamilies is almost irrelevant in terms of the hypotheses given above. Each subfamily represents a monophyletic clade that needs to be placed somewhere within the structure of an otherwise nearly complete phylogenetic tree.

In past work some of these subfamilies (e.g. Epicrysomallinae, Otitesellinae) were placed in the Pteromalidae (Boucek et al. 1981) and more recently, when placed in the Agaonidae, Boueck (1988) alludes to the fact that these subfamilies may indicate a "convergency or indication of broader relationsip" presumably to the Pteromalidae. In the Epichrysomallinae Boucek (1988) stated that some species have an occipital carina and some don't. This might indicate that the group is intermediate between Torymidae (with a carina) and Agaonidae (without a carina). Thus Epichrysomallinae may be a derived clade of torymids and the agaonids may be derived from the Epichrysomallinae.

It is apparent that much work remains to be done, and I believe that the resolution of any problems concerning the phylogenetic relationships of torymids, sycophagines, agaonids, and other "fig wasps" must await a time when someone can assemble and study representatives of all the taxa involved.

ANNOUNCEMENTS

Third Course on the Biology & Taxonomy of Parasitic Hymenoptera
5 - 11 April 1992
(Inclusive)

This course is run by The Natural History Museum, London (formerly British Museum Natural History) and University of Sheffield. It will take place at University of Sheffield, UK (residential). Cost is £550 including tuition, manual, accommodation, breakfast and evening meals. Student reductions are available.

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From ***E. W. Classey, Ltd.*** comes the announcement that "We would be grateful if you could kindly bring to the attention of your readers that we are now doing, apart from our regular catalogues, a series of special subject lists. We have so far printed lists on

Diptera, Hymenoptera, Coleoptera, Botany and Lepidoptera. If any of your members are interested all they have to do is write or telephone giving speciality interested in." (E. W. Classey, Ltd., P. O. Box 93, Faringdon, Oxon SN7 7DR, UK; Tele. 036782 399).

John Noyes (BMNH, London, England) sent the following announcement about sweep-nets: "Is anyone out there interested in buying a super-delux sweep-net? Guaranteed to improve your collecting. The net is made of aluminium and is based on my design of 1982 with slight modifications to allow for the attachment of a detachable screen. The screen excludes larger pieces of debris, such as leaves or seeds, whilst at the same time allowing microhymenoptea to pass through undamaged. As the screen is detachable it can be removed easily to allow microhymenoptera to be collected using an aspirator.

I may be able to arrange to supply screens (at extra cost) on request if mesh size is specified. Suitable mesh sizes vary from 1/8 to 1/2 " (3 to 12 mm). I can probably also arrange for net bags to be made. These will probably cost around £8 each for basic material or about £25 for polyester monofilament. Bags made of polyester monofilament are much more expensive than those made of "basic" material but they are very tough and can be used on thorny vegetation where other material would be shredded in minutes.

The cost of the sweep-net frame will be about £140 [This is no typo. Ed.] (which includes postage and packing to any part of the world) [As well it might. Ed.]. To achieve this remarkably low cost [That choking sound you hear is that of your Ed. trying not to laugh] I need a commitment [You certainly do. Ed.] for a minimum of 30 nets and payment in advance at my request (the more nets ordered, the cheaper they will be)." Anyone interested should contact: John S. Noyes, Dept. of Entomol., The Natural History Museum, Cromwell Road, London SW7 5BD, England.

NECROLOGY

Jirina Polackova wrote to inform us that her husband *Vladimir B. Polacek* died on 19 January 1990.

Barney Burks, long-time chalcidoidologist for the Systematic Entomology Laboratory (United States National Museum) died on 15 December 1990. A remembrance will appear in the next **Chalcid Forum**.

OTHER DEPARTURES FROM THE WORLD OF CHALCIDOLOGY

Sandrine Ulenberg (Amsterdam, Netherlands) states: "With this move my work on fig wasps will end definitely. From this date on I am not interested in getting Chalcid Forum."

Akey C. F. Hung (Beltsville, USA): "Due to our reorganization I will no longer work on parasitic wasps." He has asked to be deleted from our mailing list.

MUSEUM NEWS

Tachikawa Collection
by *Masaki Abe*
(Kyushu University, Fukuoka Japan)

Dr. Tachikawa's collection will move to our laboratory, Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka 812, Japan, but holotypes will be kept in his Ehime University. I do not know the number and the taxa which will move. I will write you when our laboratory receives them."

The Taiwan Agricultural Research Institute Hymenoptera Collection
by *Christopher Starr*
(National Museum of Natural Science, Taichung, Taiwan)

In the course of compiling data on the present situation in insect/arachnid systematics in Taiwan, the extraordinary Hymenoptera holdings of Taiwan's foremost insect collection have come to my attention. I thin they call for some special comment.

Out of an estimated 1.22 million prepared, pinned specimens at the Taiwan Agricultural Research Institute (TARI), 71% are Hymenoptera, and 67% are parasitics. The breakdown, in thousands, is as follows:

Symphyta	10
Parasitica	
Chalcidoidea	202
Ichneumonoidea	267
Proctotrupoidea	304
Other	39
Aculeata	39
Total	861

The evident reason for the great mass of parasitics is an extensive Malaise-trapping program let by K. S. Lin in the 1980s. The material is for the most part sorted to family, sometimes to subfamily or tribe. A quick look at the sawflies indicates that these also are mainly sorted to family. The aculeates are much less even in their treatment so far. Many are sorted only to order, but I have recently curated the social wasps and some groups of bees.

The curators of the TARI insect collection are Mr. L. Y. Chou and Mr. S. J. Fang (Dept. of Applied Zoology, Taiwan Agric. Research Institute, 189 Chung-cheng Road, Wufeng, Taichung, Taiwan). [condensed to include information of interest primarily to chalcid workers. Eds.]

TECHNIQUES

Berlese-mixture, a nearly forgotten embedding medium.
by *Udo Sellenschlo*
(Hamburg, Germany)

Berlese-mixture (also called Hoyer's embedding medium No. 1) is a very old embedding medium for microscopy. Like Kaiser's glycerol gelatin and polyvinyllactophenol handling is very simple and therefore very good for amateurs.

The objects can be embedded directly from water, lactid acid or alcohol (til 70%). Colouring with carmin, haematoxylin and also metall impregnation are stable. Nowadays Berlese-mixture is used only for the embedding of small arthropods or parts of them, which are uncoloured.

The quantity of the medium shouldn't be too low, because there is a shrinkage during drying. Bubbles under the coverglass can be removed by heating slowly. Light cloudiness, if coming from the alcohol, disappears after a short time.

Some days after embedding it is possible to turn small round larvae by cautious shifting of the coverglass. That is important, if only one specimen is available, which shall be drawn or photographed from several views. Another advantage is, many objects can be embedded without masceration by potassium hydroxide or lactid acid, because Berlese-

mixture makes the objects transparent. The transparency develops slowly, light heat (caution, bubble development) can shorten this process to some minutes.

The surrounding tissue of very small chitinised structures will be transparent and so microscopy is possible. Working with endoparasitic insects it is possible to see the parasitic larvae in their hosts. The slides can be opened by soaking them in water for some time and the parasite larvae can be prepared out of its host.

For permanent slides the coverglass must be surrounded with synthetic resin.

Because the refractive index is similar to glass (n = 1.52), Berlese-mixture is very good for embedding chitinised structures. So it is used frequently by entomologists, acarologists and aranologists. To some extent it can be used for embedding fungus and lichens.

To prepare Berlese-mixture: 30 g arabic rubber is dissolved in 50 ml aqua dest., add 20 ml glycerine and 200 g chloralhydrat. Because of contamination the solution must be filtrated, the filter paper is changed several times (with a loss of substance).

Ready-made solution can be obtained from CHROMA (Chroma-Gesellschaft, Hindelanger Strasse 9, D-7000 Stuttgart-Unterturkheim, Germany.

Net Material

by *J. Heraty, G. Zolnerowich and J. Woolley*
(College Station, Texas)

As chalcid collectors, we are continually faced with the problem of finding adequate material for making net bags. Our problems arise not only from the need for a fine mesh and flexible net material, but also a material which is tear resistant – chalcids love thorny shrubs and a small tear soon forms a major point of exodus for most chalcids. Recently we came across what we believe to be a breakthrough which was spurred on by the initial efforts of Chris Darling (ROM). The ideal fabric (in our opinion) is a fine mesh silk-screen fabric. The material is made of a meshwork of polyester monofilament threads. It can be found in a variety of thread diameters and mesh openings but so far we have found only one which is fantastic (listed below). The mesh is small enough that it retains even the smallest trichs or mymarids, and the fibers are thick enough and strong enough that the material does not tear or puncture easily; the filaments are fused and the material does not run with any small punctures. It is a little bit stiff but not to the point that it is problematical and actually it may have several advantages with its stiffness (tip of bag doesn't bash around while sweeping; easier to hold open while pooting).

On Heraty's recent trip to southeast Asia, he was able to put the net to an ultimate test in Australia (lots of thorns and tough brush). With some minor repairs (sewing up small holes and sealing them with five-minute epoxy), the net lasted for thirty days of continual use. The rim material (canvas) was replaced about three times to keep the bag functional. Woolley and Zolnerowich have also been using the bags with great success in west and south Texas. Lubomir Masner (BRC) was ecstatic about the net and LaSalle and Noyes (BMNH) have sample nets for testing. One other nice thing about the polyester material is that it is washable and becomes white with only a little soap and water (making it better to spot chalcids on the fabric).

We are able to order the material in any length for about $11.00 (American) per yard and we get them sewn for about $10.00 a bag. At $21.00 per bag, this may seem costly - but not if the bag can last a month with daily usage. The ordering information is presented below along with the fabric specifications. we expect that you could get similar material in any country. However, we have ordered at least one material of exactly the same specifications which was too stiff. If you approach a silk-screen manufacturer, you can get sample booklets to compare screen types.

As nets are so important in our specialty, we hope that this article will stimulate a series of articles on preferred net bags, both material and design.

COMPANY: The Advance Group:
- 6440 Rampart St., Houston, Texas, USA, 77081-3599
- 133 Rivalda Rd., Weston (Toronto), M9M-2M6, Ontario, Canada
- 119 Deepcut Bridge Road, Deepcut, Camberly, Surrey GU16 6SD, England

(We have only ordered fabric from the Houston supplier and cannot attest to the rest)

FABRIC SPECS: PRINTEX ™ White Monofilament Polyester
- Mesh Number - 140
- Mesh Opening - 117 microns;
- % open area - 41.0
- Thread Diameter - 65 microns.
- Catalog Number: 33-5144-2 (42" wide) -- $10.45 per meter

TRIPS

A Eucharitid Adventure

by *John Heraty*
(College Station, Texas)

Every once in a while we all get to go on a journey. In my case it happened to be a four-month trip around the world in search of the lowly eucharitid wasp. I was able to convince the United States National Science Foundation that there was not enough known about eucharitids in Southeast Asia. This was not difficult to do; however, it was a little more difficult to convince them of why everyone would want to know about eucharitids, but they were convinced and my thanks go to everyone who supported the project. To top it all off, I was not alone on my journey but was accompanied by my wife and six-year old daughter. The trip lasted from March 29 to August 3, when we finally returned to College Station some 35,000 or so miles later.

Our trip started off with a quick weekend visit to the Bishop Museum in Hawaii. This was a chance to look over their collection and sample the delights of Waikiki beach. The museum is a great place but a word of warning to visitors - don't wear shorts. They keep the museum at about 50°F to protect the collection from insects. It gets a little brisk on the thighs after a few hours of scope work. I managed to spend two days at the museum and one day of touring and collecting around the southern half of the island.

From Hawaii, it was off to Fiji for five days of collecting on the northern and western coasts of Viti Levu. For those of you who have never collected here, and plan to in the future, be prepared for a shock. If it is not sugarcane, it is pine plantations. They are doing a great job at decimating the forests on the island. I made one attempt to get up to Nandarivatu which is the forestry college just out of

Tavua on the northeastern corner of the island. The closest hotel we could find was at Saweni Beach on the northwestern corner of the island, and the steep gravel road up to the station had been washed out in a few places. This was all the more interesting since our rental car was a tiny (brand new) Suzuki car with a four-inch ground clearance! We did make it to the station but it was a slow climb and then we found out that they no longer offer accommodations for visitors. The collecting was not that great for chalcids anyway (spoiled grapes?). All of the collecting in the foothills and around the coast turned up the same collections of chalcids, probably all tramp species. One thing I will say about Fiji, the natives are extra-friendly and curious -- sometimes too curious, and it was hard to poot insects out of a net with seven people trying to see what you were doing.

From Fiji it was off to Brisbane, Australia. Most of my time was spent in the Queensland Museum looking over the Girault specimens and bothering Ted Dahms as much as possible. It was my first chance to see the Australian types and they were in such "good" condition that I was almost brought to tears. I must admit that Girault had an uncanny knack of demolishing the heads of those specimens whose heads have some of the most important characters. I must thank Ted for sorting through the mounds of slides and arranging Girault's types. It made for a productive week rather than a disastrous six months. I did slip out of Brisbane for a collecting trip over about a fifty mile radius around Brisbane. Unfortunately, we picked a holiday weekend to go on the trip. This made it interesting to find places to stay. In one case we got shuffled from a "nice" caravan park to a "not so nice" caravan park. I have never seen so many cockroaches crammed into one small trailer. That was also when we found out that their cockroaches fly. I tried not to sleep with my mouth open that night. Collecting was good and I picked up my first eucharitids on the trip. I also managed to find out that *Myrmecia*, the bulldog ants, have quite a nasty little sting. We were all rather thrilled when we had a 3'-long monitor lizard come to out picnic table looking for scraps.

After ten days in Brisbane, we flew off to Cairns and around the Atherton tablelands for a taste of Australian rainforest. We had three weeks here which was just about enough time to scratch the surface. March is the end of the rainy season, but we still managed to lose about five days to constant drizzling rains. Fortunately, this was after finding a huge population of *Orasema palgravei* on the Black Mountain Road just outside of Kuranda (right where Ted Dahms told me they would be!). The adults were everywhere and depositing their eggs into small punctures on almost every broad leaf plant that made up the rainforest understory. Even better, the host ant, *Hypoponera*, was common in decaying logs along the trail, and I came up with all sorts of parasitized pupae. I was in heaven. This was the species that I had traveled half the globe to get larval information for, and here it was, basically a pest in rainforests. The eggs were so thick on the leaves that the scars made by the oviposition punctures formed a complete crust on the underside of the leaves of some plants. In all, collecting around the tablelands was great. We managed to put 4000 km on the rental car in three weeks. Probably the most memorable occasion was my first experience with land leeches. I had always heard about them but its not the same as having those little blood-suckers chasing you down the trail.

Saying goodbye to Cairns, we went off on a whirlwind trip around Australia. We had a quick three days in Canberra to visit with Ian Naumann and the CSIRO collection, dashed off to the South Australia Museum for a visit with Eric Matthews and the Girault types, and spent the afternoon with Andy Austin at the Waite Institute. Finally, we flew over to Perth for a four-day break before going to Taiwan. I was amazed at how good the collecting was in Perth in May. The fall colours were splendid and the nights a bit nippy but the chalcids did not mind. Even the eucharitids were active, and I managed to collect a good series of *Orasema theocles*.

After a "quick" 16-hour plane ride we arrived in Hong Kong. Here we discovered the problems associated with incorrect visas and then trying to get a flight on standby. After two days of standing around the Hong Kong airport (a horrendous experience), we went ahead and bought new tickets on Korean Airlines. We were again on the collecting road in Taiwan. Thanks to Liang-yih Chou and the Taiwan Agricultural Research Institute, we had interpreters and assistants for our entire stay in Taiwan. Our first trip was into the mountains near Paling in the Da Guan Shan (once called Lo Lo Mountain) National Park. The park is a refuge of 1300-2700 year-old trees with a beautiful understory of a tremendous variety of plants. The mountains are all connected by hiking trails and it would be a glorious place to collect. Unfortunately I spent most of my time picking wet chalcids and ichneumonids out of my net with forceps. We all know the feeling of traveling a long way to a perfect habitat just to have it rain. From Paling, we traveled south to central Taiwan where I spent most of my time around Wushe and Tungpu. The mountainous regions of Taiwan are a beautiful place to collect, but they are definitely favorable to ichneumonoids and not chalcids. There were a few choice localities but the eucharitids remained elusive until my last day of collecting at Sun Moon Lake. Our first exposure to street food in Asia was in the small mountain villages of Taiwan. There were so many varieties of noodles, fish, soups, and tasty delights that we were amazed. The food and accommodation were very cheap and since the only mode of transport was by bus, we saved a fortune in expenses. I managed to visit the Taiwan Agricultural Research Institute, and I was overwhelmed by their collection of Hymenoptera (672,516 specimens). From about 1980-1984, there was a major push to sample the Hymenoptera of Taiwan, and they have built up a huge collection of well-mounted and curated material. The chalcids have been sorted to families and subfamilies by Mr. T. Lin and represent a formidable challenge in the major groups (see Chalcid Forum 12 for list of specimens). There are literally drawers upon drawers of unsorted Pteromalidae, Encyrtidae and eulophids. To wet your lips, they also have some high quality Zeiss microscopes to make things easy for visitors. Based on the quality and diversity of eucharitids that I borrowed from their collection I would rank this as one of the best collections of South-east Asian Hymenoptera. As well as Taiwan material, they also have a good collection of T.C. Maa material from mainland China in the Fukien

Province. Mr. Chou indicated that accomodations were available for researchers who wish to visit and curate the collection.

After three weeks in Taiwan, we were whisked away to peninsular Malaysia where we located ourselves in Kuala Lumpur. I was based at the University of Malaya and managed to hitch rides up to the mountain forests with a field course traveling to the Forestry Research Station near Gombak. As a quick summary, some of the best collecting sites were the botanical gardens on the university campus, the research station at Gombak and the 13th mile east of Gombak. The 13th mile site was tremendous and ranged from scrub grasses to rainforest with numerous forest roads branching off into the woods. For those with strange interests, this was a tremendous butterfly spot as well. I went along with the field course up to the Genting Highlands. There is a gorgeous elfin forest about 2 km N of the casino which has stunted trees, thick moss, orchids, rhododendrons, and some great (although sparse) chalcids and proctos. At only 3250' in elevation it seemed unusual to have a stunted forest, but there it was in all its glory. I was luckily steered clear of the casino by the 30 muslim girls with whom I was collecting. Our family also took a river trip into Taman Negara, the largest national park in peninsular Malaysia. The trip was six hours by bus and four hours by river taxi (motorized dugout), but well worth it. The park headquarters are located in Kuala Tahan in the center of the rainforest. Accommodations are modern and lots of trails fan out from the park facilities. Depending on your needs, there are Orang Asli guides available to take you on one-to two-week trips. The park has overnight hides (raised shelters) for staying overnight and watching animals come to the salt licks. Other than Sambal deer, the only other big animals we saw were the wood rats (over a foot long without the tail) that came in the night and took away the food. The rats are supposed to be relatively tame, and the guide books encourage you to leave food for the experience! Ours managed to grab a bag of noodles and then spent two hours noisily trying to remove the plastic wrapper.

From Kuala Lumpur, it was off to Bangkok. This was only a quick one week trip but turned out to be one of the most productive collecting areas. We hooked up with the royal forest department and they helped us immensely in getting around Thailand. We started off in Khao Yai National Park northeast of Bangkok. This is the oldest national park in Thailand and has a large resident population of elephants, tigers and leeches -- lots and lots of leeches! We did get our chance to see an Indian elephant on a night drive through the park. The park is traversed by lots of trails in varied habitats which made collecting fantastic. This was Thailand's wet season, and collecting was tremendous, partly because it rained very little while we were in the park. From Khao Yai, we headed west to Erawan National Park, Soi Yok N.P. and Sirathin N.P. These are mostly mixed bamboo and deciduous forests -- boring to collect in. I would warn anyone collecting in south Thailand that the land between National Parks looks pretty dismal for collecting as it is almost all farmed. Khao Yai would be well worth a longer visit than three days.

To keep things interesting, I flew off for one week to New Delhi in search of *Indosema*, one of the most unusual eucharitids I know of. Dr. Farooqi and Manickivasagam kindly helped me get established at the Indian Agricultural Research Institute which is right in the heart of New Delhi. This area is a relative paradise within the city and surrounded by walls to keep out the marauding cows. Chalcid collecting was superb and my net soon became filled with all sorts of wonderful encyrtids and chalcidids. After four days, I even managed to find my patch of *Indosema*. For those of you who do not know this wonderful beast - it has no transscutal articulation, no mandibles, but a huge ovipositor that flips up between its legs, and cylindrical eggs (others are stalked in Eucharitidae). Alas, I couldn't figure out where it was depositing its eggs. *Indosema* shares a number of characters with *Timioderus* from Africa, and its biology is important in understanding relationships in the Oraseminae. Oh well. I found the wasp in a patch of very short grass with a short, prostrate leguminous plant just as Zdenek Boucek had described to me from his earlier collections of *Indosema*. I ask that anyone traveling in India please keep their eye open for this wasp and try to collect the planidia.

From India, it was back to Bangkok to pick up Laura and Joanne and then to London and the Natural History Museum of London. The chalcidologists were excellent hosts at the museum. Collecting was kept to a minimum but I did manage to go on a "fogging" trip with Nigel Stork to Burnaby Beeches. All I could think about was how nice it would have been to have the fogger in some of the places I had just been (plus another person or two to carry the equipment!). After a fine sampling of British beers we all flew off to Washington D.C. to bother Mike and Eric for a few days, then back to the grind at College Station.

So far, I estimate that I returned with about 18,000 chalcidoids, 18,000 proctos, 7,000 ichneumonoids and a few thousand miscellaneous insects (based on a sub-sampling of 20/120 localities). I regard the trip as a great success and it would not have been possible without the help of a number of people along the way. I cannot mention them all here, but I would like to extend my special thanks to E.C. Dahms, I. D. Naumann, Ross Story (Australia); Liang-yih Chou, K.C. Chou, R. Loo, Soo-min (Taiwan); H.S. Yong (Malaysia); Chaweewan Hutachachern, S. Choldrumkul (Thailand); S. I. Farooqi, Manickivasagam (India); and John Noyes, John LaSalle, and the Bouceks and their family (England). I also thank the National Science Foundation and the Texas Agricultural Experimental Station for their financial support, and the Socio-Economic Unit of Malaysia and the National Research Council of Thailand for much assistance in supporting my research efforts in their countries.

BARGAIN

The newly published, spiral bound pictorial key to Nearctic chalcidoid families and subfamilies is now available for 10 incredibly cheap American dollars (i.e., $10.00) from the Custodian, Entomological. Society of Washington, c/o Dept. of Entomology, NHB 168, U. S. National Museum, Washington, D. C. 20560. Ask for Grissell, E. E. and M. E. Schauff. 1990. A Handbook of the families of Nearctic Chalcidoidea. Ent. Soc. Wash. Handbook No. 1. 85 pp. There are no postal charges on prepaid orders.

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to May 1991 compiled by **John Huber** (Ottawa, Canada)

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