Procedures in Revising the Thai Agathidinae

As the Thai samples arrive from the lab at QSBG (Queen Sirikit Botanic Gardens) I pull out all of the Agathidinae (Braconidae), treat them with HMDS to prevent cuticle collapse, and then mount and label the specimens. These are sorted to genus and then tentative species. Thus far I have processed 156 specimens (though there are more being processed), consisting of approximately 11 genera, and 60 morphospecies. I expect that I will have about 230 specimens and 85 species by the end of the TIGER project.

As I am sorting to morphospecies I take a lateral habitus image of each and place the images of each genus in its own folder, e.g., Figure 1. Thus when a new shipment arrives I can compare the new specimens with the images and place the specimens to morphospecies relatively easily. Once I have about 10 species in a genus this can become a little cumbersome and I build a simple DELTA key (more on this later). These keys will become the foundations of my finished descriptions and published keys, both electronic and hard copy. There are always tentative morphospecies that show confusing variation. I take CO1 barcode data for each species and all specimens that show potentially meaningful variation. With these sequence data in hand, and using it like I would any morphological evidence, I revisit the specimens and refine my species concepts. This has been very useful. I also take 28s (D1-5) for potentially new genera (I have 3), and for all species that show major morphological modifications. These data I add to a previously published data set (Sharkey et al., 2007) but they are also useful to compare with the CO1 data that I am using to delineate species. With all of this in hand I have started to take standard images of all of the species that I am reasonably certain of using my Automontage system. For an example see Figure 2a,b.

Figure 1. Lateral habitus
The next steps, which I have also started for the species of some of the smaller genera, is to create descriptions, and dichotomous keys using DELTA and IntKey, and distribution maps using Berkeley Mapper. As more species and/or more specimens are discovered these products are easy to modify.

The DELTA system is the starting point and I use the DELTA Editor to enter data. This is truly simple to do. One simply creates a matrix of taxa X characters, defines the character states and enters the taxon names. A character might be something like:

- sternalaus <presence>
- #1. smooth
- #1. crenulate

If state 1 was marked in the appropriate cell in the matrix the description for the corresponding species would read “sternalaus smooth”.

There are simple ways to create the desired punctuation between characters, to link characters so that the subject is not repeated, e.g., you might prefer, “sternalaus long and crenulate” rather than “sternalaus long; sternalaus crenulate”.

Some characters may be useful only for the key and others only for the description. However you can enter all of the characters into one matrix and simply select the characters that you wish to incorporate into the key and the description. If a phylogenetic analysis is to be included, the phylogenetically informative characters can be tagged and exported in nexus format. All of our collection data are linked to Google Earth and when any collaborator sends us identification data, i.e., T-number plus species name, these data are entered into the database and a map is generated. Thus when an electronic publication is being considered one need only to link to the species page map on our server. As an example, click here to see the map of Euagathis sp#5. If any of you are interested in using our server to link to an electronic publication, please let me know, we would be happy to oblige.

In most revisionary work it is customary to include a text list of all of the locality data. With the Thai (TIGER) material you need only go to the labels page on the TIGER web site, enter the T-number and copy and paste the locality data into your manuscript. Only minor font and format changes will be necessary, much time is saved, and spelling errors are avoided. After formatting in a word document the distribution text can be copied and pasted into the DELTA description as a TEXT character. Text characters are only incorporated into the description. Text characters may also be used for things such as the taxonomic history of a species.

Two of the most powerful tools of DELTA are capabilities to generate diagnoses and traditional dichotomous keys. There are several options to generate diagnoses but basically the data base is searched for the minimum number of character states that will separate a species from all others. When generating dichotomous keys, characters can be weighted so that those that are simple to recognize, or those that will pull out the most common species will come near the beginning of the key. If not weighted, the key is optimized to produce the shortest, most efficient, key. It is wonderful and a great time saver.

For publication, all of the diagnoses, descriptions, distribution data, distribution maps (or links to same), dichotomous keys, and links to interactive keys, are pasted together for each taxon and with the addition of an introduction, acknowledgements, and references cited the revision is complete.

I have undoubtedly left some steps out and I have oversimplified, but hopefully you get the basic idea. One very minor drawback of the DELTA/IntKey system is that, in order to run an online key, the software must first be downloaded. This can be done at (http://delta-intkey.com/www/install.htm). To see how an interactive key works (after you download the software) click here. I have posted one for the two species of Disophrys that I have found in Thailand. At sharkeylab.org there are numerous other keys to view, for example, keys to the New World genera of Braconidae.

There is a listserv for DELTA users and members of the listserv, as well as Mike Dallwitz the developer, are very helpful when problems arise. Also if any of you are considering using the system I would be happy to get you started.
I am most interested in getting questions and feedback on the above. If any readers have a similar set of steps that help them to publish revisionary studies, please consider putting an article together for the readership.

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