

A few recommendations on recording host information for reared parasitoids.

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Without wishing to be either sanctimonious or unduly proscriptive, but in the important interests of improving our understanding of the host relations of parasitoids at the species level, I'd like to recommend some good practice that is far from always followed, and complain about some bad practice that is all-too common. So this comes in two parts: first good practice for what to put on specimen data labels (and what to preserve); and second what not to put in publications – or, for reviewers and editors, what not to allow to be published.

First, what to put on data labels. It may be that you do not yourselves rear parasitoids, but if you have contact with those who do you could still have a beneficial influence. It is all to do with expressing how certainly the identity of the actual host was known. A particular issue arises in the appropriate labelling of parasitoids that result from substrate-rearings for which, unfortunately, there seems to be no established tradition. By substrate-rearings I mean parasitoids reared from a bulk substrate in which the remains of the exact host individual cannot be, or anyway has not been, located and recovered and when critical reflection would concede some doubt (however small) as to the identity of the real host. Notwithstanding the multitude other sources of error that I seem to spend my life moaning about (e.g. Shaw, 1994), the information we think we have on the host associations of parasitoids is pretty universally blighted by incorrect presumptions of the true host, and especially so in the case of parasitoids of concealed hosts, such as those developing in wood or similarly intractable substrates. When parasitoid cocoons with host remains cannot be recovered I try to adopt and promote the practice of labelling parasitoid specimens reared in this way as “ex [substrate] with [names of potential hosts that were also reared]”. The use of “with” warns that the indicated host was not certainly known. To best illustrate the wisdom of this, it might be noted here that the only modern record (van Achterberg, 2002) generally regarded as credible of a microgastrine braconid parasitising a non-lepidopteran host, the terrestrial trichopteron *Enoicyla pusilla* (Burmeister), was in fact the undeclared result of a substrate-rearing, in this case a quantity of lichens and perhaps other decaying debris among which the presumed host was certainly living (Cees Gielis, pers. comm.). Nothing was recovered to be preserved with the adult parasitoid that emerged from this material (Kees van Achterberg, pers. comm.), and it is unclear what else might have been present. A *Diadegma* species (Ichneumonidae: Campopleginae) was also described as reared from the same source and host (Horstmann, 2004). These records seem to me to be highly questionable, especially following my failure (along with Jeroen Voogd) to rear either parasitoid from a large collection of the host in good quality habitats in the same country (The Netherlands), although a long series of the adult trichopteron resulted; also my rearing of a single male of the same microgastrine from an unknown but probably case-bearing host (that I can

say for certain was not *E. pusilla*, now that I have familiarity with that species) collected many years ago with lichen on aerial *Prunus spinosa* twigs in France (Shaw, 2012)...but I, too, had failed to recover the host remains. Obviously the idea of what is and isn't a potential host requires a bit of knowledge and judgement – being big enough is an obvious criterion (satisfied in both the above cases), as is at least a pointer of being within the known higher taxon host range of the parasitoid concerned (which was not satisfied but did not trigger adequate suspicion and interrogation in either case). Of course, even with the host remains there would remain the tricky issue of how regular, for the parasitoid, this host usage was: part of its true host range or just a one-off freak event that might more sensibly be excluded from such a concept (Shaw, 1994).

To return to labelling, a further refinement might be to give the numbers of each potential host also reared from the substrate, especially if there was more than one (adding the number of specimens of the parasitoid reared would obviously also be useful) – and holding onto the substrate for long enough to give everything present time to emerge is also important. Widening this to any situation in which the host identity is not certain the bottom line is always to express any doubt fully, because unequivocally recording false positives is so powerfully destructive to our understanding of reality. If indeed it turns out to be the case, how nice it would be to be able to state with reasonable certainty the likely truth that as far as is known Microgastrinae only parasitise Lepidoptera! Or, conversely, to be sure that that is not so. In any case, taking more care with rearing and labelling will, in the long run, be helpful to people trying to evaluate the realised host ranges of particular species: if only there had been a long and satisfactory tradition of that, we would be far better off than now (see also Shaw, 1997).

In the general context of specimen preparation and labelling, some other easily incorporated and helpful things often don't happen. One is always to preserve the remains of the actual host individual (not just another example of the supposed host) and the parasitoid cocoon(s) with the specimen(s) if at all possible (dry, in gelatine capsules carried on the same pin as the adult, is good; but do not separate the individual cocoons of gregarious broods). That provides the evidence that a mistake was not made – or, if it was, a possible means to correct it; also, the cocoon (if there is one) will contain the parasitoid's larval skin, and indeed might show that the parasitoid reared is actually a hyperparasitoid. Another desirable practice is to be explicit about dates: often people give only one date on data labels, without making it clear if it was a date of collection (coll.) or a date of emergence (em.). On enquiry, I find that about half of the single dates accompanying reared parasitoids sent to me refer to dates of collection and the other half to dates of emergence, so there is no simple intuition. Obviously giving both dates, and also the date of host death or parasitoid cocoon formation (if applicable), is the most helpful for building a picture of the parasitoid's biology and phenology (making clear if the rearing was under laboratory rather than outdoor conditions is also of value).

The second of my points is a major moan, directed towards authors (and, just as importantly, at reviewers and editors): do not cite hosts for a parasitoid species that you have not personally witnessed in some direct way without making it absolutely clear that you are simply repeating already published “knowledge” (or misinformation, as it might

well be). People often flesh up their faunistic papers by listing (as if new information, or at any rate in a way easily confused with that) a string of all the recorded [recorded is not the same as verified!] hosts, which can be found in a couple of clicks in abstract resources such as (for ichneumonoids) Yu et al. (2012), against the name of a species of which they simply swept a specimen somewhere. For all their undoubted value, compilations such as Yu et al. (2012) are no more than unfiltered abstracts of the entire published record, and include an undifferentiated and unassessed mixture of accurate, questionable, incorrect and plumb crazy perceptions. So reiterating all this is not only pointless, but more seriously also immensely destructive to the real knowledge-base, as these citations will tend to be abstracted afresh as new records of rearings from those hosts, illegitimately reinforcing perceptions that were probably largely erroneous in the first place (Shaw, 1993, gives a brief case study). Adding these details to faunistic papers without good reason seems to sucker journal editors and their reviewers time and time again; any extraneous sources of the records given should always be made explicitly transparent – and if an author did that, the editor might more easily see transcription from databases such as Yu et al. (2012) for the superfluity that they are and get rid of them. Reviewers have a real role here, not just in rejecting this approach but also in explaining to editors exactly why this is such a needless and ultimately destructive practice. Finally, if new host data ARE being presented, that should be made clear – and it really helps if new or re-assessed rearings are expressed quantitatively (Shaw, 1994).

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