

## ***Dacochile microsoma* Poinar & Brown, not a tanyderid but a bruchomyiine psychodid (Diptera: Psychodidae, Tanyderidae)**

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### **Abstract**

A review of the characters used by Poinar & Brown (2004) to place their new fossil fly from Burmese amber, *Dacochile microsoma*, in the family Tanyderidae conclusively demonstrates that the fly actually belongs to the subfamily Bruchomyiinae in the family Psychodidae.

**Key words:** Diptera, Tanyderidae, Psychodidae, Bruchomyiinae, fossil, Burmese amber

### **Introduction**

There has always been a high level of interest in insects fossilized in amber because of the remarkable quality of their preservation. Poinar & Brown (2004) recently described a fossil dipteran, *Dacochile microsoma*, from Burmese amber reported to be of Lower Cretaceous age. The fly was purported to be in the family Tanyderidae, a group of crane-fly-like Diptera with generalized wing venation. In this paper, I present evidence indicating that this insect is a member of the Psychodidae, subfamily Bruchomyiinae and can be placed within the existing classification of that family. In fact, *D. microsoma* is quite similar to the extant psychodid genus *Nemapalpus* Macquart. It is further surprising that the authors made this taxonomic error, since a recent paper extensively reviews the phylogenetic position of another psychodid fossil in Burmese amber (Duckhouse 2000), and notes that additional psychodids are undescribed from Burmese amber. Also, another paper (Ansorge 1994) cited by the authors discusses characters of Tanyderidae and Psychodidae that should have led the authors to a different conclusion.

### **Character states and their distribution**

In this section an itemized discussion of important characters in *Dacochile microsoma* is presented. Those that Poinar & Brown deemed of importance in placing their new taxon in

the Tanyderidae are noted as (1), and those used in separating *Dacochile microsoma* from other tanyderid genera are noted as (2). Other characters of significance in the original description, but not specifically in either of the categories above, are not followed by a reference number. These characters are almost uniformly consistent with the placement of *D. microsoma* in the subfamily Bruchomyiinae of the Psychodidae, and show that it is very similar to the extant genus *Nemapalpus*.

*Size* (2). Poinar & Brown noted that the small size of *D. microsoma* (body length = 2.6 mm, wing length = 2.8 mm) is considerably smaller than any known fossil or extant tanyderid, except the Jurassic genus *Nannotanyderus* Ansorge (Ansorge 1994). This should have been a signal for caution in assigning *Dacochile* to the Tanyderidae. Poinar & Brown note that the Baltic amber fossil tanyderid genus, *Macrochile*, ranges in length from 8.2 to 12 mm. Extant tanyderids range in size from 6 to over 25 mm, considerably larger than *D. microsoma*. The wing length reported for *D. microsoma* fits exactly within the range found in bruchomyiine psychodids (Quate & Alexander 2000).

*Setae between ommatidia* (1). Alexander (1927) stated that the eyes of Bruchomyiinae are bare, and I have seen no subsequent references that contradict this. Conversely, Tanyderidae have setae between the ommatidia (Krzemiński & Judd 1997), the character state found in *Dacochile*. However, this character is so variable in many Diptera at the infrafamilial level that I doubt it is phylogenetically important at the family level.

*Short antennal postpedicel* (2). Poinar & Brown, in the formal description of *Dacochile*, stated that the "postpedicel" (an obsolete term for the first flagellomere) is short, equal in length to the pedicel. However, they list the absolute measurements for the first three antennomeres as 1: 63 µm, 2: 113 µm, and 3: 63 µm. It seems that they have confused the scape and pedicel, because according to their own measurements, the first flagellomere is considerably shorter than the pedicel. This description is at odds with the antennal structure of both Tanyderidae and Psychodidae, in which the scape and pedicel are each short and thick and of greater diameter than the flagellum. This leaves open the question that Poinar & Brown may have misinterpreted the antennal structure. The habitus photograph does not show sufficient detail to answer this, and the figures of the head (Poinar & Brown 2004: figs 7, 8) show no detail.

*Terminal antennal flagellomere equal to penultimate one* (2). Tanyderidae are reported to have the last antennal flagellomere shorter than the penultimate one (Alexander 1981). Poinar & Brown described *D. microsoma* as having the apical flagellomere as long as the preceding segment. This is the state commonly found in *Nemapalpus*, while some *Bruchomyia* have several of the apical flagellomeres shorter than the intermediate ones (Fairchild 1952).

*Pointed mandibles present* (2). Poinar & Brown (2004: figs. 2, 7) described and illustrated what they claim to be mandibles in *D. microsoma*. Only one such set of structures is noted, and I remain skeptical about the true identity of these structures. It seems that they could be maxillary stylets, which are widely reported in Psychodidae and other Nematocera. Mandibles are present in the psychodid subfamily Phlebotominae, which are blood

feeders (Quate & Vockeroth 1981, Silva & Grunewald 2000), but are apparently absent in Bruchomyiinae: “Mandibles are absent as functional elements while the maxillae are membranous structures with a ciliate margin, quite unfitted for cutting” (Fairchild 1952: 260). Most remarkably, in view of their placement of *Dacochile* in the Tanyderidae, Poinar & Brown (2004: 344) stated: “It is interesting that the mouth structures closely resemble those of the Psychodidae”.

*Maxillary palp 5-segmented, with elongate fifth segment* (2). Tanyderidae have 5-segmented palpi, with the apical segment subequal to the penultimate one (Krzemiński & Judd 1997). Poinar & Brown stated that *Dacochile* has five-segmented palpi with the last segment 2.6 times as long as the penultimate palpomere, and specifically figure this feature (Poinar & Brown 2004: fig. 5). This state is very similar to that found in all Bruchomyiinae (Fairchild 1952, Tonnoir 1939).

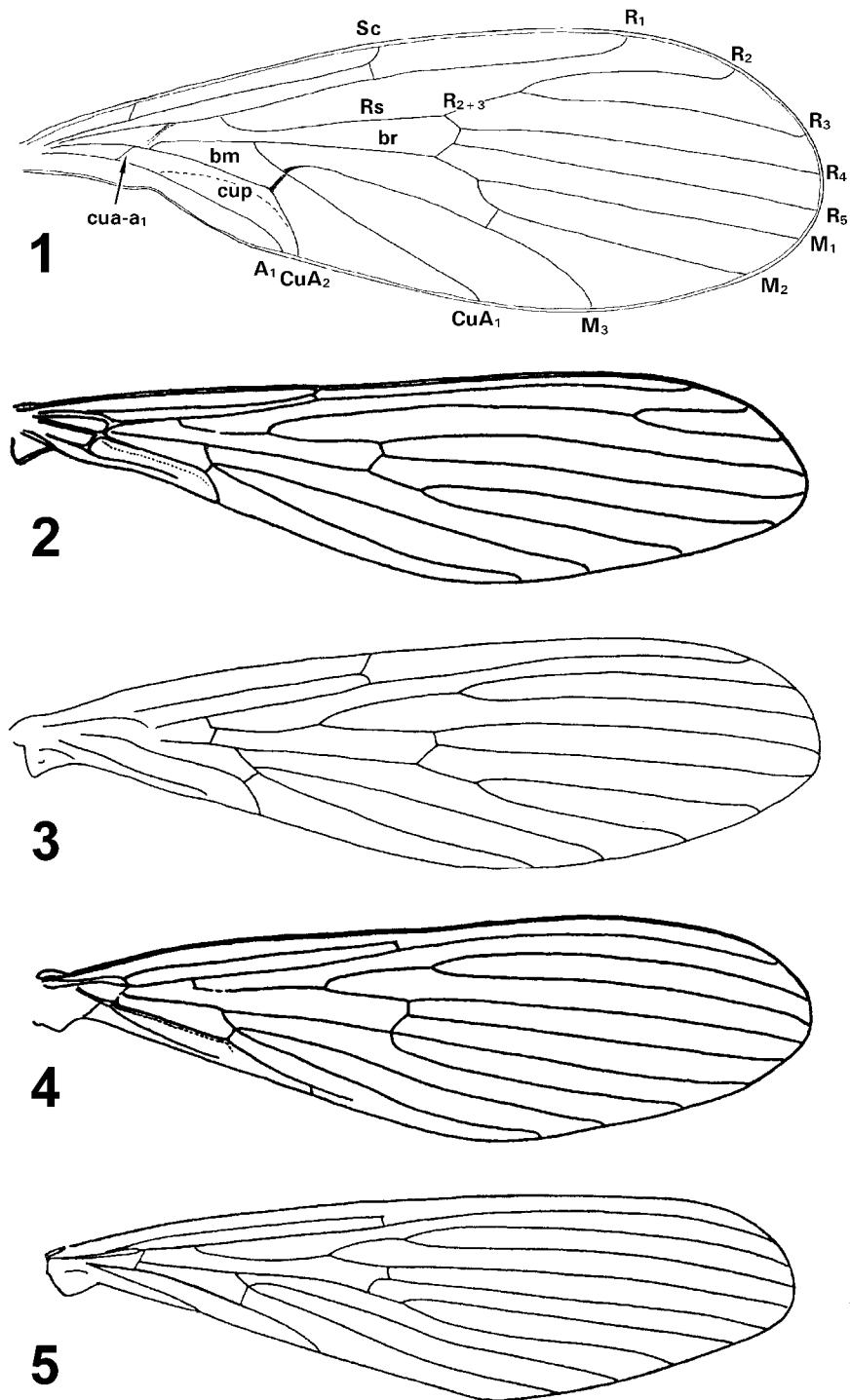
*Wing immaculate* (2). Virtually all extant Tanyderidae have boldly patterned wings. Even the odd taxon *Peringueyomyia barnardi* Alexander has a spot on R<sub>1</sub>. The fossil genus *Macrochile* has been reported to have immaculate wings (Williams 1933), but Poinar & Brown pointed out that the wings are probably at least weakly marked (Alexander 1931, Podenas 1997). On the other hand, all known Bruchomyiinae have wings without markings.

*Wings strongly pilose*. Poinar & Brown described *Dacochile* as having setae on all veins, and long setae on the costa and in the anal area (Poinar & Brown 2004: figs 1, 3). Tanyderidae have short setae on most veins and the usual marginal fringe found on many Diptera. Psychodidae, on the other hand, are well known for their conspicuously setose wings, which elicited their common name, moth flies. The bruchomyiine *Nemapalpus* has wing pilosity very similar to that described by Poinar & Brown (Young 1974: fig. 1).

*Wing lacking anal lobe* (2). All known tanyderids exhibit some development of the anal lobe of the wing, and in most extant species it is very conspicuously developed (Alexander 1981). In Tanyderidae, the anal lobe is least developed in the fossil *Nannotanyderus*, but it is still present (Ansorge 1994). On the other hand, the absence of the anal lobe in Psychodidae (Figs. 2–5), is considered a synapomorphy for the family (Ansorge 1994).

*Costa continuing around wing margin* (1). Tanyderidae have the costa complete (Krzemiński & Judd 1997). This character state is also illustrated for psychodids across broad phyletic lines within the family (e.g., Fairchild 1949: fig. 5, Quate & Vockeroth 1982: figs. 10–13). *Dacochile* also has this character state, but it cannot be considered a valid argument for assigning *Dacochile* to the Tanyderidae.

*Subcosta “bifurcate” at extremity* (1). The presence of the sc-r crossvein in *Dacochile* (Fig. 1) is a plesiomorphic character state, believed to be present in the groundplan of Diptera (McAlpine 1981). This state is usually found in the Tanyderidae (Alexander 1981, Krzemiński & Judd 1997), and is also widespread in the Psychodidae (Figs. 2–5), being absent in more derived forms in the Psychodinae (Quate 1955) and many Phlebotominae (Lewis 1982).



**FIGURES 1–5.** Wings of *Dacochile microsoma* Poinar & Brown and extant Psychodidae: Bruchomyiinae. **1**, *Dacochile microsoma* (modified from Poinar & Brown 2004: fig. 6). **2**, *Nemapalpus arroyoi* de Leon (from Fairchild 1952: fig. 39). **3**, *Nemapalpus australiensis* Alexander (modified from Duckhouse 1965: fig. 5). **4**, *Bruchomyia fusca* Barretto (from Fairchild 1952: fig. 51). **5**, *Eutonnoiria edwardsi* (Tonnoir) (modified from Tonnoir 1939: fig. 5).

*Vein R with 5 branches* (1). This character state is also plesiomorphic, and is found throughout the Tanyderidae (Krzemiński & Judd 1997). It is also widespread in the Psychodidae, being modified only in Trichomyiinae. In this subfamily there are only 4 branches of the radial sector. Hennig (1972) hypothesized that this reduction involved a loss of the fork of  $R_{2+3}$ .

*Rs 3 times as long as  $R_{2+3}$*  (2). Having  $R_{2+3}$  short, much shorter than the radial sector and the branches of  $R_2$  and  $R_3$  beyond the fork, is an unusual feature of *Dacochile* (Poinar & Brown 2004: figs. 1, 6; Fig. 1). In Tanyderidae,  $R_{2+3}$  is longer, being distinctly longer than the branches of  $R_2$  and  $R_3$  beyond the fork (Alexander 1981, Ansorge & Krzemiński 2002). This character is highly variable in the Psychodidae, but there are some species of *Nemapalpus* where  $R_{2+3}$  is long (Fig. 2), similar to that found in *Dacochile* (Duckhouse 1965: fig. 5) and in *Bruchomyia* (Fig. 4) and *Eutonnoiria* (Fig. 5) all known species have  $R_{2+3}$  short (Fairchild 1952, Tonnoir 1939). The origin of  $R_{2+3}$  near the apex of cell br in *Dacochile* is not typical of Bruchomyiinae. In *Nemapalpus*,  $R_{2+3}$  originates from near the center of cell br (Figs. 2, 3), but is more distal in *Bruchomyia* (Fig. 4) and *Eutonnoiria* (Fig. 5). On the other hand, although the general wing venation is quite different,  $R_{2+3}$  arises near the apex of cell br in the Jurassic psychodid *Tanypsysha* (Ansorge 1994).

*Cell br longer than cell bm* (1). *Dacochile* has cell bm short (Fig. 1), but this is not a useful character in placing it in the Tanyderidae. Tanyderids do have cell bm shorter than br (Alexander 1981, Ansorge & Krzemiński 2002), although sometimes the difference is not extreme. Bruchomyiinae psychodids uniformly have cell bm shorter than br (Fairchild 1952, Tonnoir 1939; Figs. 2-5) almost exactly as found in *Dacochile*.

*Crossvein m-m present*. Although Poinar & Brown did not mention the presence of the m-m crossvein in their text, it is shown in the wing illustration and can just be made out in the habitus photo (Poinar & Brown 2004: figs. 1, 5; Fig. 1). This vein is always present in Tanyderidae (Alexander 1981), forming a closed discal cell. It is only very rarely present in Bruchomyiinae, being reported only in some specimens of *Nemapalpus transvaalensis* Stuckenberg (Ansorge 1994). Crossvein m-m is present in the two Lower Jurassic psychodid genera *Tanypsysha* and *Liassopsychodina* (Ansorge 1994).

*Crossvein  $cua-a_1$  present* (2). Poinar & Brown noted that the presence of a  $cua-a_1$ , as found in *Dacochile* (Fig. 1), is rare in Tanyderidae. It is also usually absent in Psychodidae, since the anal region of the wing is reduced. It has been depicted in illustrations of some *Nemapalpus* (Fairchild 1952: fig. 39; Fig. 2).

*Single anal vein reaching wing margin* (1). This character state is found in numerous Nematocera, including Tanyderidae and some Bruchomyiinae (Tonnoir 1939), although it is frequently reduced in the latter. Ansorge (1994) noted the presence of  $A_1$ , reaching the wing margin, in the Jurassic psychodids he described.

*Cell cup short*. *Dacochile* has a short cell cup (Fig. 1), which is approximately one-third the length of the wing. Although not mentioned by Poinar & Brown, this character state differs from that found in Tanyderidae, where the cup cell is much longer, usually

about half the length of the wing (Alexander 1981, Ansorge 1994, Ansorge & Krzemiński 2002). In most Psychodidae, cell cup is incomplete, apparently modified during reduction of the anal area of the wing. Some species of *Nemopalpus* have the cell more or less well formed (Fairchild 1952; Fig. 2).

## Discussion

As can be seen from the brief analysis of characters states and their distributions in *Dacochile*, Tanyderidae, and subfamily Bruchomyiinae of the Psychodidae, none of the states Poinar & Brown thought were useful in placing *Dacochile* in the Tanyderidae are diagnostic, being found in other Nematocera, and specifically in bruchomyiine psychodids. Additionally, the character states Poinar & Brown used in their diagnosis, putatively differing from other members of the Tanyderidae, in fact indicate a placement in the subfamily Bruchomyiinae. The short cell cup seems to indicate a relationship with the extant genus *Nemopalpus*, since the genera *Bruchomyia* and *Eutonnoiria* have a longer, straighter vein  $CuA_2$ . The well-formed cell cup and the point of origin of vein  $R_{2+3}$  are unlike states found in modern *Nemopalpus*. Thus, while *Dacochile* is certainly a member of the Bruchomyiinae, it cannot be assigned to an extant genus.

Little modern work has been done on the phylogeny of the Psychodidae. Hennig (1972) produced the last treatment, which Ansorge (1994) reiterated. Hennig postulated that the Bruchomyiinae + Phlebotominae is the sister group to Trichomyiinae + Psychodinae. On the other hand, Lewis (1982: 124) stated “*Nemopalpus* is probably among the most primitive living Diptera, close to the basic stock of the Psychodidae and to the Phlebotominae in the matter of venation”. Further resolution of the phylogeny of the Psychodidae is highly desirable, and the relatively good fossil record may help in this endeavor.

## Acknowledgments

I thank Wayne N. Mathis (Smithsonian Institution) and Gary L. Miller and Allen L. Norrbom (Systematic Entomology Laboratory) for reviewing the manuscript.

## References

- Alexander, C.P. (1927) Diptera fam. Tanyderidae. *Genera Insectorum*, 189, 1–13.  
Alexander, C.P. (1931) Crane-flies of the Baltic amber (Diptera). *Bernstein-Forschungen*, 2, 1–135.  
Alexander, C.P. (1981) Tanyderidae. Chapter 6. In: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R., & Wood, D.M. (Eds.), *Manual of Nearctic Diptera*. Volume 1. Monograph No. 27. Research Branch, Agriculture Canada, Ottawa, pp. 149–151.

- Ansorge, J. (1994) Tanyderidae and Psychodidae (Insecta: Diptera) from the Lower Jurassic of northeastern Germany. *Paläontologische Zeitschrift*, 68, 199–210.
- Ansorge, J. & Krzemiński, W. (2002) Lower Jurassic tanyderids (Diptera: Tanyderidae) from Germany. *Studia dipterologica*, 9, 21–29.
- Duckhouse, D.A. (1965) Psychodidae (Diptera, Nematocera) of southern Australia, subfamilies Bruchomyiinae and Trichomyiinae. *Transactions of the Royal Entomological Society of London*, 117, 329–343.
- Duckhouse, D.A. (2000) Redescription and re-evaluation of the Burmese amber psychodid *Eophlebotomus connectens* Cockerell and its phylogenetic position (Diptera: Psychodidae). *Systematic Entomology*, 25, 503–509.
- Fairchild, G.B. (1949) A new fly related to *Phlebotomus* from Panama (Diptera, Psychodidae). *Proceedings of the Entomological Society of Washington*, 51, 81–84.
- Fairchild, G.B. (1952) Notes on *Bruchomyia* and *Nemopalpus* (Diptera, Psychodidae). *Annals of the Entomological Society of America*, 45, 259–280.
- Hennig, W. (1972) Insektenfossilien aus der unteren Kreide. IV. Psychodidae (Phlebotominae), mit einer kritischen Übersicht über das phylogenetische System der Familie und die bisher beschriebenen Fossilien (Diptera). *Stuttgarter Beiträge zur Naturkunde*, 241, 1–69.
- Krzemiński, W. & Judd, D.D. (1997) Family Tanyderidae. Chapter 2.14. In: Papp, L. & Darvas, B. (Eds.). *Contributions to a manual of Palaearctic Diptera (with special reference to flies of economic importance)*. Volume 2. Nematocera and Lower Brachycera. Science Herald, Budapest, pp. 281–289.
- Lewis, D.J. (1982) A taxonomic review of the genus *Phlebotomus* (Diptera: Psychodidae). *Bulletin of the British Museum (Natural History)*, 45, 121–209.
- McAlpine, J.F. (1981) Morphology and terminology-adults. Chapter 2. In: McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M. (Eds.). *Manual of Nearctic Diptera*. Volume 1. Monograph No. 27. Research Branch, Agriculture Canada, Ottawa, pp. 9–63.
- Podenas, S. (1997) New *Macrochile* Loew, 1850 (Diptera, Tanyderidae) from the Baltic amber. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg*, 80, 173–177.
- Poinar, G., Jr. & Brown, A.E. (2004) A new genus of primitive crane flies (Diptera: Tanyderidae) in Cretaceous Burmese amber, with a summary of fossil tanyderids. *Proceedings of the Entomological Society of Washington*, 106, 339–345.
- Quate, L.W. (1955) A revision of the Psychodidae (Diptera) in America north of Mexico. *University of California Publications in Entomology*, 10, 103–273.
- Quate, L.W. & Alexander, J.B. (2000) Synopsis of the New World *Nemopalpus* (Diptera, Psychodidae, Bruchomyiinae) with description of four new species. *Annals of the Entomological Society of America*, 93, 185–193.
- Quate, L.W. & Vockeroth, J.R. (1981) Psychodidae. Chapter 17. In: McAlpine, J. F., Peterson, B. V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M. (Eds.), *Manual of Nearctic Diptera*. Volume 1. Monograph No. 27. Research Branch, Agriculture Canada, Ottawa, pp. 293–300.
- Silva, O.S. & Grunewald, J. (2000) Comparative study of the mouthparts of males and females of *Lutzomyia migonei* (Diptera: Psychodidae) by scanning electron microscopy. *Journal of Medical Entomology*, 37, 748–753.
- Tonnoir, A.L. (1939) Psychodidae. In: *British Museum (Natural History) Ruwenzori Expedition 1934-5*. Volume I. Number 4. British Museum (Natural History), London, pp. 35–80.

- Williams, I.W. (1933) The external morphology of the primitive tanyderid dipteran *Protoplasa fitchii* O.S., with notes on the other Tanyderidae. *Journal of the New York Entomological Society*, 41, 1–35.
- Young, D.G. (1974) Bruchomyiinae in North America with a description of *Nemopalpus nearcticus* n. sp. (Diptera: Psychodidae). *The Florida Entomologist*, 57, 109–113.