Nomenclatural problems among Thysanoptera (Insecta) of Costa Rica

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Abstract: We present data to argue that several recent papers on the Thysanoptera of Costa Rica are affected by unsatisfactory technical procedures, including failure to recognize intraspecific structural variation. Fourteen new synonyms are recognized for Costa Rica Thysanoptera, nine generic and five specific. Rev. Biol. Trop. 56 (2): 961-968. Epub 2008 June 30.

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Biological taxonomy is unique amongst the sciences. In most sciences an obviously false hypothesis will be ignored. In contrast, a new taxon name and the biological hypothesis this name implies must be fully considered by subsequent taxonomists, so long as the name meets the minimal requirements of the relevant Code of Nomenclature. However, establishing that the author of a new taxon has published incorrect data, or drawn conclusions that are at variance with pre-existing biological knowledge, can involve more extensive research than that involved in the faulty publication. Commenting on one recent example, Mound and zur Strassen (2001) noted the absence of biological evidence to support the description by Johansen and Mojica-Guzman (1999) of a large number of new species of *Scirtothrips* collected mainly from two tree crops in Mexico. Subsequently, extensive field studies and DNA analyses have confirmed that only one species of *Scirtothrips* occurs in Mexico and Guatemala on Avocado (*Persea americana*), and examination of the holotypes of five of the "new species" has resulted in their formal synonymy (Hoddle *et al.* 2008). These extensive, and expensive, revisionary studies were required because of the quarantine significance of so many apparent pest species on avocados. The 18 *Scirtothrips* species described from Mexico on mango (*Mangifera indica*), a tree crop not native to the Americas, will require similar extensive studies.

Taxonomy requires a combination of good technical methods and critical scholarship. For thrips taxonomy this involves the examination of well-prepared microscope slides, using good optical apparatus, and the preparation of skilled illustrations and descriptions, whilst taking into consideration published observations from previous workers, and placing all this within the context of our understanding of the biology of the insects. The large number of synonyms, more than 20% of available names worldwide, produced by workers on this group of insects (Gaston and Mound 1993) has arisen through repeated failure to recognize one or more of the above disciplines and procedures. This paper records similar problems that have arisen in recent years among several taxonomic publications on Thysanoptera from Costa Rica.

Nakaharathrips Retana-Salazar, 2007

This genus was erected with *Anaphothrips sudanensis* Trybom as type species. However, as indicated in the world list of Thysanoptera (Mound 2005), this species, in the form of one of its 10 recognized synonyms, *Neophysopus medioflavus* Schmutz, is the type species of the genus *Neophysopus* Schmutz. Thus *Nakaharathrips* is clearly a synonym of *Neophysopus* because they share the same type species. According to the generic key and the data matrix published with *Nakaharathrips*, the species *A. sudanensis* is uniform in colour. This is incorrect, because this is one of the most remarkably bicoloured species in the Thripidae, with the median abdominal segments almost white but the head and thorax and the terminal abdominal segments dark brown (see website, PADIL). This bicoloured condition has been emphasized by many previous authors, as indicated by some of the synonyms of *sudanensis*, such as *citricinctus*, *bicolor*, and *flavicinctus* as well as *medioflavus*. All of this information is available on the web (Mound 2005), as well as in the formal taxonomic literature. A further problem in the published data matrix is that both *Nakaharathrips* and *Anaphothrips* are scored as having ocelli reduced, whereas macropterae of both *A. obscurus* and *A. sudanensis* have well-developed ocelli (see PADIL). In Thysanoptera, development of ocelli is closely correlated with wing length; the use of these in a phylogenetic analysis as independent characters is therefore questionable.

The systematic position of *Neophysopus* (=*Nakaharathrips*) has been undisputed for many years, either as a subgenus or as a synonym of *Anaphothrips* (Priesner 1949, Stannard 1968). The decision (Retana-Salazar 2007) to segregate into one genus those species that have antennal segments VII and VIII fully distinct from VI, together with those that have segment VI partially divided by an incomplete oblique suture, and to place into a second genus those species in which segment VI is completely undivided, is not supported by any additional morphological or biological evidence. The conclusion seems to be derived from a mathematical paper (Retana-Salazar and Retana-Salazar, 2004) in which it is claimed that a difference such as the number of antennal segments that can be scored must indicate that different taxa are involved. If this logic were to be accepted, then it would be essential to explain why "segment VI fully divided + segment VI with a partial division" constitutes an autapomorphy distinct from "segment VI not divided". However, the available biological evidence is contrary to this phenetic claim, with the number of antennal segments varying in some species between individuals within populations, and some individuals having a different number of segments on the left and right antennae (Palmer 1992). Moreover, there are several genera of Thripidae in which different species have a different number of antennal segments (Sakimura and O'Neill 1979, zur Strassen 2003: 259, 269). Given the many character states, including biological attributes (Nakahara 1995) that are shared among the 52 species currently treated in *Anaphothrips*, there is little justification in transferring a few of them to a different genus. The claim that having eight segments is the plesiomorphic condition and nine segments the apomorphic condition is also questionable, because the presence of nine antennal segments is characteristic of most basal-clade Thysanoptera (Mound *et al.* 1980). We conclude that *Neophysopus* (=*Nakaharathrips*) should continue to be treated as a synonym of *Anaphothrips*.

Nicolemma Retana-Salazar, 2007

This genus was erected for a single new species, *N. garitai* Retana-Salazar, although the type specimens of this species had previously been studied and identified by Mound and Marullo (1996) as *Aurantothrips orchidaceus* (Bagnall). The new genus and species was characterized on two structural features: antennal segments VII and VIII fused to produce a 7-segmented antenna, and a spherical structure present in the abdomen that was interpreted as a spermatheca. However, fusion of the terminal

two antennal segments is not unique to the few specimens listed from Costa Rica. Similar fusion has been observed on either the left or right antenna of three females within a long series of *Aurantothrips orchidaceus* collected from orchids in Colombia, and one male of this species from Britain has both antennae 7-segmented (specimens in the Natural History Museum, London). Thus the first of the character states used to distinguish the new genus is merely intraspecific variation. Similarly, the spherical structure in the abdomen that is illustrated (Retana-Salazar 2007) is clearly visible in many specimens of *Aurantothrips orchidaceus*, including the Lectotype female. We therefore conclude that *Nicolemma* is a synonym of *Aurantothrips* Bhatti, and that *N. garitai* is a synonym of *A. orchidaceus* (Bagnall).

Aurantothrips Bhatti, 1978

This genus was erected (Bhatti 1978: 90) for a single Neotropical species from orchids, *Anaphothrips orchidaceus* Bagnall, described originally from greenhouse specimens in Europe. Sakimura (1967) examined 24 females and nine males and concluded, on the basis of weak differences in colour and chaetotaxy, that two subspecies could be distinguished. Mound and Marullo (1996) reviewed the evidence produced by Sakimura, but reported further variation in colour and structure in specimens from Colombia and Brazil that cast doubt on the existence of two biological entities. The subsequent decision (Retana-Salazar 2007) that the two subspecies are distinct species was not supported by any evidence of having studied any specimens. Accompanying the decision were two short paragraphs copied (but translated) from Mound and Marullo (1996) that detailed the differences between the specimens available to Sakimura. However, the subsequent paragraph by the same authors, discussing the variation in and between samples from Colombia and Brazil, was neither translated nor discussed. Again, the logic seems to be derived from Retana-Salazar and Retana-Salazar (2004), in which the authors appear to claim that if differences can be observed and scored mathematically then these differences must be interpreted as indicating that different taxa are involved, regardless of any biological data. However, any such a mathematical system will be biased if only selected data is considered.

Quirosiella Retana-Salazar, 2000

This genus was erected for two species, a new species, *Q. sotoi* from Costa Rica, as type species and *Pseudothrips longiceps* Hood based on a single female from Brazil. The generic definition was not accompanied by any comparison with other genera, being distinguished only in a key to five genera by tergite VII lacking a marginal comb of microtrichia. This state was contrasted with species that are known to exhibit a variable number of marginal microtrichia laterally on this tergite (Stannard, 1951, Palmer and Mound 1985, Mound and Marullo 1996). In view of this variation, the genus *Quirosiella* is here regarded as a synonym of *Psectrothrips* Hood, to which genus *P. longiceps* was transferred by Palmer and Mound (1986).

A cladogram provided by Retana-Salazar (2000) involved 11 of the 17 nominal species in the genera *Psydrothrips* Palmer and Mound, *Psectrothrips* Hood (= *Lacandonithrips* Johansen) and *Pseudothrips* Hinds, but no data matrix was provided to enable the suggested relationships to be assessed, although there was a table indicating the characters used. Moreover, no indication was given of which of the 11 species the author did, or did not, personally study; for several species the data evidently came from published literature. One species not included in the cladogram for which specimens were available was a Costa Rican species named after its collector, *Pseudothrips retanae* Mound & Marullo. The cladogram for the 11 species placed the two species of *Quirosiella* as sister to two species of *Pseudothrips*, and this pair of genera as sister to five species of *Psectrothrips*. This pattern of relationships is particularly surprising because the males

of *Pseudothrips* species exhibit a remarkable character that occurs in only six other genera of the worldwide family Thripidae, each of these being from South America (Mound and Marullo 1996, De Borbón 2008). These genera include *Psydrothrips* but not *Psectrothrips*, and the character is the presence of a glandular opening on the antecostal region of sternite III, whereas the normal condition in this family is for a transverse porose area medially on several sternites posterior to the antecostal ridge (zur Strassen 2003, Tyagi *et al.* 2008).

The species *Q. sotoi* was compared to *Psectrothrips longiceps* (Hood), a species previously recorded from the same locality, Las Alturas in Costa Rica (Mound and Marullo 1996: 179). The new species was distinguished because the metanotal reticulations were considered to lack internal markings, and the interocellar setae were considered shorter. However, the metanotal internal markings are visible under phase contrast in two female paratypes of *Q. sotoi* that have been studied (deposited in the Senckenberg Museum, Frankfurt, and the Natural History Museum, London), and these markings are also clear in the previously collected specimens from Las Alturas, Costa Rica. Unfortunately, the head of the paratype deposited in the Senckenberg Museum is tilted forward such that the length of the ocellar setae cannot be measured accurately, in contrast to the Hood holotype and the specimens slide mounted in London. In view of the variation *Q. sotoi* and *P. longiceps* are here considered to represent the same species.

The generic name *Linneothrips* Johansen and Mojica (1996) should be considered a synonym of *Pseudothrips* Hinds. Contrary to Retana (2000: 57), who sent the same species for description to both Mexico and Europe, the paper by Johansen and Mojica although listed as 1995 was not published until 30.viii.1996, as confirmed by the editor of the journal; the publication data of the Mound and Marullo book was 4.iii.1996.

Vargasia
Retana-Salazar & Soto-Rodriguez, 2007

This genus was distinguished from *Karnyothrips* Watson, with *Hindsiana melaleuca* Bagnall as type species (although quoted incorrectly as *Karnyothrips melaleucus*). The authors of this new generic name indicated that they had studied specimens of *K. melaleucus* and *K. ochropezus*. However, they claimed to include a total of 24 species in this new genus, although they did not provide the names of any of these species nor any evidence of having studied any of them. *Vargasia* was distinguished on the basis that the two species studied have only three sensoria on antennal segment IV, and this was contrasted with *Karnyothrips flavipes*, the type species of *Karnyothrips*, which the authors claimed to have four sensoria on this segment. However, specimens of both *K. flavipes* and *K. melaleucus* have been studied in the collections of the Natural History Museum, London, and the Australian National Insect Collection, Canberra, and the number of sensoria on segment IV varies from three to four in both species, within and between populations (Okajima 2006: 397). Both species are known to have a similar biology as predators of scale insects, and they are essentially similar in structure. Since there is neither morphological nor biological evidence for supporting the new genus, *Vargasia* is here considered a synonym of *Karnyothrips*. In describing this new genus, the authors also returned two species to *Apterygothrips* from *Karnyothrips*, but presented no evidence of examining either species, nor yet of examining any species of *Apterygothrips* for reference.

Willeia
Retana-Salazar & Soto-Rodriguez, 2007

This new genus was erected for two species, with *Zygothrips americanus* Hood as type species (but quoted incorrectly as *Karnyothrips*

americanus). The authors did not indicate that they had examined any specimens of either species; apparently relying on data in the key to species provided by Mound and Marullo (1996). The genus was distinguished from *Karnyothrips* on two character states. First, it was claimed that antennal segment IV bears only three sensoria rather than four, but as indicated above this is variable in the type species of *Karnyothrips*, and moreover *K. americanus* has been examined at the Natural History Museum, London and actually bears only two sensoria on this segment. Second, *K. americanus* has the anteromarginal setae on the pronotum well developed instead of reduced, although the length of this pair of setae is variable among other species of *Karnyothrips*. Given this variation, the known similarities in biology, and the absence of any further supporting morphological evidence, the generic name *Willeia* is here regarded as a further synonym of *Karnyothrips*.

Dioclesianothrips
Retana-Salazar & Soto-Rodriguez, 2007

This new genus was erected for a single species, *Haplothrips* (*Xylaplothrips*) *sonorensis* Stannard (but quoted incorrectly as *Karnyothrips sonorensis*). The authors stated that they had examined specimens of this North American species in the collection of A.P. Retana-Salazar, but did not indicate how these specimens were identified nor the locality from which they were collected. If the specimens came from Costa Rica then this would be the first published record from Central America. The genus was distinguished from *Karnyothrips* and also from *Willeia* because antennal segment IV bears only two sensoria. However, contrary to the statement given by the authors, antennal segment IV of *K. americanus* also bears only two sensoria, and the form of the other antennal segments in this species and in *K. sonorensis* is very similar, as indicated by Stannard (1968: 431). There is thus no support for placing this one species in a separate genus, and *Dioclesianothrips* is therefore considered a synonym of *Karnyothrips*. The authors failed to include their new name in their abstract, but they did include a nomen nudum "*Aguilaria*" as a new genus; presumably one name replaced the other during manuscript preparation.

Jironiella
Retana-Salazar & Soto-Rodriguez, 2007

This new genus was erected for a single new species, *J. saidi*. The species was based on specimens collected from Cyperaceae in Costa Rica, and the authors claimed that it could be distinguished from *Haplothrips* species through the absence in the head of a maxillary bridge. With the exception of this character, the description agrees closely with specimens of *Haplothrips graminis* Hood, a widespread species in Costa Rica and Colombia on Cyperaceae and Poaceae. Subsequently, one paratype female of *J. saidi* in the collections of the Natural History Museum, London, has been examined under phase contrast illumination, and remnants of a maxillary bridge are clearly visible. In *H. graminis* the maxillary stylets are particularly wide apart, and the maxillary bridge is therefore unusually long and slender. This structure is thus very easily displaced during slide preparation; certainly it is not visible in all of the slides of this species in collections both in London and in Canberra. As a result, *J. saidi* is here placed into synonymy with the common Central American species, *H. graminis*, and *Jironiella* becomes a further synonym of the worldwide genus *Haplothrips* Amyot and Serville.

Gynaikothrips garitacambroneroi
Retana-Salazar, 2006

This species was described from 13 females and two males, collected in Costa Rica. The plant species from which these specimens were collected is not clearly stated in the original description, but judging from Garito-Cambronero and Lizano-Fallas (2006) it was *Ficus benjamina*. The thrips was distinguished from *Gynaikothrips uzeli* (Zimmerman) by the

greater length of the pronotal posteroangular setae. However, the measurements given fall within the range of variation found in samples of *G. uzeli* from various parts of South East Asia including the Maldive Islands. Moreover, *G. uzeli* seems to be increasing in distribution in the Caribbean region and southern States of the USA on *F. benjamina*, presumably through the activities of the horticultural trade (Boyd and Held 2006). One female paratype of *G. garitacambroneroi*, deposited in the Natural History Museum, London, has been examined, and as a result the species is here considered a synonym of the Asian species *G. uzeli*. The illustrations of the male "genitalia" are based on the unexpanded epiphallus, an inflatable sac whose shape varies with the extent of inflation. The actual pseudovirga was not illustrated, and although the pseudovirga can be useful in recognizing some Haplothripini (Mound and Minaei 2007) its structure has not been demonstrated to be useful for distinguishing species in the majority of leaf-feeding Phlaeothripinae. The number and length of setae on the apex of the parameres is not stable between individual males of *Gynaikothrips* species examined from various parts of Asia and Australia.

NOMENCLATURAL SUMMARY

Anaphothrips Uzel, 1895: 142
Nakaharathrips Retana-Salazar, 2007: 329. **syn.n.**

Aurantothrips Bhatti, 1978: 90
Nicolemma Retana-Salazar, 2007: 324. **syn.n.**

Aurantothrips orchidaceus (Bagnall); Bagnall, 1909: 33
Nicolemma garitai Retana-Salazar, 2007: 324. **syn.n.**

Psectrothrips Hood, 1937: 262
Quirosiella Retana-Salazar, 2000: 55. **syn.n.**

Psectrothrips longiceps (Hood); Hood, 1954: 211
Quirosiella sotoi Retana-Salazar, 2000: 54. **syn.n.**

Pseudothrips Hinds, 1902: 146
Linneothrips Johansen & Mojica, 1996: 59. **syn.n.**

Pseudothrips retanae Mound & Marullo, 1996: 181
Linneothrips bicolor Johansen & Mojica, 1996: 62. **syn.n.**

Gynaikothrips uzeli (Zimmermann); Zimmermann, 1900: 12
Gynaikothrips garitacambroneroi Retana-Salazar, 2006: 6. **syn.n.**

Haplothrips Amyot & Serville, 1843: 640.
Jironiella Retana-Salazar & Soto-Rodriguez, 2007: 632. **syn.n.**

Haplothrips graminis Hood, 1921: 69
Jironiella saidi Retana-Salazar & Soto-Rodriguez, 2007: 633. **syn.n.**

Karnyothrips Watson, 1923: 23

Vargasia Retana-Salazar & Soto-Rodriguez, 2007: 631. **syn.n.**
Willeia Retana-Salazar & Soto-Rodriguez, 2007: 632. **syn.n.**
Dioclesianothrips Retana-Salazar & Soto-Rodriguez, 2007: 632. **syn.n.**
"*Aguilaria*" Retana-Salazar & Soto-Rodriguez, 2007: 635. **syn.n.**

RESUMEN

Presentamos datos para apoyar nuestro argumento de que varios artículos recientes sobre los Thysanoptera de Costa Rica se han visto afectados por procedimientos técnicos insatisfactorios, incluyendo el no reconocer la variación estructural intraespecífica. Presentamos nueve sinonimias en los tisanópteros de Costa Rica: nueve a nivel de género y cinco a nivel de especie.

Palabras clave: variación, taxonomía, identificación, relaciones sistemáticas.

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