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Crotonothrips polyalthiae sp.n. (Thysanoptera: Phlaeothripidae), a leaf-galling pest of the Asian amenity tree, *Polyalthia longifolia*

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Abstract

A new species of Phlaeothripinae, *Crotonothrips polyalthiae*, is described as inducing leaf galls in Indonesia and Peninsular Malaysia on the widespread Asian tree *Polyalthia longifolia*. This is the fifteenth species to be placed in the genus *Crotonothrips*, the others being from India, but with one from Japan. The new species has exceptionally elongate maxillary stylets and mouth cone. The taxonomy and systematics of the Indian species are noted to require further study.

Key words: leaf-galls, thrips, Phlaeothripidae, new species

Introduction

Polyalthia longifolia is a small tree of the Family Annonaceae that is native to India and Sri Lanka. Common names applied to this tree, such as Budha Pine and Indian Fir, reflect its elegant pyramidal form and slender, pendant, leaves (Fig. 4). It has become popular among horticulturalists in many tropical countries, and in Singapore one cultivar has the common name “Temple Pillar” on account of being almost cylindrical in shape. The tree is planted widely in Southeast Asian countries in public spaces including parks, university campuses, and along streets, but the leaves are subject to attack by a leaf-galling species of thrips from the family Phlaeothripidae. In Makasssar, Indonesia, the satisfactory development of the tree is now recognised as being inhibited by the activities of these leaf-rolling gall thrips that sometimes occur in large numbers. Similar galls have been found on this tree species at sites around Kuala Lumpur in Peninsular Malaysia, and there is anecdotal evidence that similar galls occur on the tree in Java. The damage caused by this thrips is of increasing economic importance, and the purpose of this article is to provide a name for the insect in order to facilitate reports that are in preparation on its biology and control.

Many species of Phlaeothripidae in Asia are reported as inducing, or as living in, leaf galls on a wide variety of plants. The literature concerning such associations in India is summarised by Ananthakrishnan & Raman (1989), with earlier studies in Indonesia published by Karny & Docters van Leeuwen-Reijnvaan (1913), and also by Karny (1914–1916). Although some thrips galls are complex in their structure, the most common form involves a leaf folding along its mid-rib, or else rolling in toward the mid line from one or both margins. Galls of this type are particularly common on the leaves of *Ficus* species, induced by *Gynaikothrips* species. The thrips species described here induces the leaves of *Polyalthia longifolia* to partially fold longitudinally, but without forming the neat, flat fold that is common on *Ficus* species. On *Polyalthia*, the areas of the lamina nearest the leaf midrib become adpressed, thus enclosing the feeding site of the thrips (Fig. 2), but the margins of the lamina remain free whilst the leaf becomes distorted into various irregular shapes (Fig. 1). These galls are initiated by the feeding of adult thrips and, as in other species of Phlaeothripidae, females deposit their eggs superficially and do not insert them into the leaf tissues (Fig. 3).

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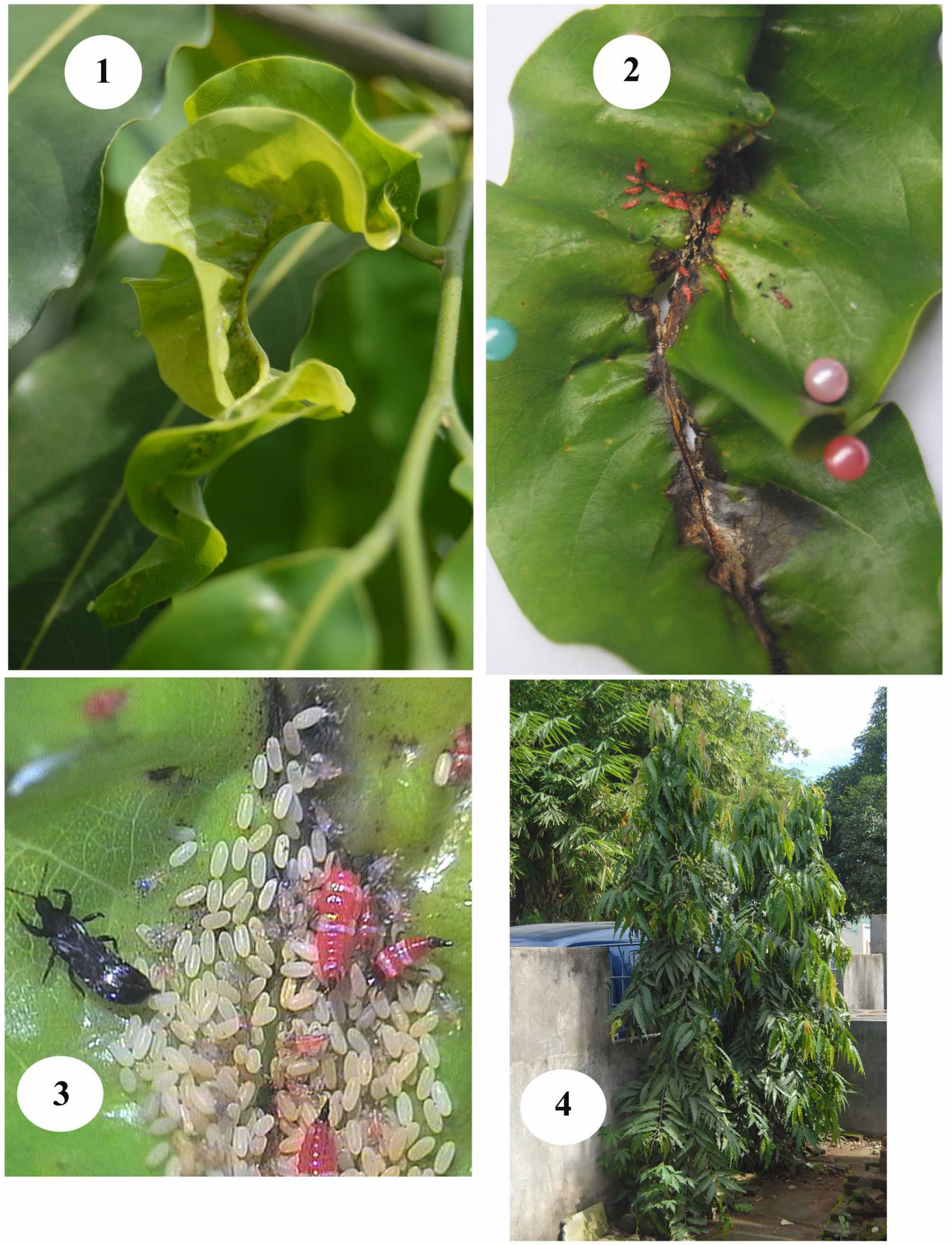


FIGURES 1–2. *Polyalthia longifolia* gall thrips. **(1)** intact gall; **(2)** gall pinned open to display tissue damage; **(3)** thrips life stages; **(4)** tree habitus.

The association of the new thrips species described here with *Polyalthia longifolia* raises questions. The plant is native to Sri Lanka and southern India, but the thrips is not recorded from those countries despite the extensive studies by T.N. Ananthakrishnan and his students (Ananthakrishnan & Raman 1989). The plant is introduced to Southeast Asia, and the thrips has therefore presumably host-shifted from some other species of *Polyalthia* in Southeast Asia. Cultivation of *P. longifolia* in Indonesia and Malaysia is usually from cuttings, not from seed. There is thus a possibility that this thrips pest is being distributed by the horticultural trade, in association with a single cultivar of limited genetic diversity.

***Crotonothrips polyalthiae* sp.n.**

Male macroptera. Body and legs dark brown, fore tarsi and apex of fore tibiae yellow; antennal segments I and VII–VIII brown, II yellow at apex, III almost clear yellow but weakly shaded at apex, IV–VI yellow on basal two-thirds, half or third respectively; fore wing extensively shaded, paler at apex, clear near base around sub-basal setae, and with a longitudinal pale line close to posterior margin (Fig. 11). Antennae 8-segmented, III with 1 sensorium, IV with 3^{+1} sensoria, VIII very weakly constricted at base (Fig. 7). Head dorsally slightly longer than wide, not projecting in front of eyes, cheeks weakly convex with weak setae (Fig. 6); dorsal surface transversely reticulate with prominent postoccipital flange; eyes slightly larger dorsally than ventrally; postocular setae long and slender with apices softly rounded; maxillary stylets close together medially, retracted to posterior margin of eyes; head elongate ventrally (Fig. 8), mouth cone pointed, extending between fore coxae; mandible restricted to mouth cone. Pronotum weakly reticulate but median area smooth, with strong median longitudinal apodeme; mid-lateral pair of setae arise in posterior position near to notopleural sutures (Fig. 9); mid-lateral and epimeral setae, long, slender with softly rounded apices; anteroangular and posteroangular setae shorter and variable in length; anteromarginal setae no larger than discal setae. Fore femora swollen, fore tibiae slightly curved, fore tarsal tooth stout (Fig. 5). Prosternal basantra not developed, chitinous islets large; ferna large, mesopraesternum incomplete medially (Fig. 8). Mesonotum reticulate, lateral setae small. Metanotum longitudinally reticulate on anterior half (Fig. 10), median setae small and slender; metathoracic sternopleural sutures sharply recurved (Fig. 8). Fore wing parallel-sided (Fig. 11), with about 25 duplicated cilia; sub-basal setae long with apices softly rounded to weakly capitate. Pelta irregular, broadly triangular with apex truncate or rounded, paired campaniform sensilla present (Fig. 10); tergites II–VII each with 2 pairs of sigmoid setae; tergite IX setae finely pointed, S2 short and stout; anal setae shorter than tube. Sternite VIII with large pore plate.

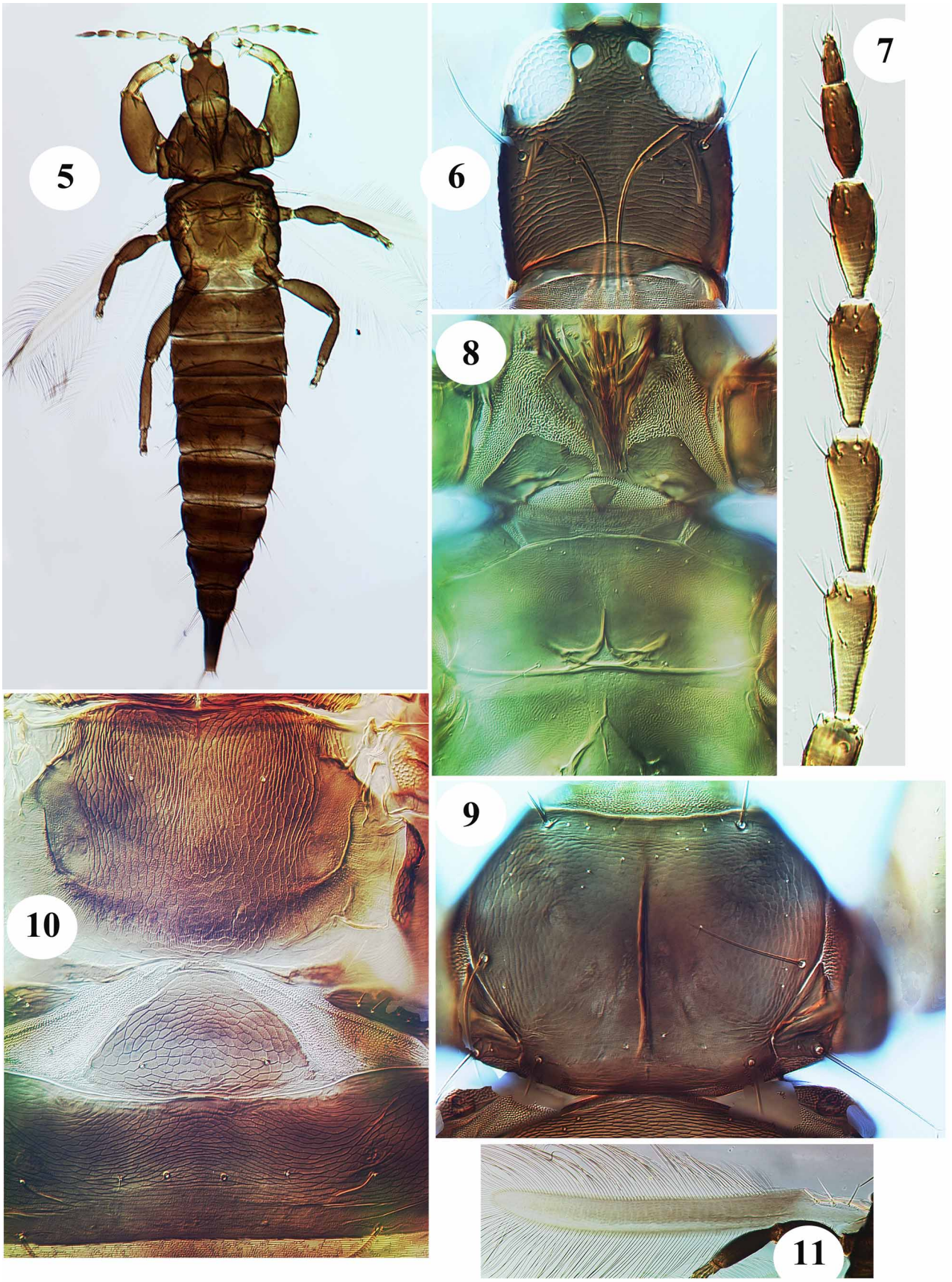
Measurements of holotype male in microns. Body length 2750. Head, dorsal length 230; width 200; ventral length to base of mouth cone 300; ventral length to apex of mouth cone 520; postocular setae 115. Pronotum, length 290; width 380; major setae, am 15; aa 50 (70); ml 130; epim 155; pa 45 (55). Fore wing, length 1050; median width 90; sub-basal setae 55, 75, 80. Tergite IV, posteromarginal setae 175; posteroangular setae 75. Tergite IX setae, S1 240; S2 60; S3 265. Tube, length 255; longest anal setae 175. Antennal segments III–VIII length 93, 90, 85, 80, 63, 35.

Female macroptera. Similar to male in colour and structure except: fore femora more slender, fore tarsal tooth smaller; pronotal am and pa setae longer, ml setae shorter; pronotal median longitudinal apodeme weak; tergite IX setae S2 as long as S1 and S3.

Measurements of large and small paratype females in microns. Body length 3150 (2500). Head, dorsal length 240 (175); width 220 (200); ventral length to base of mouth cone 300; ventral length to apex of mouth cone 520 (450); postocular setae 110 (15). Pronotum, length 250 (170); width 380 (300); major setae, am 35 (25); aa 50 (33); ml 85 (15); epim 160 (90); pa 75 (50). Fore wing, length 1050 (900); median width 110; sub-basal setae 60, 85, 85. Tergite IV, posteromarginal setae 165 (125); posteroangular setae 85 (55). Tergite IX setae, S1 240 (200); S2 225 (75); S3 240 (180). Tube, length 270 (225). Antennal segments III–VIII length 90, 90, 83, 70, 60, 35 (80, 75, 70, 68, 60, 33).

Larvae. Body with bright red internal pigments, and two transverse white bands (Fig. 3); antennae, legs, head, and abdominal segments IX–X dark brown.

Material studied. Holotype male, **Indonesia**, Makassar, Tamalanrea, in leaf gall of *Polyalthia longifolia* (Annonaceae), 7.vii.2010 (A. Nasruddin), in The Natural History Museum, London.



FIGURES 5–11. *Crotonothrips polyalthiae*. **(5–9)** holotype male: **(5)** habitus; **(6)** head; **(7)** antenna; **(8)** thoracic sternites; **(9)** pronotum. **(10–11)** paratype female: **(10)** metanotum, pelta and tergite II; **(11)** fore wing.

Paratypes: **Indonesia**, 4 males, 10 females taken with holotype and larvae; 21 females 2 males with similar data except, 22.xii.2011. **Malaysia**, University of Kuala Lumpur, 6 males, 1 female with larvae and pupae in leaf gall of *Polyalthia longifolia*, 3.vii.2006 (LAM 4903); Kuala Lumpur, Ampang, 3 males, 3 females with larvae and pupae in leaf galls of *P. longifolia*, 4.iii.2007 (LAM 5021). Paratypes deposited in: Bogor Zoological Museum-LIPI, Indonesia; Centre for Insect Systematics, Universiti Kebangsaan Malaysia; Natural History Museum, London; Australian National Insect Collection, Canberra.

Intraspecific variation

The pronotum of males is larger than that of females with a much stronger median longitudinal apodem. The anteromarginal and posteroangular setae are shorter than those of females, but the midlateral setae are much longer. The length of the anteroangular setae is particularly variable, both within and between the sexes, and these setae are commonly not bilaterally symmetrical.

Life history

In general, each gall seems to be initiated, and the colony developed, by a single pair of adults, and all life stages from eggs to pupae occur on the leaves (Fig. 3). The first and second instar larvae are red with two white transverse bands, but these paler bands are progressively lost in the propupa and pupal stadia. Moreover, the head and posterior abdominal segments of the propupa and pupae progressively become yellow. In Makassar, small pirate bugs (Anthocoridae) breed within these galls, feeding on the thrips and apparently depressing the populations to some extent. At Kuala Lumpur, a species of *Liothrips* was found breeding in low numbers in the galls, but these were probably opportunists not predators. The common gall-invading thrips of the genus *Mesothrips* have not yet been found in the galls of *C. polyalthiae*.

Systematic relationships

This new species of Phlaeothripinae can be recognised as a member of the leaf-feeding, species-rich, *Liothrips* lineage (Mound & Marullo, 1996) by the presence of one sensorium on the third antennal segment, and three sensoria on the fourth antennal segment, together with the absence of basantral plates on the prosternum. Within this large group, *Crotonothrips* has been distinguished by the presence of a stout fore tarsal tooth in both sexes (Okajima, 2006), in contrast to this tooth being absent in one or both sexes in related genera. This is the fifteenth species to be included in the genus *Crotonothrips*, and it differs from the other species, 13 of which are from India and one from Japan (Table 1), in having the mesopraesternum incomplete medially. It differs from all of these species except *longirostris* from Tripura, India, in having the mouth cone very long and pointed, the maxillary stylets close together medially in the head, and the postocular setae longer than the eyes. It further differs from *longirostris* in having the antennae more extensively brown rather than with segments I–VI “golden yellow”.

Unfortunately, the generic classification within the *Liothrips*-lineage is particularly unsatisfactory, with a considerable number of weakly defined, monobasic, genera, including many species described on few specimens with no known host-plant associations. This new species has been compared with the descriptions of such genera from the Oriental Region, including those from The Philippines (Reyes, 1994) for which holotype specimens are available at the Australian National Insect Collection, Canberra. As a result, only two possible courses of action seem appropriate – either to erect yet another monobasic genus, or else to place the species in the inadequately defined genus *Crotonothrips*. In accepting the second of these alternatives, the notes below are provided on the species currently assigned to this genus, which itself is a microcosm of the unsatisfactory taxonomic and systematic situation among *Liothrips* species and their relatives (Mound, 2011).

Ananthakrishnan (1967) erected *Crotonothrips* for a single new species, *C. gallarum*, taken in galls on an unidentified plant. The generic definition included the following character states: head and pronotum reticulate; fore tarsus with a tooth in both sexes; mesopraesternum much reduced; tergite IX setae S2 of both sexes about half as long as setae S1; tube longer than head with short anal setae.

Ananthakrishnan (1976) described four new species in *Crotonothrips*, and provided an identification key to the seven species included in the genus at that date, of which two had been described in 1969 and 1972. However, the discriminating character states used in this key are remarkably weak. For example, in couplet 2 the choice involves "…prothoracic setae very short" in contrast to "…prothoracic setae better developed". Similarly, in couplet 4 the contrast is between "B2 of IX always half as long as B1 and B3" and "B2 of IX nearly half as long, sometimes only very little shorter". One of the new species, *parvus*, was stated to have been collected together with specimens of *gallarum* in galls of *Memecylon* sp. at Coorg, Karnataka, and the possibility that these represent variation within a single species requires additional field studies. All four of the new species in the 1976 publication were described as from "*Memecylon* sp.", but the introduction to the paper provides species names of the plants involved. However, this leaves open the more interesting biological question as to whether there is a group of host specific species of *Crotonothrips*, or just a few polyphagous and structurally variable species (Table 1).

TABLE 1. Species included in the genus *Crotonothrips.*

Species	Author	Date	Page	Original genus	Country	Host plant
acharensis	Muraleedharan & Sen	1978	257	*Crotonothrips* (*Inermothrips*)	India	Not known
coorgensis	Ananthakrishnan	1976	412	*Crotonothrips*	India	*Memecylon talbotianum*[1]
antahasta	Ramakrishna	1928	294	*Brachythrips*	India	*Memecylon edule*[2]
avidi	Ananthakrishnan	1972	5	*Crotonothrips*	India	*Santalum album*[1]
entifer	Priesner	1935	365	*Haplothrips* (*Odontoplothrips*)	Japan	*Ardisia sieboldii*[3]
issimilis	Ananthakrishnan	1976	414	*Crotonothrips*	India	*Memecylon lawsoni*[1]
erraticus	Muraleedharan & Sen	1981	205	*Crotonothrips*	India	Not known
gallarum	Ananthakrishnan	1967	119	*Crotonothrips*	India	Not known
longirostris	Muraleedharan & Sen	1981	207	*Crotonothrips*	India	Not known
maoensis	Nilamani & Prasad	1990	262	*Crotonothrips* (*Inermothrips*)	India	*Schefflera wallichii* [4]
memecylonicus	Ananthakrishnan	1976	415	*Crotonothrips*	India	*Memecylon* sp.[1]
mimicus	Ananthakrishnan	1969	190	*Phaeothrips*	*India*	*Secamone emetica*[1]
nagaensis	Muraleedharan	1982	376	*Crotonothrips*	India	Not known
parvus	Ananthakrishnan	1976	417	*Crotonothrips*	India	*Memecylon* sp. [1]
polyalthiae	Mound & Nasruddin	2012		*Crotonothrips*	Indonesia; Malaysia	*Polyalthia longifolia*

[1]Ananthakrishnan TN (1976: 411); [2]Ananthakrishnan TN (1978: 43); [3]Okajima (2006); [4]Nilamani & Prasad (1990).

Ananthakrishnan & Sen (1980) reprinted the 1976 identification key, but added *C. dantahasta* (Ramakrishna) with no further comment, apparently as a new combination from its original genus *Brachythrips*. They also included at the start of the key one species placed in a subgenus, *Inermothrips*, and the significance of this is discussed further below. Subsequently, two further new species of *Crotonothrips* were described from India, by Muraleedharan & Sen (1981a) and Muraleedharan (1982), both of which were based on specimens with no host information, and neither of which is distinguished satisfactorily from the species in Ananthakrishnan (1976). In summary, the descriptions of all 10 of these species from India suffer from the lack of biological studies – there being no attempt to consider structural variation within and between galls, and between populations, and no serious attempt to investigate patterns of host-plant relationships. The importance of such studies when investigating biological diversity was stressed by Mound & Kranz (1997).

Muraleedharan & Sen (1978) described *Crotonothrips* (*Inermothrips*) *cacharensis*, based on specimens from Assam with no host plant information. This subgenus was erected on the basis that a fore tarsal tooth was lacking in

both sexes of the new species. However, this is contrary to the definition of the genus *Crotonothips*, and *Inermothrips* is thus not distinguished from *Liothrips*. Similarly, Nilamani & Prasad (1990) described *Crotonothrips* (*Inermothrips*) *maoensis* from horn galls on the leaves of *Schefflera wallichii* in northern India, but again that description does not distinguish the species satisfactorily from *Liothrips*. The significance of this subgenus can be determined only by re-examination of the type specimens.

The only other Indian species in this genus, *C. longirostris*, was described by Muraleedharan & Sen (1981b) from galls on an unidentified plant at Tripura, Northeastern India. Judging from that description, this is the only species of *Crotonothrips* that is closely similar to *C. polyalthiae*, and these two are distinguished above by the colour of the antennae and the form of the mesopraesternum. A revised definition of the genus *Crotonothrips* has recently been provided by Okajima (2006), who fully redescribed the Japanese species *Hoplothrips* (*Odontoplothrips*) *dentifer* Priesner as a new combination within *Crotonothrips*.

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References

Ananthakrishnan, TN (1967) Studies on new and little known Indian Thysanoptera. *Oriental Insects*, 1(1–2), 113–138.

Ananthakrishnan, TN (1969) Gall thrips from India. *Senckenbergiana Biologica*, 50(3–4), 179–194.

Ananthakrishnan, TN (1972) Further studies on Indian gall thrips – II. *Marcellia*, 37(3), 3–20.

Ananthakrishnan, TN (1976) New gall thrips of the genus *Crotonothrips* (Thysanoptera). *Oriental Insects*, 10(3), 411–419.

Ananthakrishnan, TN (1978) Thrips galls and gall thrips. *Technical Monograph No. 1. Zoological Survey of India*. Pp1–69.

Ananthakrishnan, TN & Raman A (1989) *Thrips and gall dynamics.* Oxford & IBH Publ. Co. 120pp.

Ananthakrishnan, TN & Sen S (1980) Taxonomy of Indian Thysanoptera. *Zoological Survey of India (Handbook Series)*, 1, 1–234.

Karny, H & Docters van Leeuwen-Reijnvaan, W & J (1913) Beiträge zur Kenntnis der Gallen von Java. 5. Über die javanischen Thysanopteren-cecidien und deren Bewohner. *Bulletin du Jardin Botanique de Buitenzorg*, 10, 1–126.

Karny, H. (1914-1916) Beiträge zur Kenntnis der Gallen von Java. Zweite Mitteilung über die javanischen Thysanopterocecidien und deren Bewohner. *Zeitschrift für wissenschaftliche Insektenbiologie*, 10 [1914], 201–208, 288–296, 355–369; 11 [1915], 32–39, 85–90, 138–147, 203–210, 249–256, 324–331; 12 [1916], 15–22, 84–94, 125–132, 188–199.

Mound, LA (2011) Thysanoptera taxonomy – purpose and practice. Pp 61-66 *in* Tyagi, B.K. & Vijay Veer [Eds] *Entomology Ecology and Biodiversity.* Scientific Publishers, Jodhpur 522pp.

Mound, LA & Kranz, B (1997) Thysanoptera and Plant Galls: Towards a Research Programme. 11-24, in Raman, A. (ed.). *Ecology and Evolution of Plant-feeding Insects in Natural and Man-made Environments*. National Institute of Ecology, New Delhi; Backhuys Publishers, Leiden, Netherlands.

Mound, LA & Marullo, R (1996) The Thrips of Central and South America: An Introduction. *Memoirs on Entomology, International*, 6, 1–488.

Muraleedharan, N (1982) Studies on Thysanoptera of N.E. India – 4. Tubulifera from Manipur. *Records of the Zoological Survey of India*, 79, 373–384.

Muraleedharan, N & Sen, S (1978) Two new species of Tubulifera (Thysanoptera: Phlaeothripidae) from N.E. India with the description of a new subgenus. *Bulletin of the Zoological Survey of India*, 1(3), 257–261.

Muraleedharan, N & Sen, S (1981a) Three new species of Tubulifera from India (Thysanoptera: Phlaeothripidae). *Bulletin of the Zoological Survey of India*, 3(3), 205–210.

Muraleedharan, N & Sen, S (1981b) Studies on Thysanoptera from N.E. India – 3. Tubulifera from Tripura. *Records of the Zoological Survey of India*, 79, 205–230.

Nilamani, L & Prasad, B (1990) A new species of gall-forming *Crotonothrips* (*Inermothrips*) (Thysanoptera: Phlaeothripidae) from Manipur. *Journal of the Bombay Natural History Society*, 87, 262–264.

Okajima, S (2006) The Suborder Tubulifera (Thysanoptera). The Insects of Japan, 2, 1–720. The Entomological Society of Japan, Touka Shobo Co. Ltd., Fukuoka.

Reyes, C.P. (1994) Thysanoptera (Hexapoda) of the Philippine Islands. *Raffles Bulletin of Zoology*, 42, 107–507.