



## Two new monobasic thrips genera for a gall-inducing species and its kleptoparasite (Thysanoptera, Phlaeothripinae)

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### Abstract

*Drypetothrips korykis* **gen. et sp.n.** is described as inducing leaf-margin galls on a small tree in Australia, *Drypetes deplanchei* [Putranjivaceae]. This thrips is similar in appearance to the smaller species of the genus *Kladothrips* that induce galls on *Acacia* species. The galls are invaded by a phytophagous kleptoparasitic thrips, *Pharothrips hynnis* **gen. et sp.n.**, females of which have a forked plough-like structure protruding ventrally on the frons that is unique amongst Thysanoptera.

**Key words:** autapomorphy, systematic relationships, leaf-margin galls, Australia

### Introduction

The small tree, *Drypetes deplanchei* [Putranjivaceae], is widespread across northern Australia as far south as Newcastle on the east coast. This tree is sometimes referred to as native holly, because the leaf margins can be sharply dentate, but these margins may also be almost smooth, and a species of thrips has been found inducing rolled margin galls on both leaf forms (Fig. 1). These galls and their thrips have been found at sites near Taree in coastal New South Wales, and also at Mt. Nebo near Brisbane in south-eastern Queensland. At each site, the galls have been found to include one or other of two very different species of Phlaeothripinae, although rarely are both species in the same leaf roll. Induction of the rolled leaf margins is apparently due to a species described below in a new genus, *Drypetothrips*. The second thrips species behaves as a kleptoparasitic phytophage that invades and usurps a leaf-margin gall, and this structurally remarkable new species is described below in another new genus, *Pharothrips*.

The new gall-inducing species shares many structural characteristics with the smaller species of the genus *Kladothrips*, all of which induce galls only on *Acacia* phyllodes (Crespi *et al.* 2004). This new species is particularly similar to *K. antennatus*, but decisions on the phylogenetic relationships between *Drypetothrips* and *Kladothrips* will need support from molecular data. The structural differences between them include an additional pair of post-ocular setae on the head, and the loss of duplicated cilia on the fore wing. This mixture of an acquired condition and a reduced condition render any conclusions on the polarity of the relationship difficult. The new species might be derived from among *Kladothrips* species, or it might represent a sister genus. However, a more likely relationship is that this new species is derived independently from within the Australian *Teuchothrips* assemblage of gall thrips (Mound 2008), with the character states shared with *Kladothrips* being adapted in some way for life within tightly enclosed galls, in contrast to the more loosely rolled leaf galls of most *Teuchothrips* species.

The new kleptoparasitic species also shares many character states with members of the *Teuchothrips* assemblage. However, the head of females bears ventrally a long tubercle that projects forward from a ridge between the tentorial pits and is shaped like a bifurcate plough-share. This structure is unique amongst Phlaeothripidae, and in large females can be as long as the head width (Figs 8–10). In males, the tubercle is represented by little more than a strong transverse ridge on the frons between the tentorial pits (Fig. 11).

## Abbreviations

The major setae on the pronotum are referred to as follows: am—anteromarginals; aa—anteroangulars; ml—mid-laterals; epim—epimerals; pa—posteroangulars. The postocular setae on the head are indicated by po. The marginal setae on tergite IX are designated pairs S1, S2, S3, where S1 is the pair closest to the mid-line.

### *Drypetothrips* gen.n.

Macropterous or micropterous Phlaeothripinae; head slightly longer than wide (Fig. 2), with 2 pairs of long, capitate po setae, compound eyes equally large dorsally and ventrally; maxillary stylets wide apart and V-shaped, retracted about half-way to po setae. Antennae 8-segmented (Fig. 4), III with 1 sense cone, IV with 3 sense cones; IV–VII each with narrow, parallel-sided pedicel. Pronotum with 5 pairs of major setae, am setae longer than aa setae, notopleural sutures complete; metanotum reticulate. Prosternal basantra absent, ferna irregularly sub-circular (Fig. 5); mesopresternum weakly complete medially or reduced to pair of lateral triangles; metathoracic sternopleural sutures present. Fore femora stout, fore tarsal tooth as long as tarsal width. Fore wing parallel sided, with 3 capitate sub-basal setae, without duplicated cilia. Pelta broadly triangular, wider than long (Fig. 7), campaniform sensilla usually absent, sometimes replaced by a minute seta; tergites II–VII each with 2 pairs of weakly sigmoid wing-retaining setae placed laterally, posterior pair on each tergite unusually long; tergite VIII with posteromarginal and posteroangular setal pairs as long as median length of tergite; tergite IX setae S1 and S2 slightly shorter than tube, tube slightly longer than head (Fig. 6). Male micropterous, similar to female microptera and with ocelli present; tergite IX setae S2 variable in length 0.5–1.0 as long as setae S1; sternite VIII with no pore plate.

Type species *Drypetothrips korykis* sp.n.

**Comments.** The general appearance and structure of the type species of this genus is remarkably similar to that of *Kladothrips antennatus* and its close relatives all of which live in pouch galls on the phyllodes of *Acacia* species (Crespi *et al.* 2004). However, macropterae of *Kladothrips* species have duplicated cilia on the posterior margin of the fore wing, and also have only two sub-basal wing setae. Among *Kladothrips* species the postocular setae are usually short, and no member of that genus has two pairs of these setae. Similarly, *Kladothrips* species rarely have the pronotal anteromarginal setae longer than the discal setae, and on the abdomen the pelta is slightly longer than wide, and the tube shorter than the head. As indicated above, the structural similarities between this new species and *K. antennatus* may be correlated in some way with life in a tightly closed gall, rather than an indication of phylogenetic relationship. This gall on *Drypetes deplanchei* is very different (Fig. 1) from the more open leaf-roll galls that are induced by several *Teuchothrips* species in Australia.

### *Drypetothrips korykis* sp.n.

(Figs 2–7)

*Female macroptera.* With generic character states as indicated above. Body brown, tube darkest; tarsi and apices of tibiae yellow; antennae brown with base of III and apex of II paler; fore wing distal half uniformly shaded. Head sculpture reticulate on posterior third, irregular on anterior third (Fig. 2); outer po setae slightly longer than inner pair. Pronotum with median longitudinal apodeme, sculpture weak and irregular, but reticulate anterolaterally and at posterior margin. Mesonotal lateral setae weakly capitate, metanotal median setae finely pointed. Pelta and tergite II reticulate, remaining tergites with reticulation weak on median third; paired median campaniform sensilla large but irregular, sometimes close together but sometimes absent; tergites II–VI with posteroangular setae shorter than median length of tergite, on VIII much longer than tergite; tube robust, constricted at anal setae. Sternites with at least 12 small fine discal setae; posteromarginal setae S1 shorter than sternite length, arising submarginally.

**Measurements** (holotype female, in microns). Body length 2150. Head, length 210; width 170; po setae 65, 75. Pronotum, length 180; width 240; setae, am 50, aa 35, ml 50, epim 75, pa 60. Fore wing, length 900; width 80; sub-basal setae 50, 45, 45. Tergite IX setae S1 165; S2 165; S3 200. Tube, length 240. Antennal segments III–VIII length 55, 45, 45, 50, 45, 25.

*Female microptera.* Closely similar in colour and structure to macroptera with well-developed ocelli; fore wing lobe about half as long as pterothorax width, with three long capitate setae.





**FIGURES 1–7.** *Drypetothrips korykis* **gen et sp. n.** and galls. (1) *Drypetes deplanchei* leaf margin galls; (2) holotype head and pronotum; (3) meso and metanotum; (4) antenna; (5) prosternites; (6) tergite IX and tube; (7) pelta and tergites II–IV.

**Measurements** (paratype female, in microns). Body length 2010. Head, length 200; po setae 60, 75. Pronotum, length 185; width 235; setae, am 50, aa 30, ml 55, epim 80, pa 60. Fore wing lobe 170. Tergite IX setae S1 160; S2 135; S3 200. Tube, length 215. Antennal segments III–VIII length 50, 45, 45, 50, 45, 25.

*Male microptera.* Similar in colour and structure to female; tergite IX setae S2 variable in length.

**Specimens studied.** Holotype female macroptera, **New South Wales**, 20km south of Taree, Black Head, from marginal leaf-roll gall on *Drypetes deplanchei*, 14.iv.2002 (LAM 4147).

Paratypes (micropterae except where indicated): **New South Wales**, taken with holotype 2 female macropterae, 12 females; 25km north of Taree, 13 females, 2 males with larvae from marginal leaf-roll galls on *Drypetes*

*deplanchei*, 27.xii.2006. **Queensland**, Brisbane, Mt Nebo, 9 female macropterae, 2 females, 7 males from marginal leaf-roll galls on *Drypetes deplanchei*, 9.vii.2002.

**Comments.** This species is remarkable for the lack of structural differences between macropterae and microppterae, and also between males and females. The largest individuals of both sexes differ from the smallest in having the fore femora rather thicker and the fore tarsal tooth slightly larger, but no allometric differences were observed.

### *Pharothrips* gen.n.

Macropterous sexually dimorphic Phlaeothripinae; head more than twice as long as wide (Fig. 8), eyes large, genae weakly concave with small tubercle behind each eye; po setae pointed, shorter than dorsal eye length; female head ventrally with pair of small tubercles between compound eyes (Fig. 10), and long bifurcate tubercle extending forward from tentorial pits (Fig. 9); males without anterior tubercles, and with bifurcate tubercle little more than a small ridge (Fig. 11); maxillary stylets scarcely retracted anterior to postoccipital ridge. Antennae 8-segmented (Figs 16–17), III with one sense cone, IV with three; VIII scarcely half as long as VII. Pronotum longer than wide, without long setae; notopleural sutures complete (Fig. 12). Prosternal basantra absent, ferna large with median margins parallel in female (Fig. 13) but not in male (Fig. 11); mesopresternum reduced to two very small oval sclerites; metathoracic sternopleural sutures present. Fore tibia stout with tubercle at inner apex, fore tarsus as long as tarsal width. Fore wing broad, parallel sided and apex not tapered, with relatively few duplicated cilia; sub-basal setae small to minute. Mesonotum broad, weakly sculptured with lateral setae small; metanotum without sculpture medially, with longitudinal reticulation laterally. Pelta reticulate, triangular (Fig. 14); tergites II–VII each with 2 pairs of long wing-retaining setae situated close to lateral margins; often with one median campaniform sensilla or these sensilla absent; tergite IX setae pointed, almost as long as tube (Fig. 15). Sternites with irregular transverse row of discal setae; marginal setae S1 shorter than sternite length, arising submarginally. Male similar to female but smaller; head ventrally with area posterior to tentorial pits recessed and bearing several setae (Fig. 11); prosternal ferna with convex inner margins; tergite IX setae S2 slightly shorter than S1; sternite VIII without pore plate.

Type species *Pharothrips hynniss* sp.n.

**Comments.** This genus is clearly a member of the *Liothrips* lineage of Phlaeothripinae, judging from the antennal sense cones, the absence of prosternal basantra, and the parallel-sided fore wings (Minaei & Mound 2014). General similarities in body form to genera from Southeast Asia such as *Phasmothrips* and *Gigantothrips* could be related to the large body size and long head. The maxillary stylets are not deeply retracted into the head in the species of all three genera, and the tergal wing-retaining setae are similarly lateral in position, although this could be related to the broad fore wings. A particularly large number of character states are shared with the two species of *Turmathrips*, described from Australia as kleptoparasites of certain *Kladothrips* species that induce galls on *Acacia phyllodes* (Crespi *et al.* 2004). However, both *Turmathrips* species have the mesonotum with a complete median longitudinal division. The presence of structurally remarkable autapomorphies, such as the unique tubercle ventrally on the head in *Pharothrips*, is a frequent problem when considering relationships among Phlaeothripinae (Dang *et al.* 2014; Mound & Ng 2018). Despite this remarkable structure, the genus is possibly related to *Drypetothrips*, but again molecular data would be needed to consider such a possibility.

### *Pharothrips hynniss* sp.n.

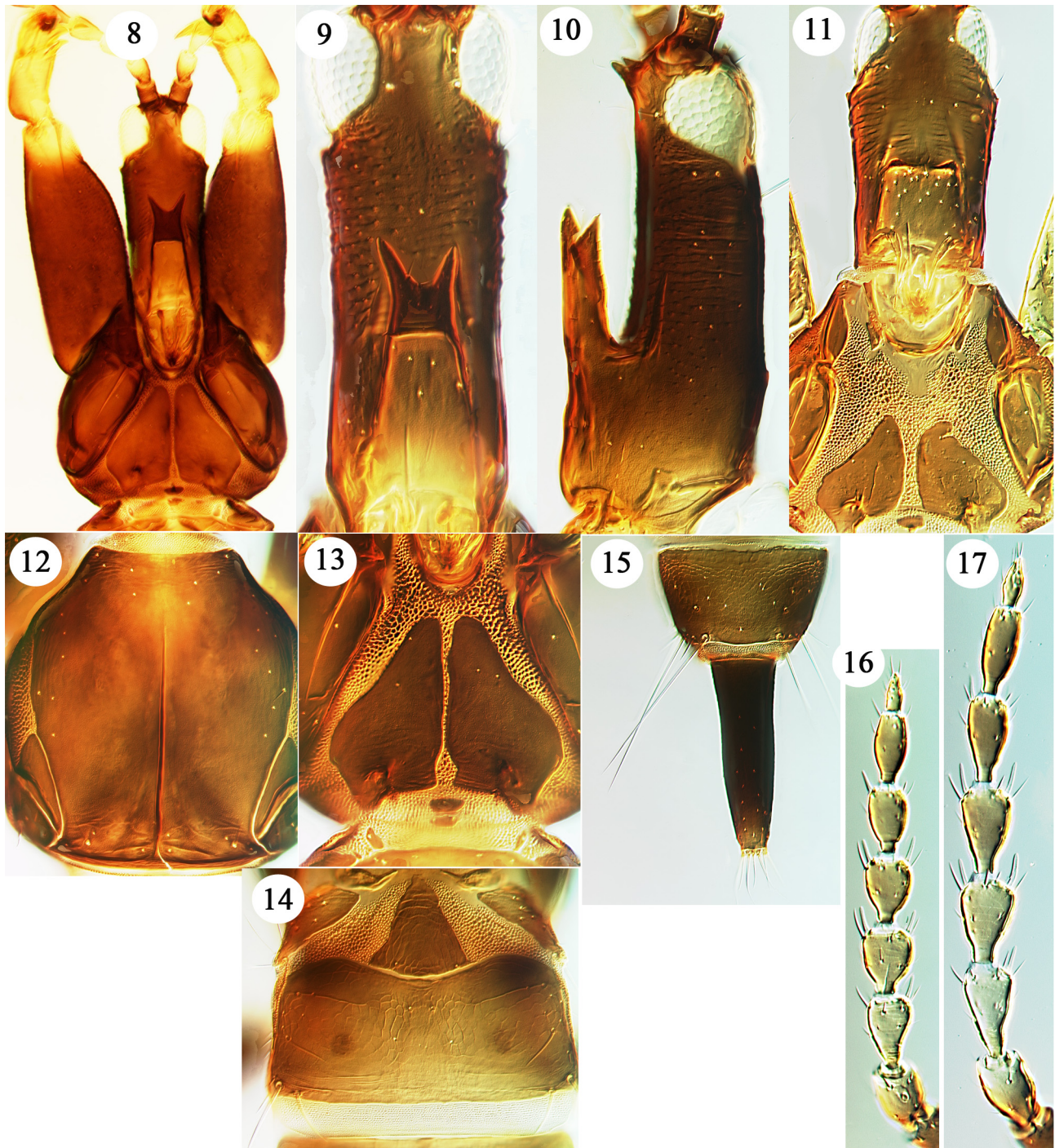
(Figs 8–17)

*Female macroptera.* With generic character states as indicated above. Body brown; tarsi, fore tibiae and apices of femora yellow; antennal segment III yellow, also apex of II, IV–VIII increasingly darker brown; fore wing shaded on distal half; setae all pale. Head with few and irregular sculpture markings; posterior ocelli almost in contact with curved inner margin of compound eyes; antennal segments III–VII evenly tapering to base (Fig. 17), sense cones not elongate; pronotum without sculpture, setae am, aa and ml not distinguished from discal setae; fore tibia sharply angulate posterolaterally, inner apex ventrally with strongly recurved tooth; fore wing with about 12 duplicated cilia; tergal wing-retaining setae weakly sigmoid; tube slightly convex in anterior third, tapering on posterior third.

**Measurements** (holotype female, in microns). Body length 3600. Head, length 480; po setae 75. Pronotum,



length 480; width 420; prothorax width 500; setae, epim 25, pa 35. Fore wing length 1550; width 160; sub-basal setae 20. Tergite IX setae S1 215; S2 225; S3 200. Tube length 270. Antennal segments III–VIII length 85, 80, 80, 80, 75, 38.



**FIGURES 8–17.** *Pharothers hynniss* gen et sp. n. (8) female head and thorax ventral; (9) female head ventral; (10) female head lateral; (11) male head ventral; (12) female pronotum; (13) female prosternum; (14) female pelta and tergite I; (15) female tergite IX and tube; (16) male antenna; (17) female antenna.

*Male microptera.* Similar to female but smaller; head shorter, ventrally in association with tentorial pits a transverse ridge or pair of small tubercles, posterior to this a recessed area with about 20 small setae (Fig. 11); antennal segments IV–VII each with narrowed pedicel (Fig. 16); pronotum less elongate than in female, particularly in small male; prosternal ferna with convex inner margins; meso and metanotum almost without sculpture, fore wing lobe shorter than thorax width; tergite IX setae S2 variable from as long as S1 to half as long, S3 shorter than S2.

**Measurements** (paratype male, in microns). Body length 2100. Head, length 270; po setae 70. Pronotum, length 230; width 270; prothorax width 320. Fore wing length 170. Tergite IX setae S1 185; S2 100; S3 100. Tube length 180. Antennal segments III–VIII length 85, 80, 80, 80, 75, 38.

**Specimens studied.** Holotype female macroptera, **New South Wales**, 20km south of Taree, Black Head, from marginal leaf-roll gall on *Drypetes deplanchei*, 14.iv.2002 (LAM 4148).

Paratypes: 10 females, 2 males taken with holotype; 25km north of Taree, 12 females 4 males from marginal leaf-roll galls on *Drypetes deplanchei*, 27.xii.2006; **Queensland**, Brisbane, Mt Nebo, 4 females, 2 males from marginal leaf-roll galls on *Drypetes deplanchei*, 9.vii.2002.

**Comments.** The small tubercles ventrally between the eyes are similar to structures found in this position on males of various unrelated, fungus-feeding, Phlaeothripinae, but they are not previously recorded from females. The elongate, bifurcate tubercle arising ventrally from near the tentorial pits is unique amongst Phlaeothripinae of either sex. This tubercle must be expensive in terms of developmental energetics, and the objective of this investment is unclear. One possibility is that the tubercle might be used to lift a leaf margin (Fig. 1) of a closely sealed gall of *Drypetothrips korykis* and thus facilitate invasion. There is no evidence that this thrips is predatory on its host, nor is there any evidence that it can itself induce a gall on a *Drypetes* leaf. It appears to invade a pre-existing gall and breed within the gall cavity, feeding on the leaf tissues. Of 26 galls examined at a site near Taree, nine healthy green galls contained only *D. korykis* adults and larvae, 13 rather older slightly distorted galls contained only *Ph. hynnisi* adults and larvae, and four contained individuals of both species. From the galls found at Mt Nebo, 18 *D. korykis* and six *Ph. hynnisi* were extracted.

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