

Review of the larval host plants and biology for fifteen species of the genus *Temognatha* Solier, 1833 (Coleoptera: Buprestidae)

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Abstract: This review provides all of the available literature and information regarding larval host plants and biology for fifteen species of the genus *Temognatha* (Coleoptera: Buprestidae). Many other species of *Temognatha* are known with recorded adult host plants and behaviour but only fifteen (those reviewed here) have larval hosts recorded in the literature. There are approx. 80 species of *Temognatha* so far described, therefore those with known larval host plant records represent of this total only 17.5%. This is a marked indication of the lack of knowledge recorded on their basic biologies. Many references cited here were omitted from the catalogue of Bellamy (2003) [*Coleoptera: Buprestoidea*. In: Houston, W.W.K. (ed) *Zoological Catalogue of Australia. Volume 29.5*].

Introduction

This paper reviews the biology and host plants (both larval and adult) for fifteen species of the genus *Temognatha* Solier, 1833 (Coleoptera: Buprestidae). Many other species of *Temognatha* are known with recorded adult host plants and behaviour but only fifteen (those reviewed here) have larval hosts recorded in the literature. The genus *Temognatha* Solier, 1833 is presently placed in the subfamily Buprestinae in the tribe Stigmoderini (Bellamy, 2003). Many of the references cited here were overlooked by Bellamy (2003)(see also Hawkeswood, 2006).

List of species and review of literature records

Genus *Temognatha* Solier, 1833

Temognatha chalcodera (Thomson, 1878)

Distribution: Australia (Western Australia).

Larval host-plant: *Casuarina acutivalvis* F. Muell. subsp. *acutivalvis* (Casuarinaceae) (Peterson, 1996).

Adult host-plants: *Eucalyptus leptophylla* F. Muell. (= *E. uncinata* Turcz.)(Myrtaceae) (Slater & Lindgren, 1955); *Eucalyptus foecunda* Schau. (Myrtaceae)(Hawkeswood, 1982; Hawkeswood & Peterson, 2004).

Biology: Slater & Lindgren (1955) recorded adults of this species [as *Themnognatha*] from flowers of *Eucalyptus* at Queen Victoria Spring, Western Australia. Hawkeswood (1982) recorded adults of this species [as *Stigmodera*] from flowers of *Eucalyptus foecunda* Schau. (Myrtaceae) during early February 1980, near Peak Charles, Western Australia. Peterson (1996) recorded the interesting observation of female *T. chalcodera* ovipositing on living trunks of mature diminutive non-flowering *Casuarina acutivalvis* F. Muell. [as *Allocasuarina*] in the Yellowdine area, Western Australia. The females lay a single subcircular egg on the east or south face of the host trunk about 7 cm above ground level and then immediately coat the egg with cemented yellow sand, thereby roughly forming a hemisphere measuring 7.7-8.5 mm in diameter and 3.7-3.8 mm high glued to the trunk surface; the encased egg appears as a "cemented sand-dome" attached to the bark (Peterson, 1996). Hawkeswood & Peterson (2004) recorded adults feeding on nectar from the flowers of *Eucalyptus foecunda* Schau. (Myrtaceae) during mid-February 1980 near East Hyden and Forrestania, Western Australia. Carnaby (undated) noted that adults of the species [as *Stigmodera Themnognatha*] were common during each season in Western Australia.

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Life-stages: The egg is described by Peterson (1996). The larva and pupa have not been described. Published collection records with biological data: Larval host-plant record: 18 km east of Yellowdine, Western Australia (31°17'S, 119°50'E), 26 Jan. 1990, M. Peterson, two females observed ovipositing on the living trunks of *Casuarina acutivalvis* F. Muell. subsp. *acutivalvis* [as *Allocasuarina acutivalvis* (F. Muell.) L. Johnson](Casuarinaceae) (Peterson, 1996).

Further comments: Bellamy (2003) overlooked the adult host record of Slater & Lindgren (1955).

Temognatha excisicollis (Macleay, 1863)

Distribution: Australia (New South Wales, Queensland).

Larval host-plant: *Eucalyptus propinqua* Deane et Maiden (Myrtaceae)(Hawkeswood & Peterson, 1982; Hawkeswood, 2002).

Adult host-plant: Not recorded.

Biology: Hawkeswood & Peterson (1982) have recorded the only larval host record for this species [as *Stigmodera*] (see details below)

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: Larval host-plant record: Sunnybank, (Brisbane), Queensland, undated, collector not cited, "chopped out of a dead grey gum", *Eucalyptus propinqua* Deane et Maiden (Myrtaceae)(Hawkeswood & Peterson, 1982; Hawkeswood, 2002).

Temognatha flavocincta (Gory & Laporte, 1838)

Distribution: Australia (Victoria, South Australia, Western Australia).

Larval host-plant: *Eucalyptus leucoxyton* F. Muell. (Myrtaceae)(Goudie, 1923; Hawkeswood, 2002).

Adult host-plant: *Eucalyptus camaldulensis* Dehn. (Myrtaceae)(Tepper, 1887)

Biology: Tepper (1887) briefly noted that adults of this species [as *Stigmodera*] were abundant in the mid 1850's in South Australia on *Eucalyptus camaldulensis* [as *Eucalyptus rostrata*] but that by the late 19th Century, it was rare. Goudie (1923) briefly noted collecting two dead adults of this species [as *Stigmodera*] from a "six inch" [c. 15 cm] diameter sapling of *Eucalyptus leucoxyton* F. Muell. in the mallee region of Victoria but did not supply any other details. [See also Hawkeswood (2002)]. Carnaby (undated) noted that the species [as *Stigmodera Themognatha*] was rare in western Australia, with adults appearing only in October.

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: None available.

Further comments: The references of Tepper (1887) and Goudie (1923) were overlooked by Bellamy (2003).

Temognatha fornumi (Hope, 1843)

Distribution: Australia (Queensland, New South Wales, Victoria, South Australia).

Larval host-plant: *Casuarina stricta* Dryander [= *C. quadrivalvis* Fiveash & Brown](Casuarinaceae)(Tepper, 1887).

Adult host-plant: Not recorded.

Biology: Tepper (1887) briefly noted that the larvae of this rare species [as *Stigmodera*] fed on the roots and trunks of she-oak, *Casuarina stricta* Dryander [as *C. quadrivalvis*]. [According to Willis (1972), the name *Casuarina quadrivalvis* is invalid, and refers to *C. stricta* Dryander, a species with a sporadic distribution in southern Victoria, Tasmania, eastern New South Wales and southern South Australia]. Tepper (1887) also noted adults are on the wing during December and January.

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: None available.

Further comments: Bellamy (2003) overlooked the larval host record of Tepper (1887)

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Temognatha fusca (Saunders, 1871)

Distribution: Australia (Victoria, South Australia, Western Australia).

Larval host-plants: *Eucalyptus gracilis* F. Muell., *E. oleosa* F. Muell. and *E. leptophylla* F. Muell. [= *E. uncinata* Turcz.](Myrtaceae)(Tepper, 1887; Hawkeswood, 2002).

Adult host-plants: *Eucalyptus oleosa* F. Muell. (Myrtaceae)(Tepper, 1887); *Eucalyptus leptophylla* F. Muell. [= *E. uncinata* Turcz.](Myrtaceae)(Slater & Lindgren, 1955).

Biology: Tepper (1887) briefly noted that this species [as *Stigmodera parryi*] bred in the wood of three *Eucalyptus* species occurring in South Australia and that adults visited the flowers of *Eucalyptus oleosa* F. Muell. during November. Slater & Lindgren (1955) recorded adults of this species [as *Themnognatha parryi*] from flowers of *Eucalyptus* at Queen Victoria Spring, Western Australia.

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: None available.

Further comments: Bellamy (2003) overlooked the host records of Tepper (1887) and Slater & Lindgren (1955).

Temognatha goryi (Gory & Laporte, 1838)

Distribution: Australia (Queensland, New South Wales).

Larval host-plants: *Eucalyptus tereticornis* Sm., *E. amplifolia* Naud. (Myrtaceae) (Hawkeswood & Peterson, 1982); *Eucalyptus* sp. (Myrtaceae)(Hawkeswood & Peterson, 1982; Williams & Williams, 1983; Hawkeswood, 2002).

Adult host-plants: None recorded.

Biology: The larvae develop in the roots of their host-plants (Hawkeswood & Peterson, 1982). Hawkeswood & Peterson (1982) noted that one adult female [as *Stigmodera*] had died after attempting to emerge head first from the trunk of a *Eucalyptus tereticornis* Sm. at Toongabbie, Sydney, New South Wales, after being trapped in small square mesh chicken wire which had been tightly wrapped around the base of the tree. The most recent emergence hole, situated about 1 m above ground level, measured 1.5 cm wide, 1.25 cm high and at least 7 cm deep; other emergence holes varied from 1-6 m above ground level on the main trunk only (Hawkeswood & Peterson, 1982). [See also Hawkeswood (2002)].

Life-stages: The egg, larva and pupa have not been described,

Published collection records with biological data: Larval host-plant records: One Tree Hill, (Mt. Coot-tha), Brisbane, Queensland, 12 Dec. 1912, H.W. Brown, specimen cut from "living grey gum" (*Eucalyptus* sp.)(Myrtaceae)(Hawkeswood & Peterson, 1982); Kin Kin, Queensland (26°16'S, 152°52'E), 16 Dec. 1929, H. Hacker, female emerged from an unidentified *Eucalyptus* sp. (Myrtaceae)(Hawkeswood & Peterson, 1982); Fairfield, Sydney, New South Wales, 13 Aug. 1959, collector not cited, dead specimen excavated from a tunnel in the trunk of *Eucalyptus* sp. (Myrtaceae)(Williams & Williams, 1983); Stanthorpe, Queensland (28°30'S, 151°55'E), Feb. 1969, J. Harslett, two adults emerged from *Eucalyptus amplifolia* Naud. (Myrtaceae) (Hawkeswood & Peterson, 1982); Toongabbie, Sydney, New South Wales, 3 Feb. 1981, N. Gawthorne, adult failed to emerge from trunk of *Eucalyptus tereticornis* Sm. (Myrtaceae) (Hawkeswood & Peterson, 1982). [See also Hawkeswood (2002)].

Further comments: Bellamy (2003) overlooked the larval host record of Williams & Williams (1983).

Temognatha grandis (Donovan, 1805)

Distribution: Australia (New South Wales, South Australia).

Larval host-plants: *Eucalyptus gracilis* F. Muell., *E. oleosa* F. Muell. and *E. leptophylla* F. Muell. [= *E. uncinata* Turcz.](Myrtaceae)(Tepper, 1887; Hawkeswood, 2002).

Adult host-plant: *Angophora hispida* (Sm.) Blaxell (Myrtaceae)(Williams & Williams, 1983).

Biology: Tepper (1887) briefly noted that this species [as *Stigmodera*] bred in the wood of three *Eucalyptus* species occurring in South Australia. [See also Hawkeswood (2002)]. Williams & Williams (1983) recorded adults of the species from flowers of *Angophora hispida* (Sm.) Blaxell (Myrtaceae) in the Sydney Basin, New South Wales.

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Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: None available.

Further comments: Bellamy (2003) overlooked the host records of Tepper (1887).

Temognatha heros (Gehin, 1855)

Distribution: Australia (New South Wales, Victoria, South Australia, Western Australia).

Larval host-plants: *Eucalyptus gracilis* F. Muell., *E. oleosa* F. Muell. and *E. leptophylla* F. Muell. [= *E. uncinata* Turcz.](Myrtaceae)(Tepper, 1887); *Casuarina* sp. (Casuarinaceae), *Eucalyptus* sp. (Myrtaceae)(French, 1911); *Eucalyptus* sp. (Myrtaceae)(Hawkeswood & Peterson, 1982). [See also Hawkeswood (2002)].

Adult host-plants: *Eucalyptus leptophylla* F. Muell. [= *E. uncinata* Turcz.](Myrtaceae) (Tepper, 1887; Slater & Lindgren, 1955); *Melaleuca uncinata* R. Br. (Myrtaceae)(French, 1911); *Melaleuca pauperiflora* F. Muell. (Myrtaceae) (Hawkeswood, 1980); *Eucalyptus foecunda* Schau. (Myrtaceae)(Hawkeswood & Peterson, 2004).

Biology: Tepper (1887) briefly noted that this species [as *Stigmodera*] bred in the wood of three *Eucalyptus* species occurring in South Australia. Tepper (1887) also mentioned that adults frequented the flowers of *Eucalyptus leptophylla* F. Muell. [as *E. uncinata*] during February 1878 and 1880 near Ardrossan, South Australia. French (1911), without reference to the work of Tepper (1887), noted that this species [as *Stigmodera*] was destructive to a number of timbers in north-western and northern Victoria, stating that it bred in the lower trunks and roots of species of *Casuarina* (Casuarinaceae) and *Eucalyptus* (Myrtaceae). French (1911) also illustrated one mature larva in a chamber in a branch of presumably *Eucalyptus* sp. (Myrtaceae). French (1911) illustrated the adult, larva and larval head, thereby showing that the larva of *T. heros* has massive jaws, broad prothorax and very thick abdominal segments; French's illustration of the larva appears to agree with the dead larva illustrated by Hawkeswood & Peterson (1982). French (1911) noted that the females clear spaces on the butts of the trees on which the eggs are laid. When hatched, the larvae commence feeding and move into the sapwood, later moving downwards and then burrowing into the heartwood, producing a large amount of frass and extensive chambers in the process. French also stated that the larval stage was short. Nothing further appears to have been recorded on the larval biology of this species until Hawkeswood & Peterson (1982) recorded another larval host record [see also comments on this species by Hawkeswood (1988)]. Slater & Lindgren (1955) recorded adults of this species [as *Themnognatha*] from flowers of *Eucalyptus* at Queen Victoria Spring, Western Australia. Hawkeswood (1980) recorded adults of this species [as *Stigmodera*] feeding on nectar and pollen of *Melaleuca* in southern Australia on 5 March 1979. Hawkeswood (1980) provided the following observations: jewel beetles were not found on every flowering bush examined; large plants (c. 2.5 m high) in full bloom appeared to be favoured by the buprestids; feeding and copulation readily occurred on flowers at the tops of plants; flight readily occurred and beetles were observed to land on nearby bushes after taking flight as a result of the author's disturbances; although most beetles had a dusting of pollen on the head and pronotum, no pollen was carried on the posterior regions of the body; no other insects apart from a few individuals of another jewel beetle, *Castiarina mustelamajor* (Thomson) were visiting the flowers. Hawkeswood & Knowles (1985) recorded possible predation of this species [as *Stigmodera*] by the Western Magpie (*Gymnorhina dorsalis*, Corvidae). Hawkeswood & Peterson (2004) recorded adults feeding on nectar from the flowers of *Eucalyptus foecunda* Schau. (Myrtaceae) during mid-February 1980 near East Hyden and Forrestania, Western Australia. Hawkeswood & Peterson (2004) also noted adults flying and landing on leaves of *E. foecunda* trees at Lake Magenta, Western Australia.

Life-stages: The egg, larva and pupa have not been described. The larva has been illustrated by French (1911), Hawkeswood & Peterson (1982) and Carnaby (undated). Carnaby (undated) illustrates two larvae apparently of *T. heros* [as *Stigmodera*], although the second one is actually that of a Cerambycidae!

Published collection records with biological data: Larval host-plant record: Streaky Bay, South Australia (32°50'S, 134°15'E), 28 June 1895, A.B. Barrand, adult emerged from the trunk of an unidentified mallee, *Eucalyptus* sp. (Myrtaceae)(Hawkeswood & Peterson, 1982). [see also

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Hawkeswood (2002)].

Further comments: Bellamy (2003) overlooked the host records of Tepper (1887) and Slater & Lindgren (1955).

Temognatha imperialis (Carter, 1916)

Distribution: Australia (Western Australia).

Larval host-plant: *Eucalyptus striatocalyx* W.V. Fitzgerald (Myrtaceae)(Hawkeswood & Peterson, 1982; Hawkeswood, 2002).

Adult host-plant: Not recorded.

Biology: Hawkeswood & Peterson (1982) have provided the only published larval host record for this species [as *Stigmodera*](see details below).

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: Larval host-plant record: Milly Soak, (Lake Austin-Cue district), Western Australia (c. 27°28'S, 117°50'E), 25 Jan. 1938, H.W. Brown, adults cut from *Eucalyptus striatocalyx* W.V. Fitz. (Myrtaceae)(Hawkeswood & Peterson, 1982; Hawkeswood, 2002).

Temognatha marginalis Carter, 1929

Distribution: Australia (Western Australia).

Larval host-plant: *Eucalyptus* sp. (Myrtaceae)(Carnaby, undated).

Adult host-plants: *Eucalyptus* sp. (Myrtaceae)(Carnaby, undated).

Biology: Carnaby (undated) noted that adults of this species [as *Stigmodera Themognatha*] occurred during late spring and summer on mallee blossoms [*Eucalyptus* sp.]. Carnaby (undated) also noted that he had cut this species from mallee roots [*Eucalyptus* sp.] in June and managed to obtain fully formed adults that were situated immediately under the bark waiting to emerge during October.

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: None available.

Further comments: Bellamy (2003) overlooked the host records of Carnaby (undated).

Temognatha martinii (Saunders, 1869)

Distribution: Australia (Western Australia).

Larval host-plant: *Casuarina corniculata* F. Muell. (Casuarinaceae)(Hawkeswood & Peterson, 1982).

Adult host-plant: Not recorded.

Biology: Hawkeswood & Peterson (1982) have provided the only published larval host record for this species [as *Stigmodera*](see details below).

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: Larval host-plant record: Locality not cited, 18 Jan. 1958, R.P. McMillan, male beetle cut from a root of *Casuarina corniculata* F. Muell. (Casuarinaceae)(Hawkeswood & Peterson, 1982).

Temognatha mnizechii (Saunders, 1868)

Distribution: Australia (Queensland, South Australia, Western Australia).

Larval host-plants: *Eucalyptus gracilis* F. Muell., *E. oleosa* F. Muell. and *E. leptophylla* F. Muell. [= *E. uncinata* Turcz.](Myrtaceae)(Tepper, 1887; Hawkeswood, 2002).

Adult host-plants: *Eucalyptus leptophylla* F. Muell. [= *E. uncinata* Turcz.](Myrtaceae) (Slater & Lindgren, 1955); *Eucalyptus cylindriflora* Maiden et Blakely (Myrtaceae)(Hawkeswood, 1982); *Eucalyptus foecunda* Schau. (Myrtaceae)(Hawkeswood, 1982; Hawkeswood & Peterson, 2004).

Biology: Tepper (1887) briefly noted that this species [as *Stigmodera Mniszecki*] bred in the wood of three *Eucalyptus* species occurring in South Australia. Slater & Lindgren (1955) recorded adults of this species [as *Themnognatha*] from flowers of *Eucalyptus* at Queen Victoria Spring, Western Australia. Hawkeswood (1982) recorded adults of this species [as *Stigmodera*] from flowers of *Eucalyptus foecunda* Schau. and *E. cylindriflora* Maiden et Blakely (Myrtaceae) during

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early February 1980, near Peak Charles, Western Australia. Hawkeswood & Peterson (2004) recorded adults feeding on nectar from the flowers of *Eucalyptus foecunda* Schau. (Myrtaceae) during mid-February 1980 near Forrestania, Western Australia.

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: None available.

Further comments: Bellamy (2003) overlooked the host records of Tepper (1887) and Slater & Lindgren (1955).

Temognatha parvicollis (Saunders, 1869)

Distribution: Australia (Queensland, South Australia, Western Australia).

Larval host-plants: *Eucalyptus gracilis* F. Muell., *E. oleosa* F. Muell. and *E. leptophylla* F. Muell. [= *E. uncinata* Turcz.](Myrtaceae)(Tepper, 1887; Hawkeswood, 2002).

Adult host-plant: Not recorded.

Biology: Tepper (1887) briefly noted that this species [as *Stigmodera*] bred in the wood of three *Eucalyptus* species occurring in South Australia and that adults were rare and occurred during October to December.

Life-stages: The egg, larva and pupa have not been described.

Published collection records with biological data: None available.

Further comments: Bellamy (2003) overlooked the larval host records of Tepper (1887).

Temognatha similis (Saunders, 1868)

Distribution: Australia (Queensland, New South Wales).

Larval host-plant: *Casuarina* sp. (Casuarinaceae)(Hawkeswood & Peterson, 1982).

Adult host-plant: Not recorded.

Biology: Hawkeswood & Peterson (1982) have recorded the only published data on larval biology for this species [as *Stigmodera*] (see details below).

Life-stages: the egg, larva and pupa have not been described.

Published collection records with biological data: Larval host-plant record: Gladstone, Queensland (23°50'S, 151°16'E), date not cited, H.W. Brown, breeding in *Casuarina* sp. (Casuarinaceae) (Hawkeswood & Peterson, 1982).

Temognatha suturalis (Donovan, 1805)

Distribution: Australia (New South Wales, Victoria, South Australia).

Larval host-plants: *Casuarina littoralis* Salisb. (Casuarinaceae)(?) (Illidge, 1908); *Casuarina stricta* Dryander and *Casuarina* spp. (Casuarinaceae)(French, 1909); *Casuarina torulosa* Ait. (Casuarinaceae)(Hawkeswood & Peterson, 1982).

Adult host-plant: Not recorded.

Biology: Illidge (1908) briefly noted that the larvae of *Stigmodera lessoni* (?) [probably *Temognatha suturalis* (Donovan)] were common in the trees of *Casuarina littoralis* Salisb. [as *Casuarina suberosa*] in the Wellington Point area, south-eastern Queensland, but unfortunately did not provide further details which could have been of interest. [Searches by the author in this area since 1983 have failed to locate this species there]. French (1909) recorded this species [incorrectly under the name of *Stigmodera vertebralis* Donovan] as destructive to *Casuarina* species (Casuarinaceae) in Victoria and New South Wales and he also believed that some *Eucalyptus* species (Myrtaceae) were also hosts because he had collected dead specimens on the ground below the trees [this latter suggestion has not been confirmed in later times]. French (1909, plate 75) illustrated a larva of *T. suturalis* [as *Stigmodera*] in a main branch of "*Casuarina quadrivalvis* Fiveash ex Brown" and also an unidentified braconid wasp parasite of the beetle. According to Willis (1972), the name *C. quadrivalvis* is invalid, but refers to *C. stricta* Dryander [the drooping she-oak, a species with a sporadic distribution in southern Victoria, Tasmania, eastern New South Wales and southern South Australia (Willis, 1972); see also Hawkeswood (1988)]. Hawkeswood & Peterson (1982) recorded a further larval host (see details below) [as *Stigmodera* (*Temognatha*) *suturalis*].

Life-stages: The egg, larva and pupa have not been described. The larva has been illustrated by

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French (1909).

Published collection records with biological data: Larval host-plant record: Lisarow, near Gosford, New South Wales, 12 Jan. 1965, K.M. Moore, larvae collected from *Casuarina torulosa* Ait. (Casuarinaceae)(Hawkeswood & Peterson, 1982).

Further comments: Bellamy (2003) overlooked the larval host record of Illidge (1908).

Discussion

There are approximately 80 species of *Temognatha* so far described, therefore those with known larval host plant records represent of this total only 17.5%. This is a marked indication of the lack of knowledge recorded on their basic biologies. However, the host plant data presented above indicate that *Temognatha* species display preferences for developing in the trees of *Eucalyptus* (Myrtaceae) and *Casuarina* (Casuarinaceae), two plant groups which are well developed across Australia. Many of the larval host plant records however, require verification and there remain no detailed scientific larval descriptions of any *Temognatha* species. The difficulty of finding larvae in the field associated with host plants appears to be one of the inhibiting factors while so little is known about the biology of Australian Buprestidae. Further discussion of larval hosts and co-evolutionary relationships of *Temognatha* will be provided elsewhere by the author.

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