

A NEW GALL MIDGE SPECIES (DIPTERA: CECIDOMYIIDAE) INFESTING FRUIT OF PUNTY BUSH, *SENNA ARTEMISIOIDES* (CAESALPINIACEAE) IN AUSTRALIA

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Summary

KOLESIK, P. & CUNNINGHAM, S. A. (2000) A new gall midge species (Diptera: Cecidomyiidae) infesting fruit of punty bush, *Senna artemisioides* (Caesalpinaceae) in Australia. *Trans. R. Soc. S. Aust.* 124 (2): 121–126. 30 November, 2000.

A new species of gall midge, *Contarinia sennicola* Kolesik, is described from fruits of the punty bush, *Senna artemisioides* (DC.) Randell in south-eastern Australia. Yellow larvae of *Contarinia sennicola* live within fruit capsules of *Senna artemisioides* and prevent seed formation without causing superficial deformation. In 11 localities in New South Wales, all plants examined were infested by the new species, with the level of damaged fruits being between 10 and 90%. Despite the high frequency of infestation damage caused by the new species, it did not appear to limit substantially reproduction of the host plant, as indicated by the overall large seed production.

KEY WORDS: Gall midge, Cecidomyiidae, *Contarinia sennicola*, *Senna artemisioides*, punty bush, Australia.

Introduction

A new species of gall midge, *Contarinia sennicola* Kolesik, is described from fruits of the punty bush, *Senna artemisioides* (DC.) Randell in south-eastern Australia. The new gall midge species was found independently by SAC during a study of the effect of habitat fragmentation on reproduction by plants in central New South Wales during 1997 and 1998 and by PK in 1998 during a South Australian Museum ecological survey in the Scotia Sanctuary, New South Wales. The host plant, *Senna artemisioides* (DC.) Randell (Caesalpinaceae), commonly known as the punty bush, is an endemic species widespread through the inland of mainland Australia (Harden 1990). It is a variable species, with 10 subspecies and nothosubspecies recognised (Harden 1990), including what was earlier considered to be *Cassia eremophila*. *Senna artemisioides* is invasive in grazed land in Western New South Wales (Cunningham *et al.* 1981) and commonly occurs in disturbed areas such as roadsides.

Materials and Methods

Branches of *Senna artemisioides* bearing fruits infested with larvae of the new species were collected in the Scotia Sanctuary, New South Wales

in November 1998. Branches were brought to the laboratory and the fruits processed in one of two ways. A small number was dissected and the larvae preserved in 70% ethanol. A larger number was cut open and the larvae transferred with entomological forceps into rearing pots containing wet sand into which they dug themselves. Pupation took place in the sand. Emerged adults together with pupal skins were preserved in 70% ethanol. Canada balsam mounts of type specimens were prepared according to the technique outlined by Kolesik (1995a). The types are deposited in the South Australian Museum, Adelaide (SAMA) and the Australian National Insect Collection, Canberra (ANIC). Dried samples of infested plants are deposited in the State Herbarium of South Australia, Adelaide (AD). Measurements refer to the holotype and paratypes.

To determine the distribution of *Contarinia sennicola* 20 fruits were collected from two plants at each of 11 sites (i.e. 440 fruits) in December 1997 and 1998. Sites ranged from a large reserve (i.e. Nombinnie Nature Reserve >140,000 ha) to narrow roadside strips of vegetation in central New South Wales (Table 1). All fruits were opened and inspected for the presence of *Contarinia sennicola* larvae. Because it is possible to overlook larvae if they are present in small numbers or when they are young and thus very small, the frequency of occurrence recorded here is likely to be a conservative estimate.

Genus *Contarinia* Rondani, 1860

Contarinia Rondani, 1860: 289

Type species: *Tipula loti* De Geer, 1776 by original designation

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TABLE 1. *Infestation of Senna artemisioides* fruits by larvae of *Contarinia sennicola*.

Year	Site	Latitude	Longitude	% fruits with larvae (plant 1, 2)
1998	Stackpoole SF	33° 50.6'	145° 50.6'	95, 82
1998	Roadside near Stackpoole SF	33° 48.1'	145° 51.2'	55, 35
1997	Roadside near Denny SF	34° 01.3'	145° 51.2'	45, 45
1998	Pulletop NR	33° 58.1'	146° 04.9'	45, 80
1997	Roadside near Pulletop NR	33° 56.2'	146° 07.3'	10, 50
1997	Nombinnie NR	33° 02.0'	146° 06.6'	65, 65
1997	Conapaira SF	33° 51.1'	146° 23.4'	75, 45
1997	Roadside near Conapaira SF	33° 51.8'	146° 23.8'	55, 20
1997	Roadside near Taleeban	33° 53.3'	146° 28.0'	20, 25
1997	Gubbatta NR	33° 38.3'	146° 33.0'	35, 44
1997	Roadside near Gubbatta NR	33° 38.3'	146° 31.5'	35, 30

SF = State Forest; NR = Nature Reserve.

Contarinia is a large, worldwide genus used as a catch-all category for the tribe Cecidomyiini. It includes species with long, tapered ovipositors, bifilar male flagellomeres and terminal larval papillae consisting of two pairs of setose and one of aetose, stublike papillae. So far 12 species of this genus have been found that are native to Australia, with 11 of them forming a natural group feeding on inflorescences and seed-heads of grasses (Harris 1979). The new gall midge together with *Contarinia bursariae* from fruits of *Bursaria spinosa* (Pittosporaceae) (Kolesik 1995b), are the only non-grass feeding species of this genus known from Australia.

Contarinia sennicola Kolesik sp. nov.
(FIGS 1-9)

Holotype: ♂, Scotia Sanctuary, New South Wales, Australia (30°11' S, 141°11' E), 11.xii.1998, P. Kolesik, reared from fruits of *Senna artemisioides* (DC.) Randell, larvae collected 21.xi.1998, (SAMA, 121480).

Paratypes: 2 ♂♂, 3 ♀♀, 3 pupal skins (SAMA, 121481-121488), 2 ♂♂, 2 ♀♀, 2 pupal skins (ANIC), same data but emerged 13.xii.1998 - 17.ii.1999; 3 larvae, (SAMA, 121489-121491), 2 larvae (ANIC), collected with holotype.

Other material: galls, collected with holotype, AD107823, AD107824 (AD).

Male (Figs 1-4)

Colour: Head yellow with eyes dark brown, antennae brown, thorax brown, abdomen with sclerotised parts grey and non-sclerotised parts yellow.

Head: Postvertical peak present. Antenna: scape and pedicel as broad as long; flagellomeres 12 in number, first and second fused; circumfilar loops

reaching midlength of next node. Palpus four-segmented. Eye facets rounded, close together, eye bridge 8 - 10 facets long. Labella large, triangular in frontal view, pointed apically, each with 7 - 9 lateral setae. Frons with 4 - 6 setae per side.

Thorax: Wing length 1.2 mm (1.0 - 1.3, $n = 5$), width 0.5 mm (0.4 - 0.5); vein C broken at juncture with R_5 , R_5 barely visible, in form of pigmented area, M_{1+2} not visible; C, R_5 , Cu pigmented. Claws simple, curved at midlength, empodium as long as claws.

Abdomen: Sclerites with a pair of anterior trichoid sensilla and setae more or less evenly distributed. Genitalia: gonocoxites cylindrical, setose, setulose; gonostylus about same width entire length, sparsely, evenly setose, with small setulose area at base, distally with strong tooth; cerci rectangular, slightly broadened distally, separated by shallow, wide incision, setose distally, setulose; hypoproct fleshy, bilobed, lobes round, each with few setae apically, setulose; aedeagus tapered distally, shorter than cerci.

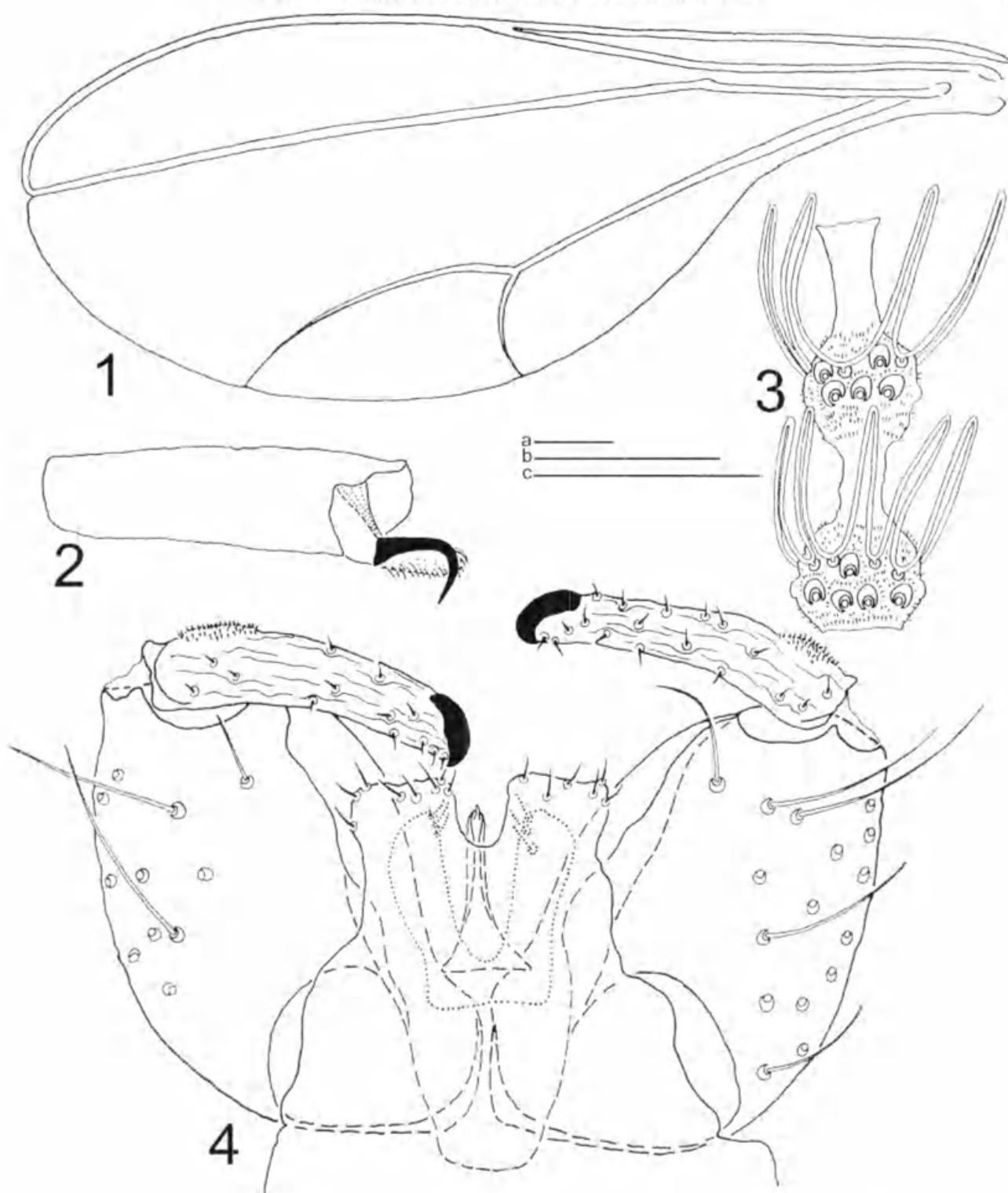
Female (Figs 7, 8)

Head: Flagellomeres with necks about $1/3$ length nodes. Circumfilar appressed, consisting of two transverse rings connected by two longitudinal bands.

Thorax: Wing length 1.5 mm (1.4 - 1.6, $n = 5$), width 0.6 mm (0.5 - 0.6). Colour and other characters as in male.

Pupa (Fig. 9)

Colour: antennal horns, prothoracic spiracles, dorsal spines light brown, remaining parts unpigmented. Length 1.8 mm (1.5 - 2.2, $n = 5$). Antennal horns small, angular, sclerotised. Cephalic papillae with long, robust setae. Two pairs of lower facial papillae, one of each setose and one aetose. A

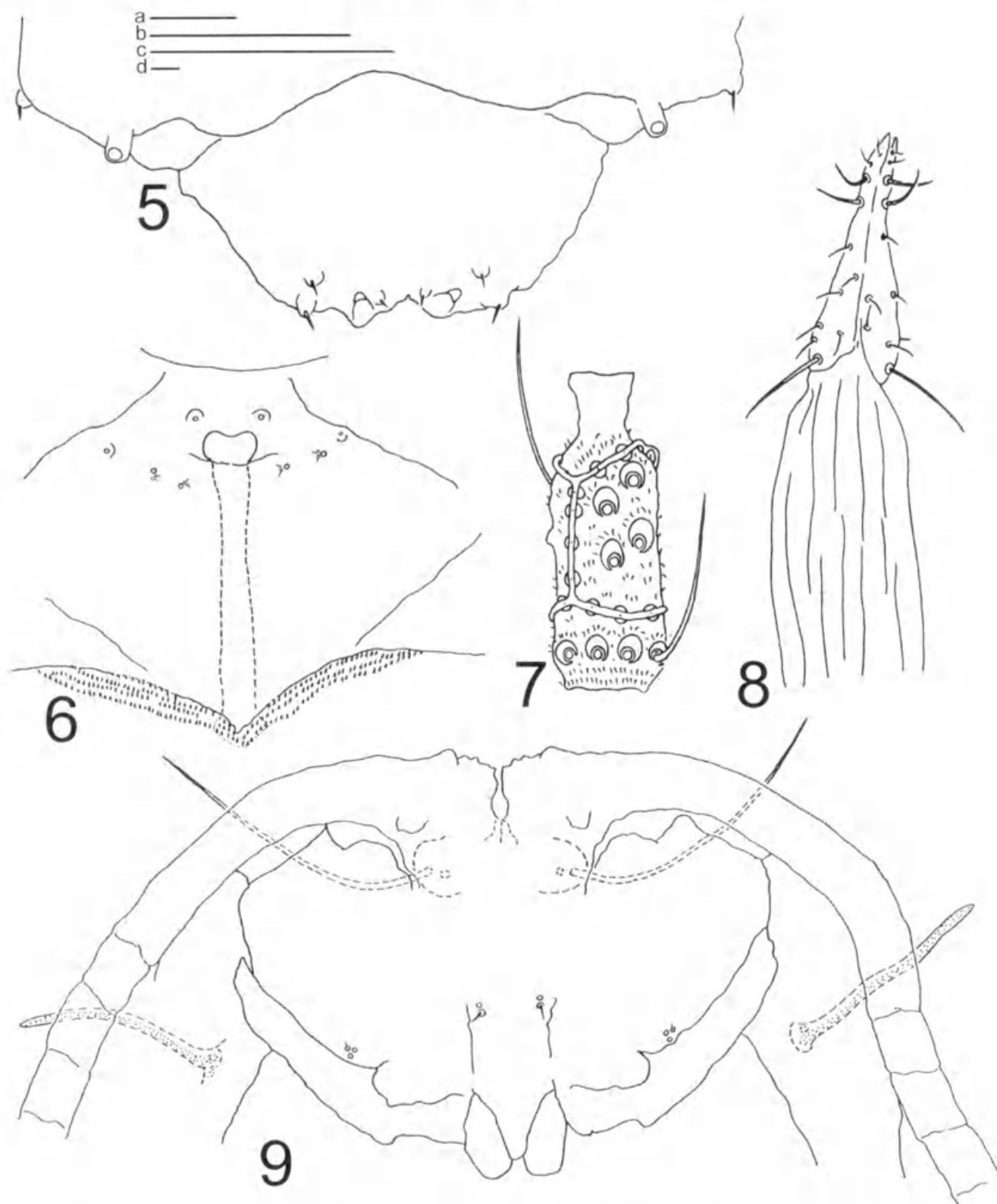


Figs 1-4. Male of *Contarinia semicola*. 1. Wing. 2. Last tarsomere with claw and empodium. 3. Sixth flagellomere. 4. Genitalia in dorsal view. Scale bars = 50 μ m (Fig. 1 = a, Figs 2, 4 = b, Fig. 3 = c).

pair of triplets of lateral facial papillae, one of each triplet with minute seta, two asetose. Prothoracic spiracle long, narrow, trachea ending at its apex. Integument of abdominal segments covered with spiculae, slightly larger and denser dorsally. Second to eighth abdominal segments with sclerotised, simple dorsal spines.

Last instar larva (Figs 5, 6)

Colour: yellow. Length 2.2 mm (2.0 - 2.4, $n = 5$). Integument smooth except several ventral transverse rows of spiculae on anterior half of abdominal and second and third thoracic segments. Head with postero-lateral apodemes as long as head length. Spatula with long shaft, narrow apical enlargement



Figs 5-9. *Contarinia sennicola*. 5, 6 larva, 7, 8, female, 9 pupa. 5. Terminal segment in dorsal view. 6. Sternal spatula with adjacent papillae. 7. Sixth flagellomere. 8. End of ovipositor with cerci. 9. Anterior part in ventral view. Scale bars = 50 μ m (Figs 5, 6 = a, Fig. 7 = b, Fig. 8 = c, Fig. 9 = d).

with small, rounded lobes divided by shallow incision. Basic papillae typical for supertribe (Gagné 1989), terminal papillae: one pair stublike, three pairs with thick setae. Anus ventral.

Etymology

The specific name is a combination of "Senna", the generic name of the host plant and "cola", Latin for dweller/inhabitant.

Fruit damage, biology and geographical distribution

Larvae of the new species live inside fruit capsules of *Senna artemisioides* without causing any apparent deformation of the capsule but reducing the number of seeds that develop. In transmitted light, 5–50 larvae can be recognised feeding inside the capsule. Late instar larvae create single or multiple openings in the capsules and leave the fruits by jumping up several centimetres. Pupation takes place within the soil. The biology and infestation symptoms of the new species are very similar to those of its Australian congener *Contarinia bursariae*, a species that infests fruit capsules of *Bursaria spinosa* Cav. (Pittosporaceae) (Kolesik 1995b). The incidence of *Contarinia sennicola* larvae in fruits examined was very high. All of the 22 plants sampled, in sites separated by as much as 100 km, had larvae in one or more fruits (Table 1).

Remarks

Contarinia sennicola differs morphologically from the other known Australian, non-grass feeding, congener, *C. bursariae* in several characters. In *C. sennicola*, the male cerci are broadened distally, the female cerci have one long proximal sensory seta each and the larval spatula has rounded apical lobes and a narrow, equally wide shaft. In *C. bursariae*, the male cerci are not broadened distally, the female cerci have two short proximal setae each and the larval spatula has angular apical lobes and a distally widened shaft.

The frequency of aborted and damaged seeds in fruits of *S. artemisioides* occupied by *C. sennicola* larvae suggests that the larvae might be responsible for reducing seed production in this leguminous plant. In some plant species, especially in legumes, predispersal seed predation by insects is an important factor in low seed production (Auld 1983, 1986; Cunningham 1997, 2000b). Cunningham (2000a) found high levels of predispersal insect seed predation in *S. artemisioides* during a study of plant reproduction in habitat fragments in the areas considered in the present paper. *Contarinia sennicola* was found at sites with relatively few fruiting shrubs as well as at those with abundant fruit production. Larvae were found in fruits with few seeds as well as in those with many undamaged seeds. The pervasive presence of *Contarinia sennicola*, in spite of this heterogeneous fruiting pattern, might indicate that it causes widespread seed loss, but is not a key determinant of variation in seed production by *S. artemisioides*. *Contarinia sennicola* may nevertheless play a role as one of the factors in the population dynamics of the plant.

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References

- ALD, T. D. (1983) Seed predation in native legumes of south-eastern Australia. *Aust. J. Ecol.* **8**, 367–376.
- (1986) Variation in predispersal seed predation in several Australian *Acacia* spp. *Oikos* **47**, 319–326.
- CUNNINGHAM, G. M., MULLHAM, W. E., MUTHORPE, P. L. & LEIGH, J. H. (1984) "Plants of Western New South Wales" (NSW Govt Printing Office, Sydney).
- CUNNINGHAM, S. A. (1997) Predator control of seed production by a rain forest understorey palm. *Oikos* **79**, 282–290.
- (2000a) Effects of habitat fragmentation on the reproductive ecology of four plant species in mallee woodland. *Conserv. Biol.* **14**, 758–768.
- (2000b) What determines the number of seed produced in a flowering event? A case study of *Culstrogynne ghiesbreghtiana* (Arecaceae). *Aust. J. Bot.* **48**, 659–665.
- DE GEER, C. (1776) "Mémoires pour servir à l'histoire des insectes" (Pierre Hesselberg, Stockholm).
- GAGNÉ, R. J. (1989) "The Plant-Feeding Gall Midges of North America" (Cornell University Press, Ithaca, New York).
- (1994) "The Gall Midges of the Neotropical Region" (Cornell University Press, Ithaca, New York).
- HARDEN, G. J. (1990) "Flora of New South Wales." (NSW University Press, Kensington).
- HARRIS, K. M. (1979) Descriptions and host ranges of the sorghum midge, *Contarinia sorghicola* (Coquillett) (Diptera: Cecidomyiidae), and of eleven new species of *Contarinia* reared from Gramineae and Cyperaceae in Australia. *Bull. ent. Res.* **69**, 161–182.

- KOLESIK, P. (1995a) A new species of *Eocincticornia* Felt (Diptera: Cecidomyiidae) on *Eucalyptus fasciculosa* in South Australia. *J. Aust. ent. Soc.* **34**, 147-152.
- _____ (1995b) *Contarinia bursariae*, a new species of Cecidomyiidae (Diptera) infesting fruits of sweet bursaria, *Bursaria spinosa* (Pittosporaceae) in Australia. *Trans. R. Soc. S. Aust.* **119**, 177-181.
- RONDANI, C. (1860) *Stirpis cecidomynarum*. Genera revisa. Nota undecima, pro dipterologia italica. *Atti della Societa italiana di Scienze naturali*. (1859-1860) **2**, 286-294.



2000. "A new gall midge species (Diptera: Cecidomyiidae) infesting fruit of punty bush, *Senna artemisioides* (Caesalpinaceae) in Australia." *Transactions of the Royal Society of South Australia, Incorporated* 124, 121–126.

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