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Description of the Australian Plant Bug Genus *Jiwarli*, n. gen. (Heteroptera: Miridae: Phylinae)

DIANE SOTO[1] AND CHRISTIANE WEIRAUCH[1]

ABSTRACT

A new genus and four new species of Phylini Carvalho, 1958, from Australia are described. *Jiwarli*, new genus, differs from other Phylini by the relatively large size and elongate ovoid shape, distinct coloration, and male genital characters. The four new species show a broad distribution in Australia and mostly occur on widespread plants. *Jiwarli exmaculae*, n. sp., was collected on the Asteraceae *Chrysocephalum apiculatum*, *Jiwarli heliotropium*, n. sp., on the Boraginaceae *Heliotropium ammophilum*, *Jiwarli ptilotus*, n. sp., on the Amaranthaceae *Ptilotus obovatus*, and *Jiwarli solanum*, n. sp., on the Solanaceae *Solanum ellipticum*, *S. orbiculatum*, and *S. lasiophyllum*.

INTRODUCTION

The fauna of Australian plant bugs (Miridae) is poorly known and host associations are often obscure. Only nine species in the tribe Phylini (Phylinae) were listed from Australia by Cassis and Gross (1995). Phylini are one of the most speciose groups of plant bugs in Mediterranean-type climates and are known to be relatively host specific. Given the extremely diverse endemic flora of Australia, the number of currently described Phylini is expected to be a drastic underestimate of the true diversity of this group in Australia. Since Cassis and Gross (1995), thousands of specimens of Miridae have been collected with their hosts through extensive fieldwork conducted by G. Cassis, R. T. Schuh, and other members of the Planetary Biodiversity Inventory (PBI) on plant bugs. Sorting in progress of this material confirms that hundreds of species of Phylini still await description (Weirauch, personal obs.). Even though some of the newly discovered taxa of Miridae have recently been described (Cassis and Moulds, 2002; Schwartz and Cassis, 2003; Wall, 2007; Weirauch, 2006, 2007), most groups of Phylini await revisionary work. The current contribution, describing a new genus and four new species of Phylini aims to be a small step toward a better understanding of the true diversity of plant bugs, their host-plant associations, and distribution in Australia.

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MATERIAL AND METHODS

Habitus photographs (Microptics system) and illustrations of the male genitalia (Nikon Eclipse 80i, with camera lucida) are provided for all taxa. Drawings of female genitalia, including a dorsal view of the bursa copulatrix and associated structures, are provided for the type species. Scanning electron micrographs (SEMs) are given for the type species. Uncoated specimens were observed and documented in a Hitachi TM-1000 Tabletop Scanning Electron Microscope (Center for Plant Cell Biology at UC Riverside).

The right paramere is drawn in dorsolateral view, the left paramere in anterolateral view and the lateral right side of the phallotheca is shown. The vesica is seen in lateral view from the left side (A) and the apical spine is shown from the right (B). Black and grey arrows in the figures refer to diagnostic characters on the species level and generic level, respectively. Measurements of males and females are provided in table 1.

About 257 specimens were examined for this project. The specimens were given matrix labels, which uniquely identify each specimen (''unique specimen identifiers'' or ''USIs''). The USI numbers comprise an institution and project prefix (AMNH_PBI) and a unique number (e.g. 00094810). The prefix AMNH_PBI is omitted in almost all cases.

Specimens were borrowed from and are deposited in the following institutions. Abbreviations for institutions follow the suggestions by Arnett et al. (1993). The institutional abbreviations listed are used throughout this paper:

AM	Australian Museum, Sydney; Dave Britton
AMNH	American Museum of Natural History, New York; Randall T. Schuh
BMNH	Natural History Museum, London; Mick Webb
CNC	Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Ottawa; Michael D. Schwartz
SAMA	South Australian Museum, Adelaide; Jan Forrest
USNM	[United States] National Museum of Natural History, Smithsonian Institution, Washington, DC; Thomas J. Henry
WAMP	Western Australian Museum, Perth; Terry Houston
ZISP	Russian Academy of Sciences, Zoological Institute, St. Petersburg; Fedor Konstantinov

Host plants collected during the Schuh and Cassis field trips are deposited at the National Herbarium of New South Wales (Sydney) and the Western Australian Herbarium (Perth). Numbers provided in the material examined section are voucher numbers of these institutions.

The maps of host-plant distribution (fig. 4) are derived from the website of the Australia's Virtual Herbarium (AVH) (http://www.cpbr.gov.au/avh/) as seen in August 2007. The Discover Life homepage (http://www.discoverlife.org/) gives online maps of the bug species as well as images of plant bugs and host plants when available.

TAXONOMY

Jiwarli, new genus

Figures 1–4

TYPE SPECIES: *Jiwarli heliotropium*, new species.

DIAGNOSIS: Recognized among Phylini by the relatively large size, elongate ovoid body, pale greenish or brownish coloration with dark spots on the pronotum, spots sometimes arranged in distinct pattern, often with spots or lines on the hemelytron, limited sexual dimorphism, J-shaped vesica with hand-shaped or arm-shaped process proximal to secondary gonopore, and sometimes with distal flaplike process distal to secondary gonopore that is beset with small spicules. Superficially similar to some species of *Opuna* Kirkaldy that have Pacific and Southeast Asian distributions, but distinguished by the setiform parempodia in the new genus as well as the distinctive process on the vesica.

DESCRIPTION: *Male*: Relatively large elongate ovate. **COLORATION** (fig. 1): General coloration pale green, pale brownish, brown suffused with some yellow or whitish with some pale green, appendages pale brown or pale tan with dark brown spots. ***Head***: Vertex pale or dark green, brown or pale tan, usually with dark brown spots, clypeus usually pale

TABLE 1
Measurements

		Length						Width				
		Body	CunClyp	Head	Pron	Scut	Cun	Head	Pron	Scut	InterOc	AntSeg2
J. exmaculae												
M (N = 3)	**Mean**	**4.22**	**3.00**	**0.40**	**0.68**	**0.57**	**0.65**	**0.90**	**1.40**	**0.75**	**0.38**	**1.05**
	SD	0.45	0.17	0.05	0.03	0.06	0.05	0.00	0.05	0.09	0.03	0.05
	Range	0.80	0.30	0.10	0.05	0.10	0.10	0.00	0.10	0.15	0.05	1.10
	Min	3.70	2.80	0.35	0.65	0.50	0.60	0.90	1.35	0.70	0.35	1.00
	Max	4.50	3.10	0.45	0.70	0.60	0.70	0.90	1.45	0.85	0.40	1.10
J. heliotropium												
M (N = 5)	**Mean**	**3.94**	**2.88**	**0.33**	**0.59**	**0.51**	**0.65**	**0.88**	**1.33**	**0.70**	**0.43**	**1.12**
	SD	0.33	0.28	0.03	0.05	0.07	0.09	0.04	0.10	0.09	0.03	0.12
	Range	0.85	0.70	0.05	0.15	0.15	0.20	0.10	0.25	0.20	0.05	0.30
	Min	3.40	2.40	0.30	0.50	0.40	0.55	0.80	1.15	0.55	0.40	0.95
	Max	4.25	3.10	0.35	0.65	0.55	0.75	0.90	1.40	0.75	0.45	1.25
F (N = 5)	**Mean**	**4.19**	**2.96**	**0.36**	**0.65**	**0.51**	**0.69**	**0.89**	**1.42**	**0.72**	**0.45**	**1.20**
	SD	0.32	0.17	0.02	0.06	0.04	0.07	0.05	0.14	0.08	0.04	0.07
	Range	0.65	0.45	0.05	0.15	0.10	0.15	0.15	0.40	0.20	0.10	0.20
	Min	3.85	2.70	0.35	0.55	0.45	0.60	0.80	1.20	0.60	0.40	1.10
	Max	4.50	3.15	0.40	0.70	0.55	0.75	0.95	1.60	0.80	0.50	1.30
J. ptilotus												
M (N = 5)	**Mean**	**4.42**	**2.96**	**0.30**	**0.59**	**0.52**	**0.80**	**0.82**	**1.36**	**0.70**	**0.39**	**0.98**
	SD	0.43	0.19	0.04	0.02	0.03	0.06	0.03	0.07	0.04	0.04	0.18
	Range	1.20	0.50	0.10	0.05	0.05	0.15	0.05	0.15	0.10	0.10	0.45
	Min	3.80	2.75	0.25	0.55	0.50	0.75	0.80	1.30	0.65	0.35	0.75
	Max	5.00	3.25	0.35	0.60	0.55	0.90	0.85	1.45	0.75	0.45	1.20
F (N = 5)	**Mean**	**4.03**	**2.81**	**0.39**	**0.58**	**0.48**	**0.65**	**0.80**	**1.30**	**0.65**	**0.42**	**0.86**
	SD	0.39	0.21	0.04	0.04	0.04	0.10	0.05	0.12	0.09	0.03	0.21
	Range	0.95	0.55	0.10	0.10	0.10	0.25	0.10	0.30	0.20	0.05	0.50
	Min	3.75	2.60	0.35	0.55	0.45	0.55	0.75	1.20	0.60	0.40	0.60
	Max	4.70	3.15	0.45	0.65	0.55	0.80	0.85	1.50	0.80	0.45	1.10
J. solanum												
M (N = 5)	**Mean**	**3.97**	**2.94**	**0.31**	**0.66**	**0.41**	**0.66**	**0.93**	**1.38**	**0.65**	**0.45**	**1.12**
	SD	0.16	0.20	0.07	0.08	0.12	0.08	0.03	0.13	0.09	0.00	0.14
	Range	0.45	0.45	0.15	0.20	0.30	0.20	0.05	0.25	0.25	0.00	0.35
	Min	3.70	2.70	0.20	0.55	0.20	0.55	0.90	1.25	0.50	0.45	1.00
	Max	4.15	3.15	0.35	0.75	0.50	0.75	0.95	1.50	0.75	0.45	1.35
F (N = 5)	**Mean**	**4.34**	**3.19**	**0.38**	**0.72**	**0.52**	**0.70**	**0.98**	**1.49**	**0.76**	**0.52**	**1.16**
	SD	0.17	0.18	0.03	0.08	0.03	0.08	0.04	0.08	0.04	0.03	0.07
	Range	0.45	0.45	0.05	0.20	0.05	0.20	0.10	0.20	0.10	0.05	0.15
	Min	4.15	3.00	0.35	0.60	0.50	0.60	0.90	1.35	0.70	0.50	1.10
	Max	4.60	3.45	0.40	0.80	0.55	0.80	1.00	1.55	0.80	0.55	1.25

brown or brown with dark marks, mandibular and maxillary plates pale green, pale tan or pale brown; antennal segment 1 pale brown, pale tan, or pale green, segment 2 ranging from pale to darkish brown, segment 3 ranging from pale to dark brown, segment 4 dark brown or brown; labium with segment 1 pale green with anterior margin suffused with various shades of brown or greenish, segments 2 and 3 shades of brown, segment 4 dark brown. ***Thorax***: Pronotum olive green, pale green, or pale brown with variable patterns of black or dark spots, mesoscutum orange or yellow-orange, scutellum pale olive green or pale brown suffused with yellow-green or pale tan, sometimes with dark brown spots; pleura

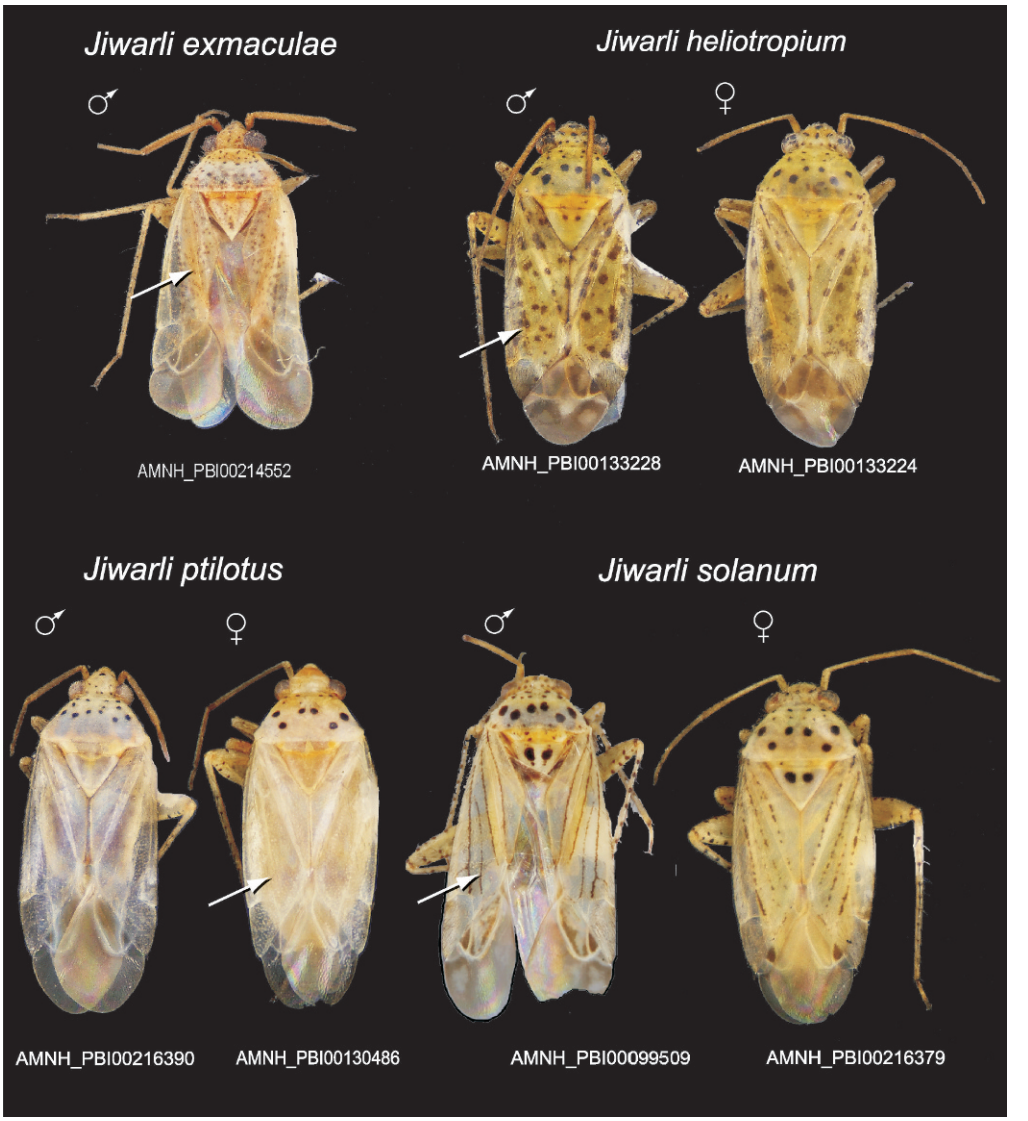

Fig. 1. Habitus photographs of the four species of *Jiwarli*, new genus.

pale olive green with yellow tinge, pale tan suffused with pale yellow-greene, or pale tan suffused with pale yellow. *Legs*: Femora pale green, pale brown or pale tan, variable numbers and sizes of dark brown spots on pro-, meso-, and metathoracic legs, tibia pale tan or tannish or pale brown with dark brown spines, tarsus brown or dark brown, claws dark brown. *Hemelytra*: Corium including clavus pale olive green, olive green, pale brown or tan, or whitish, covered with brown spots, brown vertically skewed lines or without spots or lines, cuneus transparent proximally or distally or both, sometimes with distal part pale brown or brown, membrane transparent or pale brown or tan with varying patterns. ***Abdomen***: Venter greenish, pale tan, sometimes suffused with yellow, pale tan, or pale brown. **SURFACE AND VESTITURE** (figs. 1, 2): Dorsum shining or weakly shining, few to many adpressed setae of moderate length (fig. 2), cuneus either densely covered

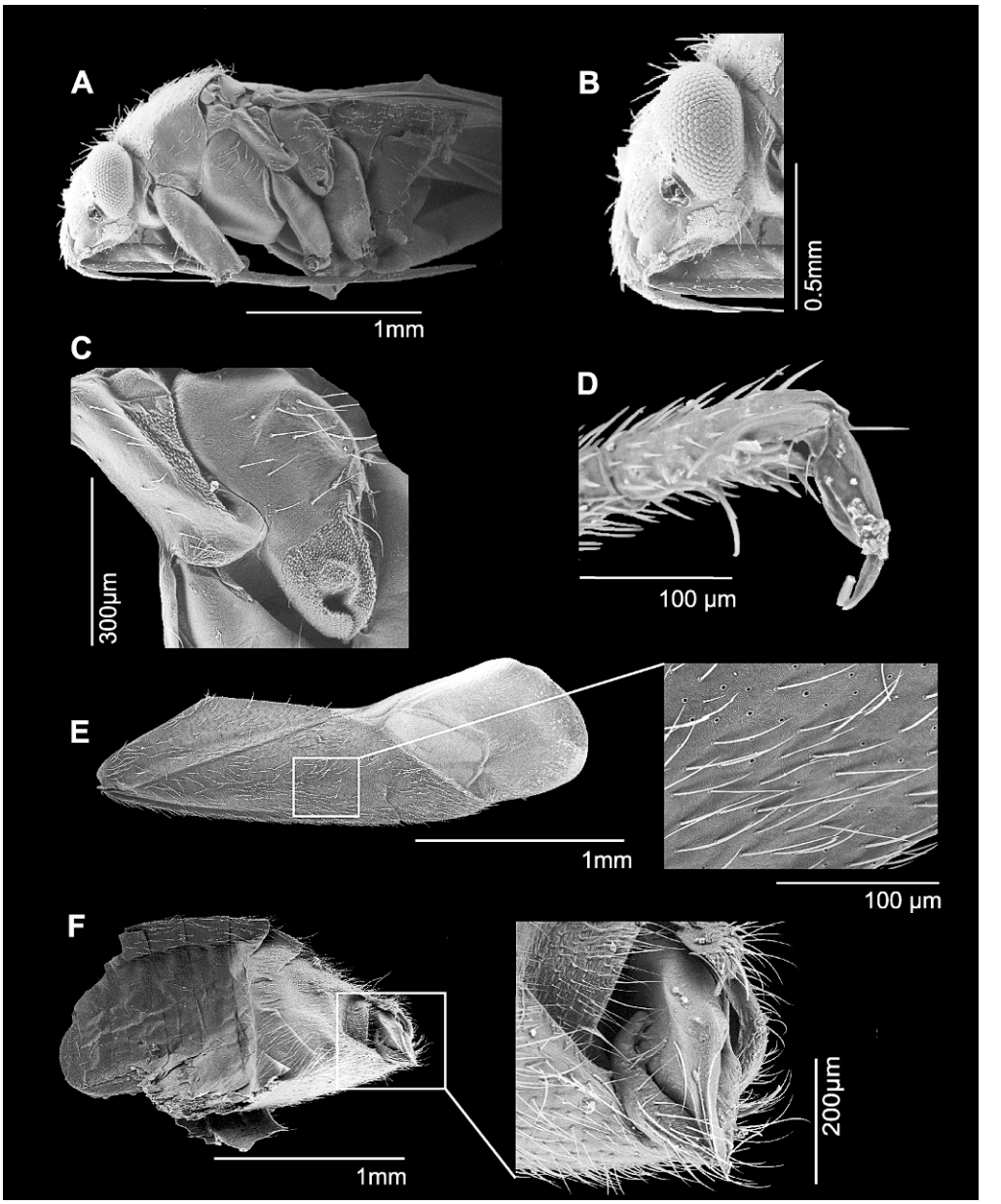

Fig. 2. Structures of *Jiwarli heliotropium*, n. sp., as seen in the scanning electron microscope. **A**. Head and thorax, lateral view. **B**. Head, lateral view. **C**. Metathorax with evaporatory area and peritreme, lateral view. **D**. Pretarsus. **E**. Hemelytron, inset: close-up of vestiture. **F**. Abdomen with pygophore in dorsal view; inset: close-up of pygophore, with phallotheca and left paramere.

with setae or covered with few or moderate number of setae. **STRUCTURE**: ***Head*** (figs. 1, 2A, B): Triangular in dorsal view with apex pointed, clypeus protruding anteriorly, mandibular and maxillary plates slightly convex, mandibular plate relatively small or large, buccula convex or slightly convex; eye moderately large or large, located adjacent to antennal socket, hind margin of eye adjacent to pronotum; antenna with segment 1 short,

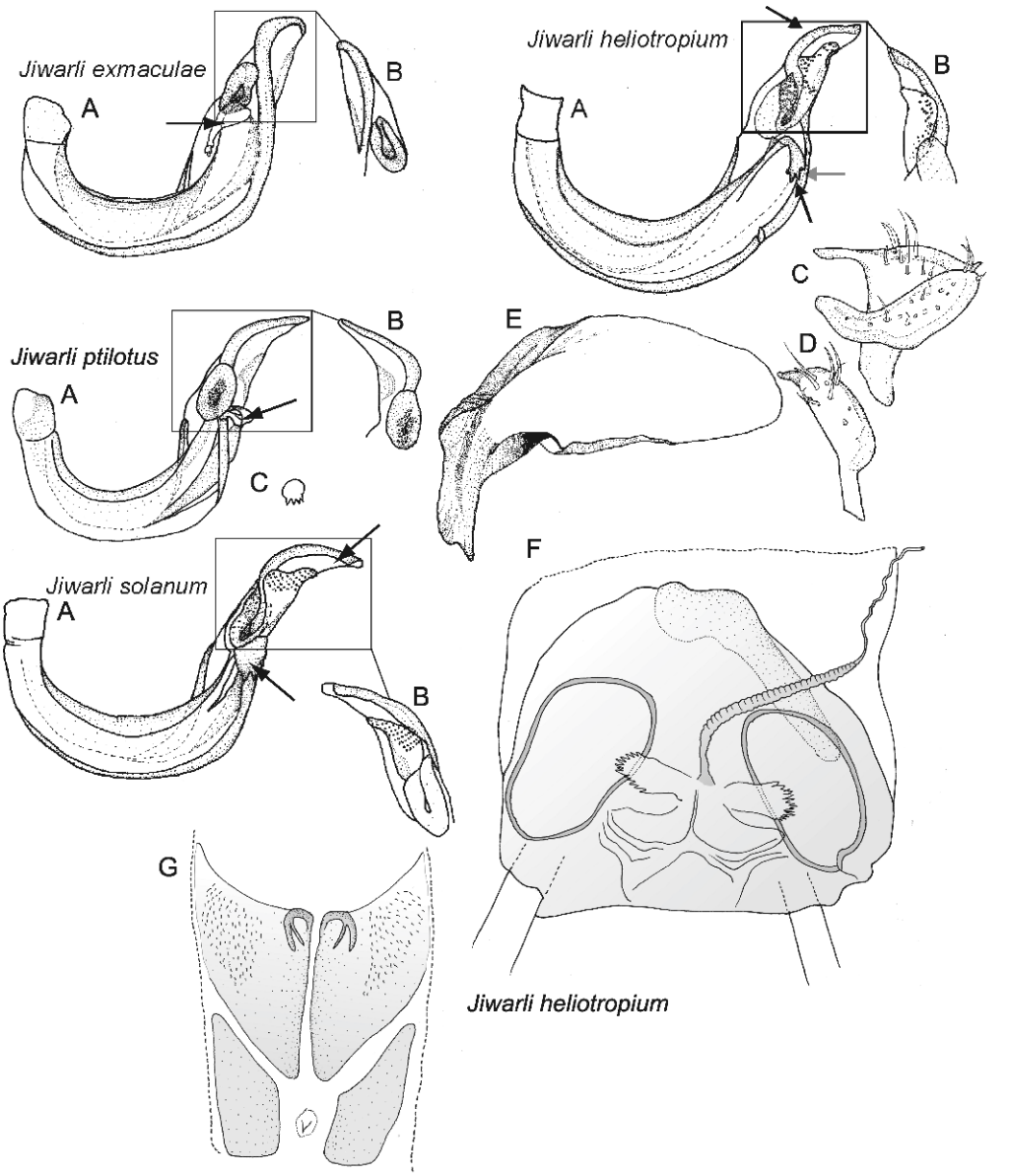

Fig. 3. Male genitalic structures of *Jiwarli* spp. (A–D) and female genitalic structures of *J. heliotropium* (F, G). **A**. Vesica seen from left. **B**. Apex of vesica seen from right. **C**. *J. pilotus*, process proximal to secondary gonopore. **C**. *J. heliotropium*, left paramere. **D**. *J. heliotropium*, right paramere. **E**. *J. heliotropium*, phallotheca. **F**. Bursa copulatrix and associated structures. **G**. Interramal sclerites with hook-shaped processes.

segment 2 long, smaller diameter than segment 1, segment 3 shorter than segment 2, segment 4 shortest; length of labium variable, apex ranging from base of abdomen to apex of pygophore, segments 2 through 4 slender or very slender. ***Thorax*** (figs. 1, 2C–E): Pronotum trapeziform, anterior margin slightly concave, lateral margins slightly convex, posterior margin slightly concave; margin of mesoscutum sloping towards scutellum,

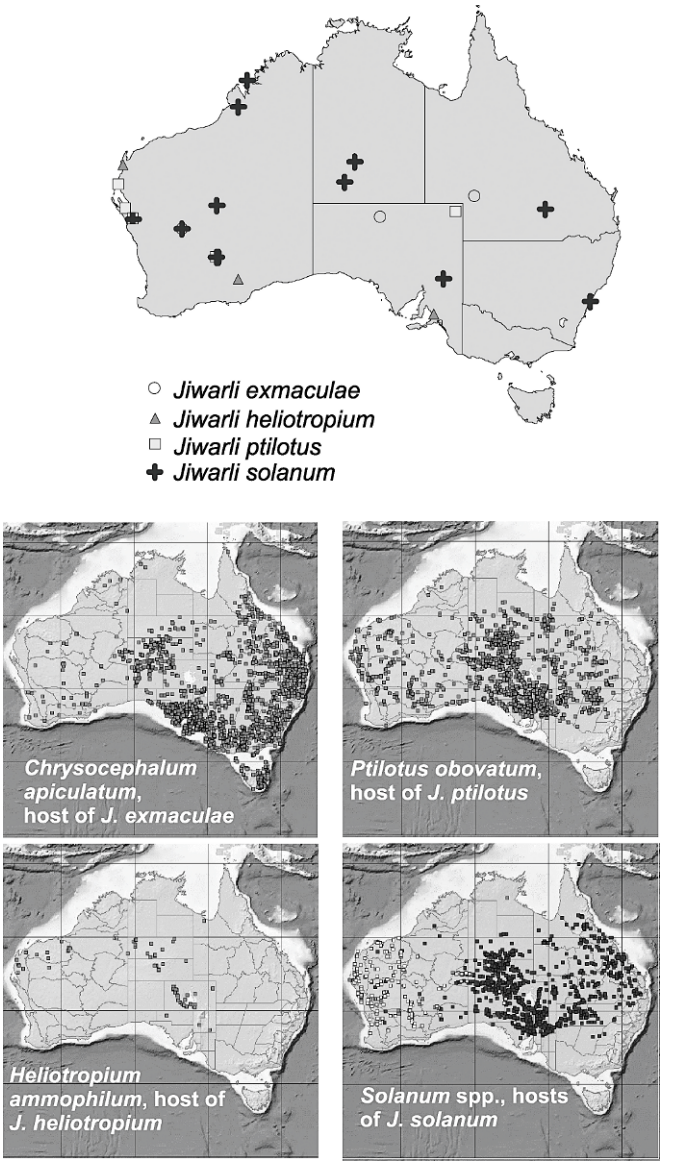

Fig. 4. Distribution maps of species of the plant bug genus *Jiwarli*, based on specimen records examined during this project, and host plants of the four species based on data from the Australia's Virtual Herbarium. The mapped species of *Solanum* are *Solanum ellipticum* (black), *S. lasiophyllum* (white), and *S. orbiculatum* (grey).

scutellum slightly convex from lateral view, adpressed setae on pronotum or adpressed setae on lateral sides of pronotum. *Legs*: Slender, hind legs long with bulky femur, claws slender (fig. 2D), pulvilli covering large area of claw, parempodia setiform. *Hemelytra* (figs. 1, 2E): Hemelytra only slightly convex, almost parallel to one another, cuneus elongate triangular, cuneus and membrane often tilted downward in dried specimens. ***Abdomen*:** Corpulent abdomen extending to cuneal base or cuneal apex, setae on abdomen adpressed, sometimes translucent. GENITALIA (figs. 2F, 3): ***Pygophore*:** Smooth, rounded, sometimes

large. ***Parameres*:** Right paramere relatively slender, almost parallel sided and elongate, apically with slender setae located closely to apex (fig. 3E); left paramere with anterior process relatively thick, posterior process of same length as anterior process, straight and slender (fig. 3C). ***Phallotheca*:** Relatively small, sclerotized anteriorly, posterior membranous, curved to the right (figs. 2F, 3D). ***Vesica:*** Slightly J-shaped, secondary gonopore located subapically, gonopore sclerite absent, heavily sclerotized process proximal to secondary gonopore, either long with about four heavily sclerotized spines, short and broad with about 3–4 spines or broad based with about five spines, some species with membranous, flaplike process distal to secondary gonopore beset with small spicules.

Female (fig. 1): As male, not distinctly more ovoid than male, but antenna more slender. GENITALIA (fig. 3F, G): Studied only for *J. heliotropium*; see description of that species.

ETYMOLOGY: Named for its distribution in Australia, after the name of a Western Australian Aboriginal language. The last native speaker of Jiwarli died in April 1986. The gender is masculine.

DISCUSSION: *Jiwarli* is distinguished from other Australian Phylini by the relatively large size, pale coloration with usually distinct pattern of black dots on the pronotum, and characters of the male genitalia, such as the J-shaped vesica with a hand-shaped process proximal to the secondary gonopore. These characters may prove to be synapomorphic for the genus.

The host-plant associations of species in this genus are puzzling: Each species seems to have a relatively restricted preference for a certain host-plant species or a limited group of species within a genus. However, the different species of *Jiwarli* feed on hosts in the Amaranthaceae, Asteraceae, Boraginaceae, and Solanacae families (table 2). A preference for any family of host plants across the genus is therefore apparently absent.

The distribution patterns of species of *Jiwarli* are currently based on a limited number of localities. Assuming that the species are relatively host specific and that they occur across the distribution range of their host plants, wide distributions may be

TABLE 2
Host plant species of the four species of *Jiwarli*

Jiwarli exmaculae	
Chrysocephalum apiculatum (Asteraceae): 1 specimen	AUSTRALIA, Queensland, 75.7 km W of Windorah
Jiwarli heliotropium	
Heliotropium ammophilum (Boraginaceae): 90 specimens	AUSTRALIA, Western Australia, 120 km E of Norseman
Heliotropium sp. (Boraginaceae): 9 specimens	AUSTRALIA, Western Australia, 27.6 km N of Coral Bay Rd on Cardabia-Ningaloo Rd
Jiwarli ptilotus	
Ptilotus obovatus (Amaranthaceae): 34 specimens	AUSTRALIA, South Australia, 18.8 km NW of Cordillo Downs Homestead AUSTRALIA, Western Australia, 24 km SE of jct of Manga Rd and Shark Bay Rd, Shark Bay World Heritage Area AUSTRALIA, Western Australia, 89.2 km N of jct of Agana Kilabarra Rd and Brand Hiway, on Brand Hiway AUSTRALIA, Western Australia, Blowholes Rd NW of North West Coastal Hiway, Beagle Hill Area
Eremophila scoparia (Myoporaceae): 1 specimen	AUSTRALIA, Western Australia, 53.9 km N of Kalgoorlie
Jiwarli solanum	
Ixiolaena leptolepis (Asteraceae): 2 specimens	AUSTRALIA, Western Australia, 53.9 km N of Kalgoorlie
Anthotroche walcottii (Solanaceae): 4 specimens	AUSTRALIA, Western Australia, NW Coastal Hiway 80.7 km N of Kalbarri Rd
Solanum cf. *nemophilum* (Solanaceae): 3 specimens	AUSTRALIA, Queensland, 8.2 km E of Mungallala
Solanum ellipticum (Solanaceae): 52 specimens	AUSTRALIA, South Australia, 72 km N of Yunta, Nillinghoo Creek
Solanum lasiophyllum (Solanaceae): 7 specimens	AUSTRALIA, Western Australia, 79 km W of Sandstone
Solanum orbiculatum orbiculatum (Solanaceae): 4 specimens	AUSTRALIA, Western Australia, 49.1 km N of Norseman
Solanum orbiculatum orbiculatum (Solanaceae): 2 specimens	AUSTRALIA, Northern Territory, 8.8 km N of Mt Wedge Stn jct on Tanami Rd

postulated for the four species of *Jiwarli* based on the broad distribution of their given host plant (fig. 4).

KEY TO THE SPECIES OF *JIWARLI* (Fig. 1)

1a. Hemelytron transparent, without spots or lines . . . . . *Jiwarli ptilotus*, n. sp.
1b. Hemelytron with spots or lines 2
2a. Hemelytron with brown vertical lines . . . . . *Jiwarli solanum*, n. sp.
2b. Hemelytron with brown spots 3
3a. Hemelytron with big brown spots . . . . . *Jiwarli heliotropium*, n. sp.
3b. Hemelytron with small brown spots . . . . . *Jiwarli exmaculae*, n. sp.

Jiwarli exmaculae, new species

Figures 1, 3, 4

HOLOTYPE: **AUSTRALIA: Western Australia:** 79 km W of Sandstone, 28.03737°S 118.4983°E, 650 m, 26 Oct 1996, Schuh and Cassis, Light Trap, 1♂ (00214552) (WAMP).

DIAGNOSIS: Recognized by the numerous, small brown spots on pronotum and hemelytra (fig. 1), large eyes, short labium with apex extending only to the base of the abdomen, absence of the distal, flaplike process on the vesica and the elongate, hand-shaped proximal process with a broad base.

DESCRIPTION: *Male*: Macropterous; total length 3.70–4.50, length from apex of clypeus to cuneal fracture 2.80–3.10, width across pronotum 1.35–1.45. **COLORATION** (fig. 1): General coloration pale green to pale or darker brownish suffused with some yellow, appendages pale tan. ***Head*:** Vertex brown with dark brown spots, clypeus pale brown to brown with brown spots and pale shade of red, mandibular and maxillary plates pale green to pale brown; antennal segment 1 pale brown with basal and subapical rings darker and some brown spots, segments 2 and 3 brown; labial segment 1 pale brown, segments 2 and 3 brown. ***Thorax*:** Pale green suffused with some yellow and red-orange, indistinct pattern of brown spots, scutellum pale tan covered with small brown spots, mesoscutum yellow-orange; pleura pale tan suffused with pale yellow. *Legs*: Pale tan to pale brown, with few brown spots, tibia pale tan, tarsus brown to dark brown. *Hemelytra*: Corium including clavus pale tan, membrane transparent with pale brown patches and with apex of membrane pale tan to pale brown. ***Abdomen*:** Pale tan with some yellowish and pale brown. **SURFACE AND VESTITURE**: Dorsum shining, few adpressed setae of moderate length, cuneus covered with very pale brown setae. **STRUCTURE**: ***Head*:** Mandibular plate relatively small, buccula slightly convex; eyes large; labium short, apex of labium extending to base of abdomen, segments 2 through 4 very slender. ***Thorax*:** With adpressed setae on lateral sides of pronotum. ***Abdomen*:** Corpulent abdomen extending to cuneal apex, translucent adpressed setae present on abdomen. GENITALIA: ***Vesica*:** Distal flaplike process absent, secondary gonopore located subapically, proximal process long and slender, with broad base and five spines.

FEMALE: Unknown.

ETYMOLOGY: Named for the many relatively small-sized spots (maculae) on pronotum and hemelytra.

HOST (table 2): One of the three known specimens was recorded from *Chrysocephalum apiculatum* (Labill.) Steetz (Asteraceae), the second specimen does not bear host information, and the third specimen was taken at a light trap.

DISTRIBUTION (fig. 4): Known from three widely separated localities in Queensland, South Australia, and Western Australia. Given the wide distribution of its host plant, *C. apiculatum*, this species may be very widespread in Australia.

PARATYPES: **AUSTRALIA: Queensland:** 75.7 km W of Windorah, 25.37703°S 141.9457°E, 250 m, 03 Nov 1998, Schuh, Cassis, Silveira, *Chrysocephalum apiculatum* (Labill.) Steetz. (Asteraceae), det. Royal Bot Gard. NSW 427518, 1♂ (00214551) (AMNH). **South Australia:** 45 km NE of Welbourn Hill, 27.05°S 134.36666°E, 20 Sep 1978, J. A. Cardale, 1♂ (00214550) (AM).

Jiwarli heliotropium, new species

Figures 1–4

HOLOTYPE: **AUSTRALIA: Western Australia:** 120 km E of Norseman, 32.0619°S 123.0117°E, 600 m, 23 Oct 1996, Schuh and Cassis, *Heliotr-*

opium ammophilum Craven (Boraginaceae), det. 05100038, 1♂ (00133228) (WAMP).

DIAGNOSIS: Recognized by the large brown spots on the hemelytron (fig. 1), the apex of the labium extending to middle of pygophore, the proximal process on the vesica long with about four to five spines, the short apical spine of the vesica, and the large pygophore. Most similar to *Jiwarli solanum*, n. sp., based on the pattern of bold spots on the pronotum, similar overall coloration, and shape of the vesica, but distinguished by the brown spots on the hemelytra, different shape of the proximal process on the vesica and length of the apical spine of the vesica.

DESCRIPTION: *Male*: Macropterous; total length 3.40–4.25, length from apex of clypeus to cuneal fracture 2.40–3.10, width across pronotum 1.15–1.40. **COLORATION** (fig. 1): General coloration pale green, appendages pale brown. ***Head*:** Vertex pale to dark green with outline of pale shades of brown and dark brown spots, clypeus pale brown with bold dark brown to black stripe, mandibular and maxillary plates pale green suffused with yellow; antennal segment 1 pale brown with basal and subapical rings darker, segment 2 pale brown to darkish brown with indistinct subapical darker ring, segment 3 and 4 dark brown; labium with segment 1 pale green with anterior rim slightly brown, segment 2 and 3 brownish. ***Thorax:*** Pronotum olive green with distinct pattern of 10 smaller spots lined up in two transverse rows and eight bold dark brown spots on posterior pronotal lobe; mesoscutellum pale orange, scutellum pale olive green with two to four smaller pale to dark brown spots; pleura pale olive green with yellowish tinge. *Legs*: Base of pro-, meso-, and metathoracic coxae pale green to pale brownish, femora of pro- and mesothoracic leg spotted with dark brown spots anteriorly and to lesser degree posteriorly, hind leg heavily covered with relatively large dark brown spots, tibia tannish to pale brown, hind tibia with dark brown spines only in anterior portion with indistinct dark brown bases, tarsi dark brown. *Hemelytra*: Corium including clavus pale olive green with shades of pale brown, covered with brown spots, cuneus proximally transparent and distally pale brown to brownish, sometimes with one brown spot towards posterior margin of cuneus; membrane transparent with veins pale and anterior cell dark brown, posterior cell dark brown with pale elliptical spot, apex of membrane pale brown with transparent mark. ***Abdomen*:** Venter greenish, outer lining suffused with pale yellow and slightly darker shade of yellow. **SURFACE AND VESTITURE**: Dorsum shining, corium covered with adpressed setae of moderate length, cuneus densely covered with setae. **STRUCTURE**: ***Head*:** Mandibular plate relatively large, buccula convex; eyes moderately large; apex of labium extending from anterior margin to middle of pygophore, segments 2 through 4 slender. ***Abdomen*:** Corpulent abdomen extending to cuneal apex, adpressed setae present on abdomen. GENITALIA: ***Pygophore*:** Large. ***Vesica*:** Distal flaplike process present, beset with spicules, secondary gonopore located subapically, proximal process relatively long, with about 4–5 spines, moderate to heavily sclerotized, apical spine of vesica relatively short.

FEMALE: As male, but slightly larger. Total length 3.85–4.50, length from apex of clypeus to cuneal fracture 2.70–3.15, width across pronotum 1.20–1.60. GENITALIA (fig. 3F, G): Bursa copulatrix relatively large, sclerotized rings large with slender rim, vestibulum relatively simple, elongate in dorsal view, interramal sclerites with double-hook–shaped processes.

ETYMOLOGY: Named for the host-plant genus, *Heliotropium*, where all of the host plant recorded specimens of this species were found.

HOST (table 2): Recorded from *Heliotropium ammophilum* Craven (Boraginaceae) and one unidentified species of *Heliotropium*.

DISTRIBUTION (fig. 4): Recorded from South and Western Australia.

PARATYPES: **AUSTRALIA: Western Australia:** 120 km E of Norseman, 32.0619°S 123.0117°E, 600 m, 23 Oct 1996, Schuh and Cassis, Craven *Heliotropium ammophilum* Craven (Boraginaceae), det. PERTH staff 05100038, 1♂ (00214574), 1♀ (00214583) (AM). Craven *Heliotropium ammophilum* Craven (Boraginaceae), det. PERTH staff 05100038, 1♂ (00133232), 1♀ (00133224) (AMNH). Craven *Heliotropium ammophilum* Craven (Boraginaceae), det. PERTH staff

05100038, 2♂ (00214572, 00214573), 2♀ (00214587, 00214588) (WAMP).

OTHER SPECIMENS EXAMINED: **AUSTRALIA: New South Wales:** Barham, 35.63152°S 144.13082°E, 23 Mar 1960, M. I. Nikitin, 10♂, 16♀ (BMNH). **Northern Territory:** Alice Springs, 23.699°S 133.881°E, 14 Feb 1966, J. A. Grant, 2♂, 2♀ (BMNH). **South Australia:** Athelstone, 34.87116°S 138.70668°E, 13 Apr 1976, J. J. H. Szent-Ivany, Light Trap, 1♀ (00218583) (SAMA). **Victoria:** Ouyen, 35.07221°S 142.31882°E, 16 Mar 1966, J. A. Grant, 1♂ (BMNH). **Western Australia:** 120 km E of Norseman, 32.0619°S 123.0117°E, 600 m, 23 Oct 1996, Schuh and Cassis, Craven *Heliotropium ammophilum* Craven (Boraginaceae), det. PERTH staff 05100038, 4♂ (00214575–00214578), 7♀ (00214582, 00214584–00214586, 00214589–00214591), 3 nymphs (00214579–00214581) (AM). Craven *Heliotropium ammophilum* Craven (Boraginaceae), det. PERTH staff 05100038, 30♂ (00133197–00133208, 00133226–00133227, 00133229–00133231, 00133233–00133245), 30♀ (00133210–00133223, 00133225, 00133252–00133266), 7 nymphs (00133209, 00133246–00133251) (AMNH). 27.6 km N of Coral Bay Rd on Cardabia-Ningaloo Rd, 22.90198°S 113.8167°E, 25 m, 29 Oct 2004, Cassis, Wall, Weirauch, Tatarnic, Symonds, *Heliotropium* sp. (Boraginaceae), det. PERTH staff 6989330, 4♂ (00214563–00214566), 4♀ (00214568–00214571), 1 nymphs (00214567) (AM).

Jiwarli ptilotus, new species

Figures 1, 3, 4

HOLOTYPE: **AUSTRALIA: Western Australia:** Blowholes Rd NW of North West Coastal Hiway, Beagle Hill Area, 24.49068°S 113.4626°E, 20 m, 27 Oct 2004, Cassis, Wall, Weirauch, Tatarnic, Symonds, *Ptilotus obovatus* (Gaudich.) F.Muell. (Amaranthaceae), det. PERTH staff 6988911, 1♂ (00216390) (WAMP).

DIAGNOSIS: Recognized by the uniformly transparent hemelytron, whitish abdomen, the apex of the labium extending from the middle region to almost the apex of the pygophore, absence of the distal flaplike process of the vesica, and the condensed and broad proximal process with about 3 to 4 spines.

DESCRIPTION: *Male*: Macropterous; total length 3.80–5.00, length from apex of clypeus to cuneal fracture 2.75–3.25, width across pronotum 1.35–1.45. **COLORATION** (fig. 1): General coloration whitish with some pale green, appendages pale tan. ***Head*:** Vertex pale tan with few dark brown spots, clypeus with tan stripe, mandibular and maxillary plates tannish; antennal segment 1 pale tan to pale green, segment 2 pale tan to pale brown, segment 3 pale brown to brown, segment 4 brown; labium with segment 1 pale tan, segment 2 pale tan to brown, segment 3 brown. ***Thorax:*** Pale green suffused with shade of green on posterior pronotal lobe, eight bold brown spots on posterior pronotal lobe, arranged in variable pattern, scutellum pale tan, spots present on scutellum of some specimens, mesoscutum yellow-orange with some pale tan; pleura pale tan. *Legs*: Pale tan to pale brown, few dark brown spots, more spots on anterior surface than on posterior surface, tibia pale tan, tarsus brown proximally and dark brown distally to tibia. *Hemelytra*: Corium including clavus whitish, part of corium transparent, cuneus transparent proximally and distally; membrane transparent with pale tan, distal to cuneus pale brown spot with apex of membrane transparent to pale tan. ***Abdomen*:** Whitish, suffused with yellowish to pale tan. **SURFACE AND VESTITURE**: Dorsum shining, with adpressed setae of moderate length; adpressed setae on pronotum and abdomen; cuneus covered with setae. **STRUCTURE**: ***Head*:** Mandibular plate relatively small, buccula slightly convex; eyes moderately large; apex of labium extending from middle to almost apex of pygophore, segments 2 through 4 slender. ***Thorax*:** As in generic description. ***Abdomen:*** Corpulent abdomen extending to cuneal base. GENITALIA: ***Vesica*:** Distal flaplike process absent, secondary gonopore located subapically, partly sclerotized proximal process, process short and broad, condensed, with 3–4 spines.

FEMALE (fig. 1): Female as in generic description. Total length 3.75–4.70, length from apex of clypeus to cuneal fracture 2.60–3.15, width across pronotum 1.20–1.50.

ETYMOLOGY: Named for the genus of the host plant, *Ptilotus*, where many of the specimens of *J. ptilotus* were found.

HOST (table 2): Predominantly recorded from *Ptilotus obovatus* (Gaudich.) F. Muell. (Amaranthaceae).

DISTRIBUTION (fig. 4): Known from central Australia and the coastal areas of Western Australia. Given the extremely wide distribution of its host plant, *Ptilotus obovatus*, the plant bug may be suspected to also occur in Queensland, New South Wales, and the Northern Territory.

MATERIAL EXAMINED: Paratypes: **AUSTRALIA: Western Australia:** Blowholes Rd NW of North West Coastal Hiway, Beagle Hill Area, 24.49068°S 113.4626°E, 20 m, 27 Oct 2004, Cassis, Wall, Weirauch, Tatarnic, Symonds, (Gaudich.) F.Muell. *Ptilotus obovatus* (Gaudich.) F.Muell. (Amaranthaceae), det. PERTH staff 6988911, 1♂ (00216392), 1♀ (00216089) (AM). (Gaudich.) F.Muell. *Ptilotus obovatus* (Gaudich.) F.Muell. (Amaranthaceae), det. PERTH staff 6988911, 1♂ (00216393), 1♀ (00216090) (AMNH). (Gaudich.) F.Muell. *Ptilotus obovatus* (Gaudich.) F.Muell. (Amaranthaceae), det. PERTH staff 6988911, 2♂ (00216389, 00216391), 2♀ (00216087, 00216088) (WAMP).

OTHER SPECIMENS EXAMINED: **AUSTRALIA: South Australia:** 18.8 km NW of Cordillo Downs Homestead, 26.64315°S 140.4723°E, 140 m, 05 Nov 1998, Schuh, Cassis, Silveira, (Gaudich.) F. Muell. *Ptilotus obovatus* (Gaudich.) F. Muell. (Amaranthaceae), det. Royal Bot Gard. NSW 427988, 2♂ (00130483, 00130484), 4♀ (00130485–00130488) (AMNH). **Western Australia:** 24 km SE of jct of Manga Rd and Shark Bay Rd, Shark Bay World Heritage Area, 26.39014°S 114.0094°E, 60 m, 26 Oct 2004, Cassis, Wall, Weirauch, Symonds, (Gaudich.) F. Muell. *Ptilotus obovatus* (Gaudich.) F. Muell. (Amaranthaceae), det. Field ID, 1♂ (00214557), 2♀ (00214559, 00214560), 1 nymphs (00214558) (AM). 53.9 km N of Kalgoorlie, 30.28882°S 121.2558°E, 600 m, 24 Oct 1996, Schuh and Cassis, (R.Br.) F.Muell. *Eremophila scoparia* (R.Br.) F.Muell. (Myoporaceae), det. PERTH staff 05095123, 1♂ (00216382) (AMNH). 89.2 km N of jct of Agana Kilabarra Rd and Brand Hiway, on Brand Hiway, 27.18877°S 114.6159°E, 178 m, 24 Oct 2004, Cassis, Wall, Weirauch, Symonds, (Gaudich.) F.Muell. *Ptilotus obovatus* (Gaudich.) F.Muell. (Amaranthaceae), det. PERTH staff 6989845, 3♂ (00214553–00214555), 1♀ (00214556) (AM). Blowholes Rd NW of North West Coastal Hiway, Beagle Hill Area, 24.49068°S 113.4626°E, 20 m, 27 Oct 2004, Cassis, Wall, Weirauch, Tatarnic, Symonds, (Gaudich.) F. Muell. *Ptilotus obovatus* (Gaudich.) F.Muell. (Amaranthaceae), det. PERTH staff 6988911, 6♂ (00216383–00216388), 5♀ (00216091–00216092, 00216396–00216398), 2 nymphs (00216394, 00216395) (AMNH).

Jiwarli solanum, new species

Figures 1, 3, 4

HOLOTYPE: **AUSTRALIA: South Australia:** 72 km N of Yunta, Nillinghoo Creek, 32.00924°S 139.4523°E, 194 m, 09 Nov 2001, Cassis, Schuh, Schwartz, R.Br. *Solanum ellipticum* R.Br. (Solanaceae), det. NSW staff 666382, 1♂ (00099509) (AM).

DIAGNOSIS: Recognized by the brown vertically skewed lines on the hemelytron, the weakly shining dorsum, the apex of labium extending only to the anterior margin of the pygophore, the proximal process of the vesica long and wide, with 3 to 4 spines, and the long apical spine on the vesica. Most similar to *Jiwarli heliotropium*, n. sp., based on the pattern of bold spots on the pronotum, overall coloration, and presence of the flaplike process distal to the secondary gonopore, but distinguished by the color pattern of the hemelytron and the longer apical spine of the vesica in *J. solanum*.

DESCRIPTION: *Male*: Macropterous; total length 3.70–4.15, length from apex of clypeus to cuneal fracture 2.70–3.15, width across pronotum 1.25–1.50. **COLORATION** (fig. 1): General coloration pale green to pale brownish, appendages pale tan. ***Head*:** Vertex pale tan with dark brown spots, clypeus with pale tan stripe with small brown spots, mandibular and maxillary plates pale green to pale tan; antennal segment 1 pale brown with basal ring darker, segment 2 pale brown to dark brown, segment 3 brown, segment 4 dark brown; labium with segment 1 pale greenish, segment 2 pale brown, segment 3 brown. ***Thorax:*** Olive green and pale brown with distinct pattern of 6 bold dark brown spots on posterior pronotal lobe and 3 bold dark brown spots each side of pronotal lobe,

8–10 smaller spots usually arranged up in two transverse rows; mesoscutum yellow-orange with several small spots; scutellum pale brown with longitudinal yellowish-green stripe with two bold dark brown spots; pleura pale tan suffused with pale yellow-greenish. *Legs*: Mixture of pale green and pale brown, few spots on pro- and mesocoxae, femur of metathoracic leg with slightly more spots, tibia pale tan, tarsi brown to dark brown. *Hemelytra*: Corium including clavus olive green and pale brown, covered with diagonally skewed brown lines, part of corium transparent, cuneus proximally and distally transparent, membrane transparent with pale tan, distal to cuneus with brown triangular mark with apex of membrane pale brown with transparent mark. ***Abdomen*:** Pale green suffused with yellowish to pale tan. **SURFACE AND VESTITURE**: Dorsum weakly shining, few adpressed setae of moderate length, cuneus densely covered with setae.

STRUCTURE: ***Head*:** Mandibular plate relatively small, buccula convex; eyes moderately large; apex of labium extending to anterior margin of pygophore, short, segments 2 through 4 slender, elongate. ***Abdomen*:** Corpulent abdomen extending to cuneal base, very translucent adpressed setae present on abdomen. GENITALIA: ***Vesica*:** Distal flap-like process of vesica present, beset with spicules, proximal process long and heavily sclerotized, with 3–4 spines, apical spine of vesica long.

Female (fig. 1): Female as in generic description. Total length 4.15–4.60, length from apex of clypeus to cuneal fracture 3.00–3.45, width across pronotum 1.35–1.55.

Etymology: Named for the genus of its host plant, *Solanum* spp.

Host (table 2): Predominantly recorded from several species of *Solanum* (Solanaceae).

Distribution (fig. 4): Known to be widely distributed throughout Australia.

Material examined: Paratypes: **AUSTRALIA: New South Wales:** Sydney, 33.8652°S 151.2096°E, C. Gibbons, 1♀ (00214548) (AM). **Northern Territory:** 8.8 km N of Mt Wedge Stn Rd jct on Tanami Rd, 22.63335°S 132.3525°E, 598 m, 23 Oct 2001, Cassis, Schuh, Schwartz, Silveira, Wall, Dunal ex Poir. *Solanum orbiculatum orbiculatum* Dunal ex Poir. (Solanaceae), det. NSW staff 658318, 2♀ (00216378, 00216379) (AMNH). Kings Canyon, Watarrka National Park, 24.25001°S 131.5689°E, 633 m, 02 Nov 2001, Cassis, Schuh, Schwartz, Silveira, Wall, 1♀ (00216377) (AMNH). **Queensland:** 8.2 km E of Mungallala, 26.46401°S 147.6248°E, 560 m, 31 Oct 1998, Schuh, Cassis, Silveira, F. Muell. *Solanum* cf. *nemophilum* F. Muell. (Solanaceae), det. Royal Bot Gard. NSW 427370, 2♂ (00130418, 00130419), 1♀ (00130420) (AMNH). Morven District, Apr 1941, N. Geary, 1♀ (00214547) (AM). **South Australia:** 72 km N of Yunta, Nillinghoo Creek, 32.00924°S 139.4523°E, 194 m, 09 Nov 2001, Cassis, Schuh, Schwartz, R.Br. *Solanum ellipticum* R.Br. (Solanaceae), det. NSW staff 666382, 12♂ (00099508, 00099512–00099516, 00099518–00099522, 00215360), 33♀ (00099523–00099541, 00099543–00099546, 00099548, 00099550–00099558) (AMNH). R.Br. *Solanum ellipticum* R.Br. (Solanaceae), det. NSW staff 666382, 1♂ (00099511) (CNC). R.Br. *Solanum ellipticum* R.Br. (Solanaceae), det. NSW staff 666382, 1♂ (00099517), 1♀ (00099542) (USNM). R.Br. *Solanum ellipticum* R.Br. (Solanaceae), det. NSW staff 666382, 1♂ (00099510), 1♀ (00099547) (ZISP). **Western Australia:** 30 km NW of Lorna Glen HS, 26.13°S 121.33°E, 10 Aug 1983, T. F. Houston & R. P. McMillan, 1♂ (00219627), 1♀ (00219628) (WAMP). 49.1 km N of Norseman, 30.32116°S 121.2851°E, 600 m, 24 Oct 1996, Schuh and Cassis, Poir. *Solanum orbiculatum orbiculatum* Poir. (Solanaceae), det. PERTH staff 05054613, 1♂ (00214543), 1♀ (00214546) (AM). 53.9 km N of Kalgoorlie, 30.28882°S 121.2558°E, 600 m, 24 Oct 1996, Schuh and Cassis, (DC.) Benth. *Ixiolaena leptolepis* (DC.) Benth. (Asteraceae), det. PERTH staff 05099927, 1♂ (00216380), 1♀ (00216381) (AMNH). 79 km W of Sandstone, 28.03737°S 118.4983°E, 650 m, 26 Oct 1996, Schuh and Cassis, Poir. *Solanum lasiophyllum* Poir. (Solanaceae), det. PERTH staff 05120721, 1♂ (00133101), 6♀ (00133102–00133107) (AMNH). Koolan Island, 16.124°S 123.74°E, Jul 1967–Sep 1967, O. Milton, 1♂ (00219626), 3♀ (00219623–00219625) (WAMP). Logues Springs, 102 km SE by E. Broome, W.A., 18.25°S 123.05°E, 18 Aug 1976, I. F. B. Common, 1♀ (00216426) (ANIC). NW

Coastal Hiway 80.7 km N of Kalbarri Rd, 27.25379°S 114.5998°E, 400 m, 30 Oct 1996, Schuh and Cassis, F. Muell. *Anthotroche walcottii* F. Muell. (Solanaceae), det. PERTH staff 05120233, 2♂ (00087849, 00087850) (AM). F. Muell. *Anthotroche walcottii* F. Muell. (Solanaceae), det. PERTH staff 05120233, 2♀ (00216375, 00216376) (AMNH).

OTHER SPECIMENS EXAMINED: **AUSTRALIA: Australian Capital Territory:** Canberra, 35.33333°N 149.16666°E, 21 Apr 1966, 1♀ (00214541) (AM). **Western Australia:** 49.1 km N of Norseman, 30.32116°S 121.2851°E, 600 m, 24 Oct 1996, Schuh and Cassis, Poir. *Solanum orbiculatum orbiculatum* Poir. (Solanaceae), det. PERTH staff 05054613, 2 nymphs (00214544, 00214545) (AM). **unknown locality:** 19 May 1966, Unknown, 1♂ (00214542) (AM).

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