Freshwater Ostracoda (Crustacea) collected from the islands of Futuna and Wallis, Pacific Ocean, with a check-list of the non-marine Ostracoda of the Pacific Islands

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Abstract. The freshwater Ostracoda collected during a survey carried out in October 2004 on the French islands of Futuna and Wallis, Polynesia, Pacific Ocean, are presented. In total, 10 species were found, of which 5 could be identified to the species level. Notes on the taxonomy of the species are provided. *Parastenocypris perarmata* (Brady, 1904) McKenzie, 1971 is transferred into the genus *Chrissia* Hartmann, 1957: *Chrissia perarmata* (Brady, 1904) comb. nov. Scanning electron micrographs of *Strandesia vinciguerrae* (Masi, 1905) and *Cypretta seurati* Gauthier, 1929 are presented. A check-list of the non-marine Ostracoda of the Pacific Islands (Oceania minus Australia and New Zealand) is given.

Key words. Ostracoda, Crustacea, Pacific Islands, Polynesia, Futuna, Wallis, freshwater, non-marine.

1. Introduction

Wallis and Futuna is a small archipelago located in the South Pacific Ocean, west of Samoa and north-east of Fiji (fig. 1). The archipelago is part of the so-called Pacific Islands, which together with Australia and New Zealand form the geographic region commonly designated as Oceania.

In October 2004 one of us (NMS) carried out an extensive survey of the freshwater habitats of Futuna and Wallis. That investigation aimed at improving the knowledge of the flora, the fauna and the environmental conditions of the freshwater ecosystems of the two islands. In the present contribution we present the Ostracoda (Crustacea) collected in the course of that survey.

No freshwater ostracods had formerly been reported from the islands of Futuna and Wallis. Indeed, the record of *Hemicypris futunaensis* Victor & Fernando, 1978, which was collected from "a large hole in a lump of coral, Mission Bay, Futuna, New Hebrides" (Victor & Fernando 1978) comes from a different island. That other island of Futuna, sometimes called West Futuna to distinguish it from the French Futuna, is part of the Republic of Vanuatu (the Vanuatu archipelago was designated as The New Hebrides before acquiring its independence in 1980).

While the marine ostracods from the Pacific Islands are relatively well known, only a relatively small number of publications deals with their non-marine fauna (see references in table 4).

Hartmann (1984) was the first to publish a check-list of both marine and non-marine ostracods known from the Pacific Islands. Hartmann's (op. cit.) list comprised 20 non-marine ostracod species.

More recently, Eldredge & Miller (1997) provided a list of the freshwater invertebrates, the ostracods included, of Hawaii, while Colin

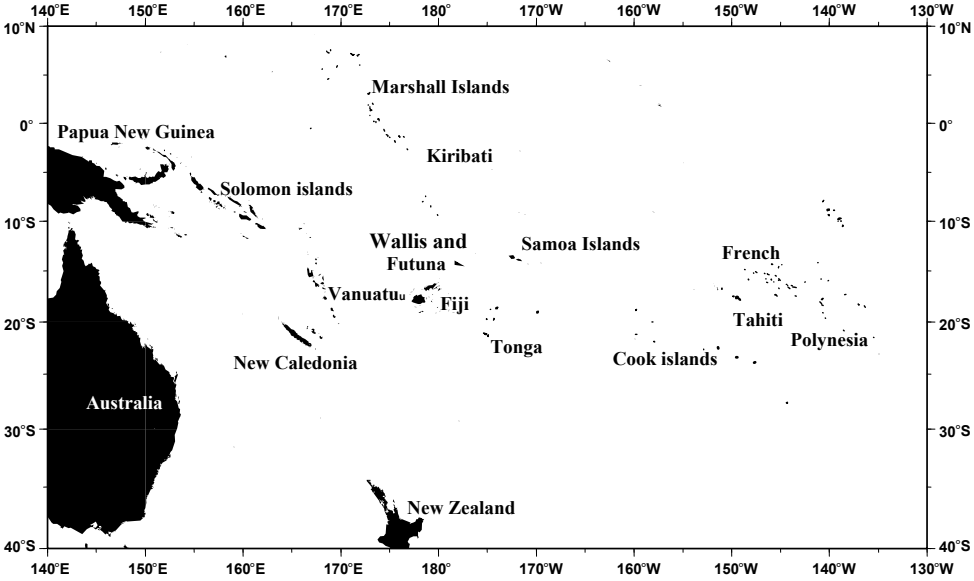


Fig. 1. Location of Wallis and Futuna in the Pacific Ocean.

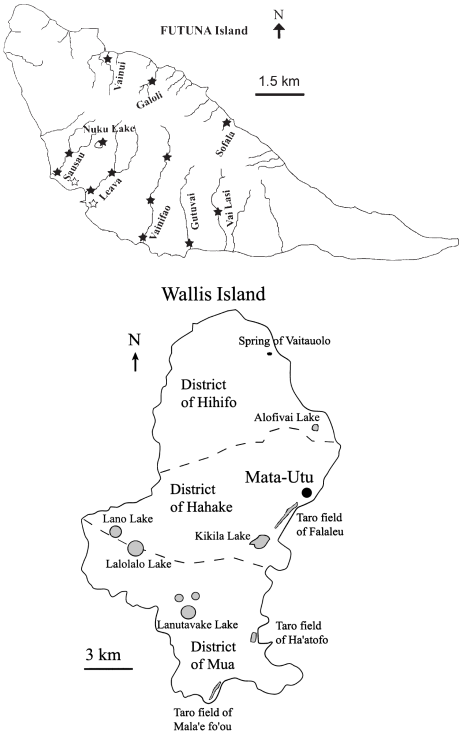


Fig. 2. Maps of Futuna and Wallis with sampled localities.

(2002) and Colin & Hoibian (2003) published annotated check-lists of the non-marine ostracods from French Polynesia, Clipperton, and New Caledonia, respectively.

In the absence of any comprehensive faunistic synopsis and in order to facilitate future research, we here present an updated checklist of the non-marine ostracods recorded from the Pacific Islands (table 4).

2. Material and methods

2.1. Study area

Wallis and Futuna, officially the Territory of Wallis and Futuna Islands (French: Wallis-et-Futuna or Territoire des îles Wallis-et-Futuna) consists of the three following main islands: Wallis (77.5 km²) on the one side, and Futuna and Alofi (64.5 km² in total) on the other side. While Futuna and Alofi are close to each other (1.8 km), Wallis is located 230 km northeast of the former two islands. Within Oceania, the archipelago belongs to the geographical region designated as Polynesia.

Wallis (also called Uvea Island) and Futuna are situated in the southern tropics, at latitudes of 13° S and 19° S, respectively. The climate is warm, with an annual average

Table 1. List of species collected from Futuna (F) and Wallis (W).

Stenocypris major (Baird, 1859) Daday, 1898	F	W
Stenocypris malayica Victor & Fernando, 1981	F	W
Chrissia cf. *perarmata* (Brady, 1904) McKenzie, 1971		W
Strandesia vinciguerrae (Masi, 1905) G.W. Müller, 1912	F	W
Cypretta seurati Gauthier, 1929	F	W
Cypridopsis vidua (O.F. Müller, 1776) Brady, 1867	F	W
Alicenula cf. *serricaudata* (Klie, 1935) Rossetti & Martens, 1998		W
Candonopsis sp. juv.	F	
Cyprididae sp. juv.		W
Cytheroidea sp.		W

Table 2. List of localities and species recorded.

	S. major	*S. malayica*	*C.* cf. *perarm.*	*S. vinci-guerrae*	*C. seurati*	*C. vidua*	*A.* cf. *serric.*	*Candon-opsis* sp.	Cyprid-idae sp.	Cyther-oidea sp.
Futuna										
Leava	×	×		×	×	×				
Sausau		×				×				
Sausau taro f.		×			×	×				
Gutuvai		×				×				
Lake Nuku						×		×		
Wallis										
Alofivai	×									
Lano	×	×	×	×	×					×
Lalolalo	×		×	×	×	×	×		×	
Kikila 1	×	×	×		×					
Kikila 2	×		×							
Lanutavake	×									
Ha'atofo			×		×					
Mala'e fo'ou			×							

of 27°C in Wallis, 26°C in Futuna, humid, and subject to tropical cyclones. The annual temperature amplitude is very low (1°C). Rainfall is abundant, with over 3 m in 260 days, from approximately October to May, on Wallis and up to 4 m on Futuna.

There is significant seasonal variation and, though there is no 'true' dry period, a strong rainy season occurs between October and May. The rainiest month on Wallis is December, with three times more abundant rain falls than in August (Angleviel et al. 1994).

Although the three islands are volcanic in origin, they differ in their geologic history and have therefore developed different geomorphological characteristics (Angleviel et al. 1994; Malau et al. 1999).

Wallis: due to the extreme permeability of the soils and a weak relief (highest point 151 m asl), there are no surface streams. However, there are several lakes, located in depressions (Alofivai, Kikila) and craters (Lano, Lalolalo, Lanutavake). Only little information is available on the lakes: for example, lake Lalolalo is supposed to be 80 meters deep.

Futuna and Alofi have a more pronounced relief. Futuna is about 20 km long, with a maximum width of 5 km. The longitudinal mountain range reaches its highest point at 524 m (Mount Puke), its slopes have been

cut down into valleys by numerous short, permanent rivers. Alofi is a small island, without permanent surface waters; it was not explored during the survey in 2004.

2.2. Sampling

The sampling was carried out in the period immediately preceding the heavy rains, from 5 to 23 October 2004. All together, 24 sites (rivers, lakes, springs and taro paddy fields) were investigated, of which 13 yielded ostracods (table 2).

On Futuna (fig. 2), the following 15 localities were visited: Lake Nuku, the taro fields of Leava and Sausau, and the rivers Vainifao (lower, middle and upper courses), Galoli (middle course), Leava (lower and middle courses), Vailasi (middle course), Gutuvai (lower course), Sofala (lower course), Sausau (lower and middle courses), and Vainui (lower course). Ostracods were collected from five of these sites (table 2).

On Wallis (fig. 2) the following nine localities were investigated: the lakes Kikila, Alofivai, Lanutavake, Lalolalo and Lano; the taro fields of Ha'atofo, Mala'e fo'ou and Falaleu, and the freshwater spring of Vaitauolo, close to the coast. Ostracods were retrieved from eight of these sites (table 2).

At each locality, a number of physico-chemical parameters were registered (table 3). The ben-

Table 3. Physico-chemical parameters of the investigated sites on Futuna and Wallis. NTU = nephelometric turbidity index; COD = chemical oxygen demand; BOD = biochemical oxygen demand; NO_3, Cl, etc in mg/L.

Dates 2004	Localities	Coord. GPS WGS 84	T°C	O_2 %	O_2 mg/L	pH	Cond. µS/cm	Turb. NTU	NO_3	Cl	Ca	Mg	SO_4	K	Na	COD	BOD5
Futuna																	
14/10	Leava taro field	S 14.292 W 178.158															
16/10	Gutuvai riv. low. course	S 14.308 W 178.129	28.1	96	7.49	9.3	187	8.93	<0,5	7	10	5	<5	<5	<10		
16/10	Sofala river low. course	S 14.272 W 178.117	25.0	90	7.38	8.9	252										
19/10	Sausau taro field	S 14.288 W 178.167	30.5	117	8.84	9.0	192	6.53	<0,5	8	12	6	8	<5	<10		
20/10	Nuku lake	S 14.281 W 178.154	27.1	98	7.55	7.4	37										
Wallis																	
06/10	Lanutavake lake	S 13.323 W 176.214	29.9	108	8.02		97.2	1.57	<0,5	<5	<5	<5	<5	<5	<10	47	2
06/10	Kikila lake	S 13.294 W 176.189	30.2	110	8.37	7.8	41.9	18.34	<0,5	5	<5	<5	21	<5	<10	87	6
07/10	Lalolalo lake	S 13.299 W 176.235	30.0	110	8.50	9.0	1646	0.94	<0,5	440	7	23	67	7.7	264	57	1
08/10	Alofivai lake	S 13.257 W 176.170	32.7	109	7.99	6.5	35.6	30.50	<0,5	6	<5	<5	5	<5	<10	67	5
09/10	Lano lake	S 13.293 W 176.240	30.6	77	5.74	6.4	35.2	7.45	<0,5	<5	<5	<5	28	<5	<10	73	1
07/10	Ha'atofo t. f. (spring)	S 13.325 W 176.191	28.8	69	5.26	6.0	167										
08/10	Mala'efo'ou t. f. spring	S 13.340 W 176.201	33.0	172	12.42	6.6	116										

thic invertebrates were collected using a Surber net (0.05 m^2; 250 µm mesh). Samples were preserved in 5 % formaldehyde at the collecting site. In the laboratory, invertebrates were sorted out from the samples under the stereomicroscope to be preserved in 70 % ethanol. The (relatively short) sojourn of the ostracods in the formaldehyde entailed partial or total decalcification of the valves, depending on the valve thickness and resistance to acid conditions of the different species. Decalcification prevented the examination of the carapaces and valves in the SEM, except for *Strandesia vinciguerrae* and *Cypretta seurati* (fig. 4).

2.3. Check-list of the non-marine Ostracoda from the Pacific Islands (table 4)

(a) Area covered

The check-list covers the territory of the so-called Pacific Islands, a geographic region which is commonly divided into the following three subregions: Melanesia, Micronesia, and Polynesia. These islands are also sometimes collectively called Oceania, although Oceania usually also includes Australia and New Zealand (the latter two are not considered here).

Melanesia includes New Guinea, New Caledonia, Vanuatu, Fiji and the Solomon Islands.

Microneasia includes the Marianas, Guam, Wake Island, Palau, the Marshall islands, Kiribati, Naru and the Federated States of Micronesia.

Polynesia includes New Zealand (not considered here), the Hawaiian Islands, Rotuma, the Midway Islands, Samoa, American Samoa, Tonga, Tuvalu, Wallis and Futuna, the Cook Islands, French Polynesia, and Easter Island.

Many other islands also located within the boundaries of the Pacific Ocean are not considered part of Oceania (e.g., the Galapagos Islands of Ecuador, the Philippines, most of the islands of Indonesia, etc). Source: www.wikipedia.org under 'Pacific Islands'; see there for a detailed list of islands (June 2007).

(b) Non-marine and marine Ostracoda

The ostracods colonising marine brackish waters consist of an assemblage comprising both originally freshwater species that have progressively adapted to brackish conditions, and marine species with the opposite evolutionary adaptation. It is therefore often not possible to make a clear distinction between non-marine and marine species. For practical reasons we opted to follow the 'decisions' taken by Kempf (1980, 1986, 1995, 1997; also more recent unpublished working copies) in his comprehensive taxonomic indexes which list non-marine and marine species in separate volumes.

(c) Islands previously investigated (see references in table 4)

Most of the data available come from New Caledonia (mainly Grande Terre) and New Guinea. Further records of non-marine ostracods come from Tonga, Manono of Somoa, the Tokelau islets, Futuna (Vanuatu), Kiribati and several other islands of Micronesia, the Loyalty Island, the Solomon Islands, the Cook Islands, the Marquesas Islands, the Bismarck archipelago, Rangiroa of the Tuamotus, Palau, and Easter Island.

2.4. Nomenclature and abbreviations

The taxonomic nomenclature follows Horne et al. (2002), Martens (2001b) and Meisch (2000). Spms = specimens; fem. = female; m. = male; (sub)ad. = (sub)adult; juv. = juvenile; L = carapace length; SEM = scanning electron microscope.

3. Results

In total, ten ostracod species were collected from five localities on Futuna and eight others on Wallis. The samples were taken from lakes, springs, rivers, and taro paddy fields (tables 2, 3; fig. 2). GPS coordinates and a number of physical and chemical parameters of the habitats are presented in table 3. The identity of five taxa could be determined down to the species level, that of two others, *Chrissia* cf. *perarmata* and *Alicenula* cf. *serricaudata,* is given with a slight uncertainty. The specific identity of two individuals belonging to the Cytheroidea could not be identified because of poor preservation. Of two other species only unidentifiable

Table 4. Check-list of the non-marine ostracods from the Pacific Islands (Oceania minus Australia and New Zealand). The distinction between non-marine and marine species relies on the taxonomic indices published by Kempf (1980, 1986, 1995, 1997 and more recent unpublished working copies). The species recorded under open nomenclature (e.g., *Candona* sp.) are excluded from the list. Species names are arranged in alphabetical order.

Species	**Pacific Islands**
Alicenula cf. *serricaudata* (Klie, 1935)	Wallis (this paper)
Callistocypris zlotini Schornikov, 1980	Solomon Islands (Schornikov 1980)
Ankylocythere sinuosa (Rioja, 1942)	Hawaii (Hart & Hart 1974; Eldredge & Miller 1997)
Candona illiesi McKenzie, 1971 = *Typhlocypris illiesii* (McK.) Karanovic, 2005	New Guinea (McKenzie 1971; De Deckker & Jones 1978)
Candonocypris incosta De Deckker, 1981 = *Ilyodromus* cf. *smaragdinus* Sars, 1894 sensu McKenzie 1971 (fide De Deckker 1981)	New Guinea (McKenzie 1971; De Deckker & Jones 1978)
Candonopsis caledonica (Méhes, 1939) De Deckker, 1981, subspecies *caledonica* and *minor* by Méhes	New Caledonia (Grande Terre) (Méhes 1939; Hartmann 1984; Maddocks et al. 1993; Colin & Hoibian 2003; Maddocks 2005)
Candonopsis calva Harding, 1962	Bismarck Archipelago (Harding 1962; Hartmann 1984)
Candonopsis tenuis (Brady, 1886)	Samoa; Tonga (Hartmann 1984)
Chlamydotheca unispinosa (Baird, 1862)	Hawaii (Tressler 1950; Eldredge & Miller 1997)
Chrissia cf. *perarmata* (Brady, 1904)	Wallis (this paper)
Cypretta globula (Sars, 1889)	Cook Island; Samoa; Solomon Islands (Hartmann 1984)
Cypretta nukuhivana Furtos, 1934	Marquesas Islands (Nuku Hiva; Furtos 1934)
Cypretta papuana Vávra, 1901	Bismarck Archipelago (Vávra 1901; Hartmann 1984)
Cypretta seurati Gauthier, 1929	Easter Island (Dumont & Martens 1996); Futuna; Wallis (this paper)
Cypretta turgida (Sars, 1896)	Samoa (Hartmann 1984)
Cyprideis australiensis Hartmann, 1978	New Caledonia (Grande Terre) (Hoibian et al. 2000, 2002)
Cypridopsis cypera Tressler, 1937	Hawaii (Tressler 1937; Eldredge & Miller 1997)
Cypridopsis dentatomarginata (Daday, 1902)	Hawaii (Tressler 1937; Eldredge & Miller 1997)
Cypridopsis oceanus Allison & Holden, 1971	Clipperton (Allison & Holden 1971; Hartmann 1984; Colin 2002)
Cypridopsis sarasini Méhes, 1939	New Caledonia (Loyalty Islands) (Méhes 1939; Hartmann 1984; Maddocks et al. 1993; Colin & Hoibian 2003; Maddocks 2005)
Cypridopsis vidua (O.F. Müller, 1776)	Hawaii (Tressler 1937; Eldredge & Miller 1997); Futuna, Wallis (this paper)
Cyprinotus cingalensis Brady, 1886	Kiribati (Eagar 2000a,b); New Caledonia (Loyalty Islands) (Neale 1979; Maddocks et al. 1993; Maddocks 2005). Misidentified from Hawaii by Vávra 1906 (fide Neale 1979; Victor & Fernando 1980)
Cypris vitiensis Dana, 1852	Fiji (Hartmann 1984)
Dolerocypria heylenae Wouters, 2001	Papua New Guinea (Wouters 2001; Maddocks 2005)
Dolerocypria iliffei Maddocks, 2005	New Caledonia (Loyalty Islands) (Maddocks 2005)
Dolerocypria taalensis Tressler, 1937	Solomon Islands; Papua New Guinea (Tressler 1937; Wouters 1987a; Maddocks 2005)
Eucypris fabaeformis Daday, 1900	New Guinea (Daday 1900; Hartmann 1984)
Hansacypris aspera Wouters, 1984 = *Renaudcypris natans* Hartmann, 1984 (fide Gou 1990)	Papua New Guinea, Tuamotu Islands (Rangiroa), Kiribati (Wouters 1984; Hartmann 1984; Gou 1990; Wouters 2001; Eagar 1998, as *Hansacypris* sp., fide Wouters 2001; Micronesia (Weissleader et al. 1989); Micronesia (Islands of Enewtak, Guam, Onotoa, Pinaki and Pingelap) and New Guinea (T. Cronin, unpubl. report)
Hansacypris glabra Wouters, 1984	Papua New Guinea (Wouters 1984)

Hansacypris motuporensis Wouters, 2001	Papua New Guinea (Wouters 2001)
Hemicypris futunaensis Victor & Fernando, 1978	Futuna of Vanuatu (Victor & Fernando 1978)
Heterocypris incongruens (Ramdohr, 1808)	Manono Island (cf. *incongruens* in Hartmann 1984); Easter Island (Dumont & Martens 1996)
Heterocypris makua (Tressler, 1937)	Hawaii (Tressler 1937; Hartmann 1984; Eldredge & Miller 1997
Heterocypris wolfhügeli (Méhes, 1914)	New Caledonia (Loyalty Islands) (Méhes 1939; Maddocks et al. 1993; Colin & Hoibian 2003; Maddocks 2005)
Kennethia major (Méhes, 1939)	New Caledonia (Grande Terre, Loyalty Islands, Ile des Pins) (Méhes 1939; De Deckker 1979; Hartmann 1984; Maddocks et al. 1993; Colin & Hoibian 2003; Maddocks 2005)
Limnocythere notodonta Vávra, 1906	Kiribati (Eagar 2000a,b)
Mangalocypria africana (Hartmann, 1974)	Papua New Guinea (Wouters 1998; Maddocks 2005); Palau, Mecherchar Island (jellyfish lake; unpubl. new record by KW, this paper)
Mangalocypria appendix Wouters, 1998	Papua New Guinea (Wouters 1998; Maddocks 2005)
Mangalocypria eleotridis (Harding, 1962)	Solomon Islands (Harding 1962; Hartmann 1984; Wouters 1998; Maddocks 2005)
Mungava intermedia Wouters, 1987	Papua New Guinea (Wouters 1987b, 1995; Maddocks 2005)
Mungava munda Harding, 1962	Solomon Islands (Harding 1962; Wouters 1987b, 1995; Maddocks 2005); Papua New Guinea (Wouters 1987b; Wouters 1995; Maddocks 2005)
Mungava papuensis Wouters, 1987	Papua New Guinea (Wouters 1987b; Maddocks 2005)
Mungava woutersi Maddocks, 2005	New Caledonia (Loyalty Islands) (Maddocks et al. 1993; Maddocks 2005)
Mungava xariessa Maddocks, 2005	New Caledonia (Loyalty Islands) (Maddocks et al. 1993; Maddocks 2005)
Paracypria uberis Maddocks, 2005	New Caledonia (Loyalty Islands) (Maddocks et al. 1993; Maddocks 2005)
Penthesilenula brasiliensis (Pinto & Kotzian, 1961)	New Caledonia (Grande Terre) (Martens & Rossetti 2002; Colin & Hoibian 2003; Maddocks 2005)
Pontoparta rara Vávra, 1901	Papua New Guinea, Bismarck Archipelago (Vávra 1901; Hartmann 1984; Maddocks 2005)
Potamocypris insularis Allison & Holden, 1971	Clipperton (Allison & Holden 1971; Hartmann 1984; Colin 2002)
Renaudcypris wolffi (Harding, 1962)	Solomon Islands (Rennell) (Harding 1962; Hartmann 1984); Papua New Guinea (Wouters 1984)
*Stenocypris major (*Baird, 1889) = *Stenocypris malcolmsoni* (Brady, 1886)	Hawaii (Tressler1937; fide Victor & Fernando 1980: the identification may not be correct); New Caledonia (Grande Terre) (Méhes 1939; Maddocks et al. 1993; Colin & Hoibian 2003; Maddocks 2005); Futuna; Wallis (this paper)
Stenocypris malayica Victor & Fernando, 1981	Futuna; Wallis (this paper)
Stenocypris marginata Daday, 1910	New Caledonia (Grande Terre) (Méhes 1939; Maddocks et al. 1993; Colin & Hoibian 2003; Maddocks 2005)
Strandesia rouxi Méhes, 1939	New Caledonia (Grande Terre) (Méhes 1939; Hartmann 1984; Maddocks et al. 1993; Colin & Hoibian 2003; Maddocks 2005
Strandesia vinciguerrae Masi, 1905	Futuna; Wallis (this paper)
Terrestricypris arborea Schornikov, 1980	Solomon Islands (Schornikov 1980)
Tungucypridopsis lairdi (Victor & Fernando, 1978)	Tokelau Islands (Victor & Fernando 1978; Victor 1983; Hartmann 1984)
Vestalenula daps (Harding, 1962)	Solomon Islands (Rennell) (Harding 1962; Rossetti & Martens 1998, 2002)
Vestalenula marmonieri Rosseti & Martens, 1999	New Caledonia (Grande Terre) (Rosetti & Martens 1999; Mary & Marmonier 2000; Colin & Hoibian 2003; Maddocks 2005)

juveniles were found (*Candonopsis* sp. and Cyprididae sp.).

Four species are new to the Pacific Islands: *Stenocypris malayica* (of which the first record after the original description is presented), *Chrissia* cf. *perarmata*, *Strandesia vinciguerrae* and *Alicenula* cf. *serricaudata*. *Parastenocypris perarmata* (Brady, 1904) is transferred into the genus *Chrissia*: *Chrissia perarmata* comb. nov.

Finally, an updated check-list of the non-marine Ostracoda of the Pacific Islands is presented.

Notes on species

Class Ostracoda Latreille, 1802
Subclass Podocopa G.W. Müller, 1894
Order Podocopida Sars, 1861
Suborder Cypridocopina Jones, 1901
Superfamily Cypridoidea Baird, 1845
Family Cyprididae Baird, 1845
Subfamily Herpetocyprinae Kaufmann, 1900

Genus *Stenocypris* Sars, 1889

Type species: *Stenocypris major* (Baird, 1859).

Within the Herpetocypridinae, this genus is easily recognized by the conspicuous marginal stripe of septa developed along the entire free margin of both valves. See Martens (2001a,b) for recent diagnoses of the genus.

***Stenocypris major* (Baird, 1859) Daday, 1898 (fig. 4A)**

Synonym: *S. malcolmsoni* (Brady, 1886).

Futuna. Leava, taro paddy field: 1 ovigerous fem., L=1.80 mm.
Wallis. Lake Alofivai: 7 ad. fem., L=1.78-1.96 mm; lake Lano: 26 ad. and juv. fem.; lake Lalolalo: 7 ad. and subad. fem., L=1.77-2.01 mm; Kikila 1: ca 540 spms (187 ad. fem.; L=1.76-1.89 mm for n=13 ovigerous fem.; ca 350 juv.); Kikila 2: 5 subad. fem.; lake Lanutavake: 1 ad. fem.

Only females were found. The males of this species are unknown.

Regional distribution: Hawaii; New Caledonia (Grande Terre); Futuna and Wallis.

Global distribution: circumtropical. Also Spain, southern France, Italy, the Balkans and Turkey.

Remark. The remarkable variability in both carapace shape and length of this widespread and apparently entirely parthenogenetic species has caused much confusion in the taxonomic literature. For recent contributions see Petkovski & Meisch (1996) and Martens (2001a).

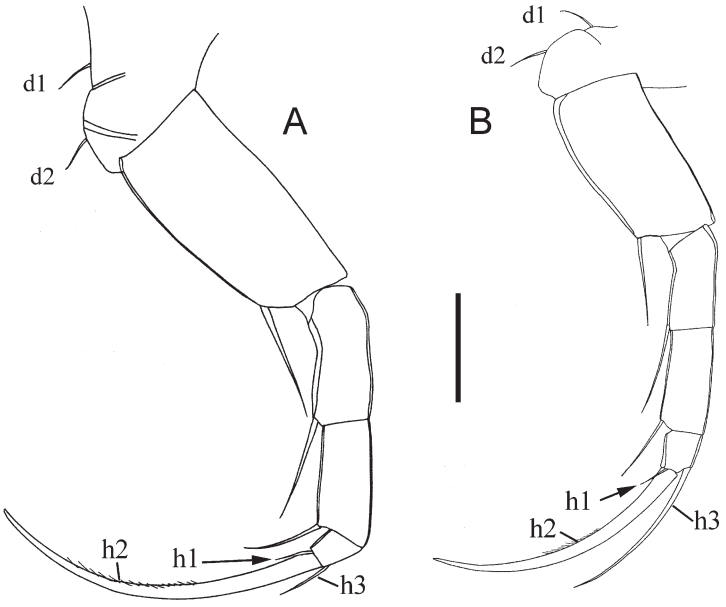


Fig. 3. Walking legs (2nd thoracopod, T2) of *Stenocypris major* (A) and *Stenocypris malayica* (B). Scale bar: 100 μm.

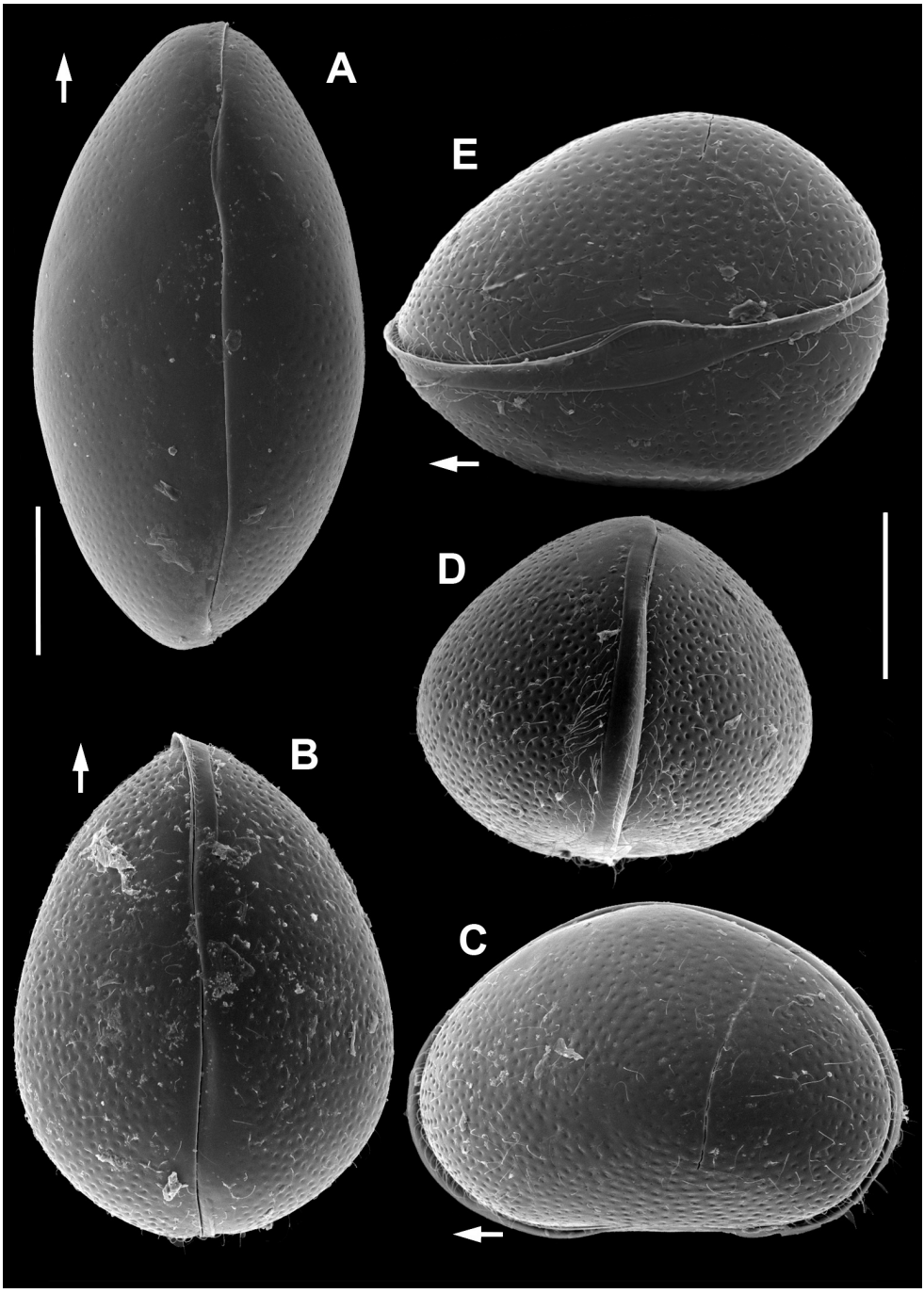


Fig. 4. *Strandesia vinciguerrae* (Masi) (female): A, carapace in dorsal view. *Cypretta seurati* Gauthier (female): B, carapace in dorsal view; C, in lateral view; D, in frontal view; E, in oblique ventral view. Scale bars: 0.20 mm (left bar for A; right bar for B-E).

***Stenocypris malayica* Victor & Fernando, 1981 (fig. 4B)**

Futuna. Leava, taro paddy field: 239 spms (71 ad., mostly ovigerous fem.; 168 juv.); Sausau: 2 ad. and 1 juv.; Sausau taro paddy field: 2 juv.; Gutuvai: 1 juv.
Wallis. Lake Lano: 9 ad. and subad. fem.; Kikila 1: 3 ovigerous fem.

Only females were found. The males of this species are unknown.

Distribution: previously only known from the environs of Kuala Lumpur, Malaysia (Victor & Fernando 1981).

Remarks. (1) *S. malayica* is new to the Pacific Islands and Oceania in general. It is recorded here for the first time since its original description from Malaysia (Victor & Fernando 1981).

(2) In the samples from Futuna and Wallis, the adults of *S. malayica* could readily be separated from those of *S. major* by the carapace size alone: 1.24-1.53 mm for *S. malayica*, 1.68-2.01 mm for *S. major*.

(3) The subadult females of the last instar (A-1) lack the marginal valve septa, the latter appearing only after the last moult. The last instar is best recognized by the presence of 4+1 natatory setae on the antennae (5+1 such setae in the adult).

(4) While distinction of many species of the genus *Stenocypris* is (extremely) uneasy, *S. malayica* is readily recognized by a remarkable 'soft part' character. Indeed, each of the sixth limbs (L6, 2nd thoracopods, T2, walking legs) bears two claws: the usual cypridid h2-claw plus a shorter additional claw (fig. 3B). The latter results from the reinforcement of the terminal h3-seta. Within the genus *Stenocypris*, only *S. spinosa* Tressler, 1937, which was originally described from a single juvenile (subadult ?) female from the Philippines, is known to have a similar h3-claw. *S. spinosa* has A2-natatory setae which extend to mid-length of the terminal A2-claws (to the tips of these claws in *S. malayica*), which character should allow easy distinction of the two species. Also, the valves of the type specimen of *S. spinosa* lack the marginal stripe of septa. If the absence of the septa will be confirmed in the adults, then *S. spinosa* should be transferred to the genus *Chrissia* (Tressler 1937; Victor & Fernando 1981).

Genus *Chrissia* Hartmann, 1957

Synonyms (fide Martens 2001a): *Gesa* Hartmann, 1957; *Parastenocypris* Hartmann, 1957. Type species: *Chrissia levetzovi* Hartmann, 1957.

The species of this genus share with those of *Stenocypris* the following conspicuous features: (a) the carapace is elongated and laterally compressed (best seen in dorsal view); (b) the uropodal (caudal) rami are strongly asymmetrical, the right ramus bearing distinctly larger spines than the left one. *Chrissia* is readily separated from *Stenocypris* by the absence of marginal septa on both valves.

***Chrissia* cf. *perarmata* (Brady, 1904)**

Wallis. Lano: 9 spms (5 ovigerous fem., L=1.48-1.53 mm and 4 juv.); Lalolalo: ca 43 ad. and juv. spms; Kikila 1: 2 ovigerous fem. (L=1.45-1.47 mm); Kikila 2: 7 ad. and juv. spms; Ha'atofo: several spms; Mala'e fo'ou: several spms.

Only females were found. The males of *Chrissia perarmata* remain unknown.

Distribution: formerly only known from South and Central Africa.

Remarks. (1) The animals from Futuna and Wallis closely resemble in both carapace shape and size those described and illustrated by Sars (1924) from South Africa. The species not having been recorded from outside Africa, we cautiously prefer to identify our specimens as cf. *perarmata*.

(2) *Chrissia perarmata* was first described as *Stenocypris perarmata* by Brady (1904) from Natal in South Africa. McKenzie (1971), because of the absence of marginal septa, transferred it into the genus *Parastenocypris* Hartmann, 1964. Martens (2001a; also pers. comm.) put *Parastenocypris* in synonymy with *Chrissia*, but without formally reassigning the corresponding species to *Chrissia*. The formal transfer of *perarmata* to the genus *Chrissia* is proposed here: *Chrissia perarmata* (Brady, 1904) comb. nov.

Subfamily Cypricercinae McKenzie, 1971

Genus *Strandesia* Stuhlmann, 1888

Type species: *Strandesia mercatorum* (Vávra, 1895) G.W. Müller, 1912.

This is a large and complex genus in need of revision (Martens 2001a). See Karanovic (2005) for a recent contribution to the taxonomy of *Strandesia* and a key to the species currently assigned to the genus. The identification of the single species recorded from Futuna and Wallis is unproblematic.

***Strandesia vinciguerrae* (Masi, 1905) G.W. Müller, 1912 (fig. 4A)**

Synonyms: *Strandesia rotunda* Hartmann, 1964 (fide Karanovic 2006); *Strandesia anterotundata* Rome, 1977 (fide Martens 1984).

Futuna. Leava taro paddy field: 4 ad. fem. (L=0.80-0.84 mm).
Wallis. Lano: 17 spms (mostly ovigerous fem., L=0.84-0.86 mm); Lalolalo: 54 mostly ovigerous fem. (L= 0.82-0.84 mm for n=5 ad. fem.).

Only females were found. The males of this species are unknown. Both the carapace and the appendages of the animals from Futuna and Wallis comply rather perfectly with those recorded and illustrated by Beyer et al. (1997) from the Canary Islands.

Regional distribution: the species is here reported for the first time from the Pacific Islands.

Global distribution: Canary Islands, southern Europe (Spain, Italy, the Balkans), the Middle East, North and subsaharian Africa, India, Pacific Islands.

Subfamily Cyprettinae Hartmann, 1963

Genus *Cypretta* (Vávra, 1895) Müller, 1898

Type species: *Cypretta tenuicauda* (Vávra, 1895) G.W. Müller, 1898.

This genus comprises around 55 extant nominal species (Kempf 1980, 1997), many of which have been rather poorly described. We suspect that quite a number of them will turn up to be identical with the widely distributed *Cypretta seurati*.

***Cypretta seurati* Gauthier, 1929 (fig. 4B-D)**

Synonym: *Cypretta dubiosa* (Daday, 1900) G.W. Müller, 1912.

Futuna. Leava taro paddy field: 119 spms (mostly middle aged juv.); Sausau taro paddy field: 51 spms (L=0.57-0.60 mm for n=9 ad. fem.).
Wallis. Lano: 295 spms; Lalolalo: 94 spms (mostly ovigerous fem., L=0.63-0.67 mm, n=4 ad. fem.); Kikila 1: 19 fem. (L=0.54-0.57 mm, n=10 ad. fem); Ha'atofo: ca 130 spms.

Only females were found. The males of this species are unknown.
Both valves of the species of this genus, and the Cyprettinae in general, have conspicuous marginal septa. The latter are internal valve structures and therefore visible in the light microscope, but not the SEM. The individuals collected from Futuna and Wallis comply well with those described and illustrated from southern Japan (Okubo 1973), France (Meisch 1987), and Easter Island (Dumont & Martens 1996).

Regional distribution: Easter Island; Futuna; Wallis; Japan; South Korea; Malaysia; Indonesia; the Philippines.

Global distribution: widely distributed in the circumtropical regions; also in the 'warm' areas of the temperate zones (e.g., Spain, southern France, Italy, the Balkans and the circum-mediterranean areas in general).

Family Cypridopsinae Kaufmann, 1900

This large family is characterised by the reduced, flagelliform uropodal rami (caudal rami, 'furca'). Cypridopsinae is most certainly a polyphyletic lineage, the partial reduction of the uropodal rami having occurred repeatedly and independently in separate cypridid lineages.

Genus *Cypridopsis* Brady, 1867

Type species: *Cypridopsis vidua* (O.F. Müller, 1776) Brady, 1867.

***Cypridopsis vidua* (O.F. Müller, 1776) Brady, 1867**

Futuna. Leava taro paddy field: 105 ad. and subad. fem.; Sausau: 62 mostly ad. fem.; Sausau taro paddy field: 172 ad. and juv. spms (L=0.54-0.58 mm, n=9 ad. fem.); Gutuvai: 32 ad. and subad. fem.; lake Nuku: 2 ad. fem.
Wallis. Lalolalo: 4 fem.

Only females were found. The males of this species are unknown (except if the North American *C. okeechobei* Furtos, 1936, of which both parthenogenetic and bisexual popula-

tions are known, will be found to be conspecific with *C. vidua*) (see Meisch 2000: 377).

Regional distribution: Hawaii; Futuna; Wallis. Global distribution: cosmopolitan.

Family Candonidae Kaufmann, 1900
Subfamily Candoninae Kaufmann, 1900

***Candonopsis* sp.**

Futuna. Lake Nuku: 17 juv.

Only unidentifiable juveniles were found. For a key to all the species of this genus and a recent contribution to its taxonomy see Karanovic & Marmonier (2002) and Karanovic (2004), respectively.

Suborder Darwinulocopina Sohn, 1988
Superfamily Darwinuloidea Brady & Norman, 1889
Family Darwinulidae Brady & Norman, 1889

Until recently, the entirely freshwater Darwinulidae, the single extant family of the whole darwinuloid lineage, with 30 living species, were believed to be so-called "ancient asexuals" (e.g., Martens et al. 2005), having persisted for some 200 million years without sexual reproduction. Indeed, both fossil and extant populations were known to consist of females only. Very recently, however, Smith et al. (2006) reported the first (believable) finding of males of an extant darwinulid species, *Vestalenula cornelia* Smith et al., 2006 from Japan.

Genus *Alicenula* Rossetti & Martens, 1998

Type species: *Alicenula serricaudata* (Klie, 1935) Rossetti & Martens, 1998.

***Alicenula* cf. *serricaudata* (Klie, 1935) Rossetti & Martens, 1998**

Wallis. Lalolalo: 2 ovigerous females, L=0.61 mm.

The decalcified valves and the small number of individuals entail a slight uncertainty regarding the specific identification. The carapace length of the two animals is similar to those reported by Klie (1938) from West Africa.

Regional distribution: if confirmed, this would be the first record of the species, and also the genus, from the Pacific Islands and Oceania in general (Martens & Rossetti 2002).

Global distribution: West Africa, Brasil (Martens et al. 1998).

Suborder Cytherocopina Baird, 1850
Superfamily Cytheroidea Baird, 1850

Wallis. Lano: 2 spms.

Poor preservation prevented the specific identification of the two individuals belonging to this superfamily.

4. Conclusion

The first check-list of both marine and non-marine Ostracoda from the Pacific Islands, published by Hartmann (1984), comprised 20 non-marine species. Although that number has increased to 58 in the updated list provided here, the non-marine ostracods of that huge geographic region remain very imperfectly known. This because since 1984 only around 23 contributions, most of them based on occasional findings, have dealt with that fauna.

That poor knowledge can also be seen from the fact that four of the nine species recorded from Futuna and Wallis are new to the Pacific Islands: *Stenocypris malayica, Chrissia* cf. *perarmata*, *Strandesia vinciguerrae* and *Alicenula* cf. *serricaudata*. Of these, at least *S. vinciguerrae* is known to have a very wide distribution, from the Canary Islands, southern Europe and both northern and central Africa to India and the islands of Futuna and Wallis. From this, a wide circumtropical distribution may be inferred. In fact, one may suspect the three other species new to the region to have a similar wide distribution.

Remarkably, the seven species from Futuna and Wallis of which adults have been found (table 1), are represented by females only, from which observation parthenogenetic reproduction must be inferred. In fact, for none of these seven species, with the possible exception of *Cypridopsis vidua* (see there), any males have thus far been recorded. Parthenogenesis greatly facilitates colonisation of remote habitats, as indeed one single female is sufficient to found a new population.

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