

THE GENUS *SIMOGNATHUS* (ACARI : HALACARIDAE), DESCRIPTION OF SIX NEW SPECIES FROM SOUTHERN AUSTRALIA AND A TABULAR KEY TO ALL SPECIES

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SIMOGNATHUS
HALACARIDS
WESTERN AUSTRALIA

ABSTRACT : The halacarid fauna in southwestern Australia proved to be remarkably rich in species. The genus *Simognathus* is represented with at least six species. The species are described and figured and a key to all known species is presented.

SIMOGNATHUS
HALACARIDAE
WESTAUSTRALIEN

ZUSAMMENFASSUNG : Die Halacariden-Fauna im Südwesten Australiens erwies sich als sehr artenreich. Sechs Arten der Gattung *Simognathus* werden aus dieser Region beschrieben. In einem tabellarischen Bestimmungsschlüssel werden Merkmale aller Arten zusammengestellt.

SIMOGNATHUS
HALACARIENS
AUSTRALIE OCCIDENTALE

RÉSUMÉ : Du littoral d'Australie Occidentale on trouve une faune d'halacariens très riche en espèces. Six nouvelles espèces de *Simognathus* ont été trouvées. Les espèces sont décrites et une clé tabulaire de toutes les espèces est présentée.

INTRODUCTION

Simognathines are easily distinguished from other halacarid mites by the oblong, heavily armoured idiosoma, the almost spherical gnathosoma base with short, cone-like rostrum, heavily armoured legs with clavate tibiae, tibia I characterized by the large ventral spine and tarsus I being distinctly shorter than the posterior tarsi. The subfamily Simognathinae includes 2 genera, *Simognathus* and *Acaromantis*. In western Australia, the genus *Simognathus* is represented with at least six species.

MATERIAL AND METHODS

The species described were collected in January 1991 during the Fifth International Marine Biological Workshop : The Marine Flora and Fauna of

Rottneest Island, Western Australia. Various substrata such as colonies of corals, polychaetes, barnacles, brown and red algae and sediment were scanned for halacarid mites.

Holotypes are deposited in the Western Australian Museum (WAM), Perth, paratypes and other material in the WAM and the author's collection.

Abbreviations used in the descriptions : *AD*, anterior dorsal plate ; *AE*, anterior epimeral plate ; *ds*, dorsal setae on idiosoma, *ds-I*, anterior pair of dorsal setae ; *E*, epimeral plate(s) ; *GA*, genitoanal plate ; *GO*, genital opening ; *GP*, genital plate ; *OC*, ocular plate(s) ; *P*, palp ; *pas*, parambulacral setae ; *PD*, posterior dorsal plate ; *PE*, posterior epimeral plate ; *pgs*, perigenital setae ; *sgs*, subgenital setae. Legs are numbered I to IV, leg segments 1 to 6, e.g. I-5 is tibia on leg I.

Formula for leg chaetotaxy is given from the trochanter onward ; solenidia and famuli are omitted.

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Simognathus delicatulus n. sp.

(Figs. 1-10)

Material examined : Holotype female (WAM), Rottneest Island, Cape Vlamingh, medium-grained sediment from lower beach, 2-15 cm sediment depth, 15 January 1991.

Paratype male (author's collection), type locality.

Female : Idiosoma length 250 μ m. Dorsal plates with delicate foveae and with fine porosity. *AD* 105 μ m long, 92 μ m wide, with a pair of gland pores posterior to level of insertion of leg I. *OC* oblong, slender, 20 μ m long, 6 μ m wide, obscured by striated integument. *PD* 127 μ m long, 87 μ m wide, anterior margin truncate. Setae *ds-1* and *ds-3* on the *AD*, *ds-1* slightly posterior to level of gland pore, *ds-2* on minute sclerites anterior to *OC*. Adanal setae marginally (Fig. 1).

Median *AE* and anterior *GA* with very delicate porosity, not foveate; lateral portions of *AE* and posterior *GA* foveate (Fig. 2). *AE* 98 μ m long, 118 μ m wide; posterior margin truncate. Epimeral processes present. Epimeral vesicles large. *GA* 127 μ m long, 70 μ m wide, *GO* 28 μ m long, 15 μ m wide; interval from *GO* to anterior margin of *GA* equalling 3 times the *GO*'s length.

Gnathosoma 75 μ m long, 65 μ m wide. Tectum small, scale-like (Fig. 5). Second palpal segment with a ventral bristle; ventral knob probably present and separated from the bristle (Fig. 6) (specimen not in favourable position for study).

Legs I and II with telofemora longer than basifemora and trochanters. Legs III and IV with telofemora distinctly longer than basifemora and almost as long as trochanters. Telofemur I slender, 2.4 longer than high. Tibia I almost as long as telofemur I, but much wider, about 1.6 longer than high (length without posterior lamellae); with short cylindrical base, then abruptly bulging; the base being less than one third of the tibia's height (Fig. 8). Tibia II 1.7 longer than high. Telofemora III and IV 1.8 and 1.7 longer than high, tibiae III and IV 1.9 and 2.1 longer than high. Length of tarsus I (without posterior lamellae) 1.4 its height. Leg chaetotaxy : leg I, 1, 2, 2, 4, 5, 6; leg II, 1, 2, 2, 4, 5, 6; legs III and IV, 1, 1, 2, 3, 5, 5. Telofemur III

with one of the 2 dorsal setae being long and inserted near the segment's base; IV-3 with the 2 setae short, subequal in size and inserted adjacent (Fig. 10). Ventral spine on tibia I stout, apically pointed but not slowly tapering; without basal swelling (Fig. 7). Articular membrane with slender, flagelliform ventromedial seta. Ventral and ventro-medial spines on tibiae II-IV bipectinate (Figs. 9, 10). Tarsus I with long and tapering ventral spine inserted in basal half of the tarsus; solenidion slender, seta-like, placed close to lateral membrane of claw fossa (Fig. 7). Tarsi II-IV each with a ventral, slightly pilose seta. Solenidion on tarsus II, on inner flank of the medial membrane of claw fossa, about 8 μ m long.

Tarsus I with long median claw and slender lateral claws. Posterior tarsi with minute median claw; lateral claws stout, with pecten.

Male : Idiosoma length 241 μ m. Dorsal plates similar in outline though slightly longer than in female. *GA* 110 μ m long, *GO* 15 μ m long, its distance to anterior margin of *GA* about 5 times its length. One pair of outlying setae and 12-13 pairs of *pgs* close around the *GO* (Fig. 4).

Remarks : *Simognathus delicatulus* is characterized by *OC* reduced to elongate sclerites and tibia I having short cylindrical base and then strongly bulging, with the height equalling 0.6 the length.

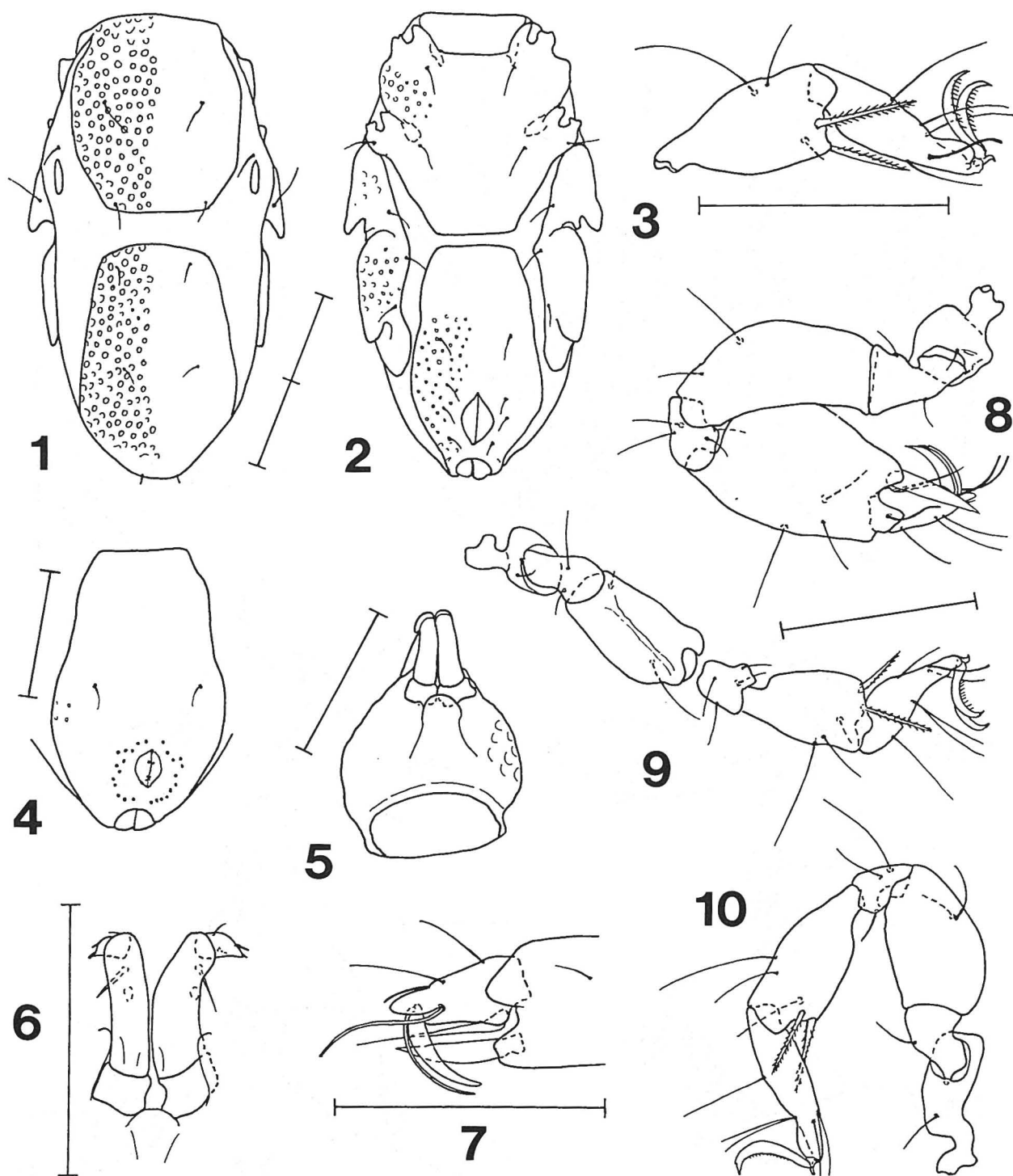
Simognathus gibberosus n. sp.

(Figs. 11-22)

Material examined : Holotype female (WAM), Rottneest Island, Little Armstrong Bay, sediment from 30 cm sediment depth in upper slope, 23 January 1991.

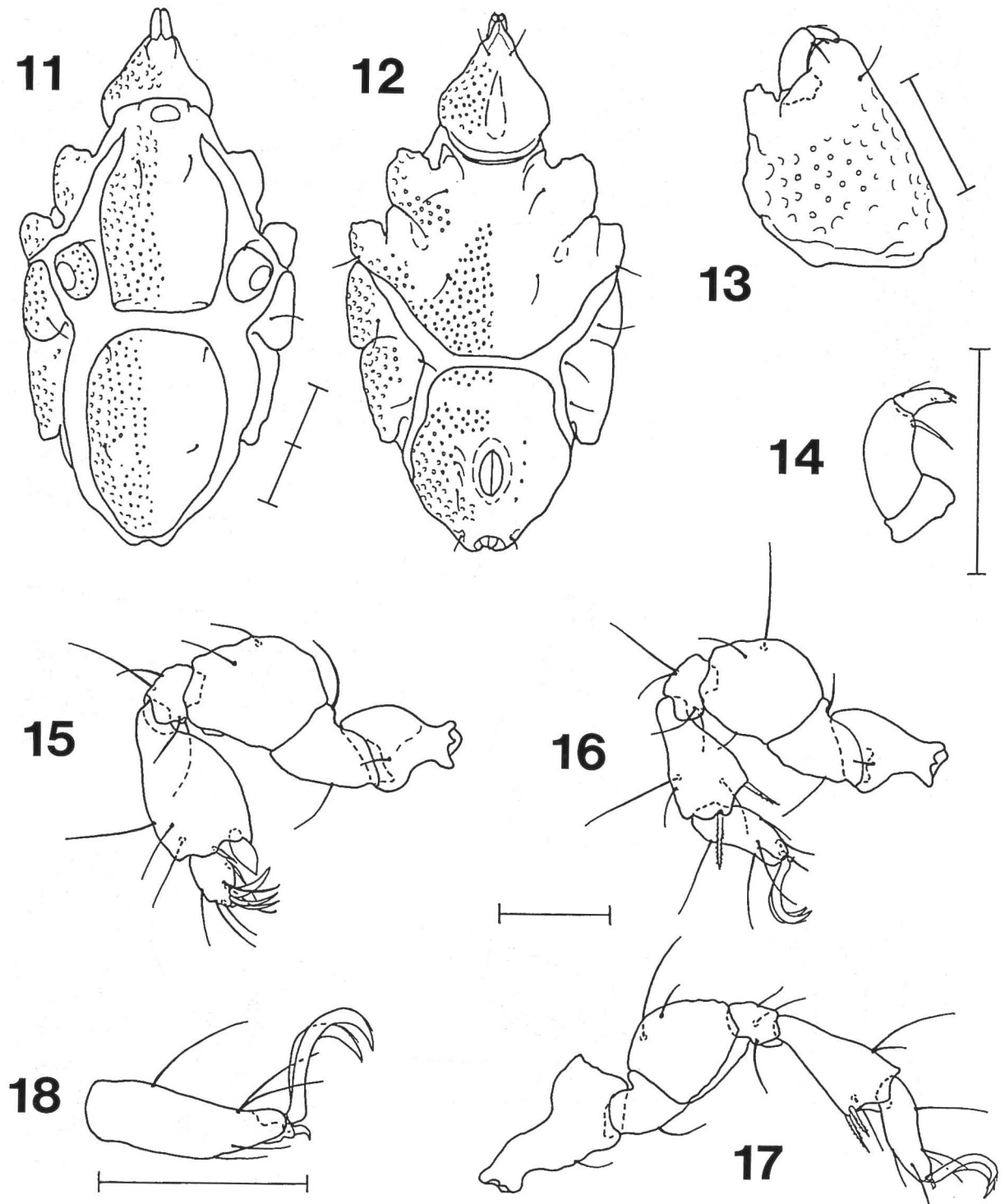
One male (WAM), Nancy Cove, corallines from concrete piling, just below low water zone, 12 January 1991.

One female, 1 male, Nancy Cove, sediment and algae on rocky platform, 12 January 1991; 1 female, Fish Hook Bay, sediment and green algae on microcliff, 9 January 1991; 1 female, 1 male, Fish Hook Bay, algae, mainly red algae *Liagora* sp. on rocky platform, 9 January 1991 (all in the author's collection).



FIGS. 1-10 : *Simognathus delicatulus* n. sp.

1. — Idiosoma, dorsal, female. 2. — Idiosoma, ventral, female. 3. — Tibia and tarsus III, medial, male. 4. — Genitoanal plate, male. 5. — Gnathosoma, dorsal, male. 6. — Tectum and palps, dorsal, female. 7. — Posterior tibia and tarsus I, lateral, male (medial setae and claw omitted). 8. — Leg I, medial, male. 9. — Leg II, ventromedial, male. 10. — Leg IV, medial, male. (Each scale division equals 50 μ m)



FIGS. 11-18 : *Simognathus gibberosus* n. sp.

11. — Idiosoma and gnathosoma, dorsal, female. 12. — Idiosoma and gnathosoma, ventral, female. 13. — Gnathosoma, lateral, male. 14. — Palp, male. 15. — Leg I, medial, female. 16. — Leg II, medial, female. 17. — Leg III, medial, female. 18. — Tarsus IV, medial, female. (Each scale division equals 50 μ m)

Female : Idiosoma length 357-408 μm , in holotype 357 μm . Anterior idiosoma elongate, projecting beyond level of insertion of leg I (Fig. 11). Dorsal and ventral plates yellowish-brownish, but without distinct area with dark-brown pigmentation. Dorsal plates with foveae and with few and very delicate canaliculi in deeper integumental layers. *AD* 168 μm long, 105 μm wide. Anterior *AD* with a distinct cornea; posterior *AD* rectangular. *OC* 40 μm long, 32 μm wide, foveate, and with one large lateral cornea. *PD* 166 μm long, 115 μm wide; widest in its anterior half. *PD* with 2 slightly raised longitudinal costae. Anterior margin rather truncate. Membraneous integument between the plates very coarsely striated. Setae *ds-1* and *ds-3* inserted on the *AD*, *ds-1* on a level with insertion of leg I, *ds-3* in posterior edges of the *AD*. Setae *ds-2* placed in anterior margin of the *OC*; *ds-4* and *ds-5* on the *PD*, *ds-4* in anterior corners, *ds-5* on a level with insertion of leg IV. Adanal setae in ventrolateral position.

Ventral plates foveate save for a gable-like area on the *AE* and a transverse area on the *GA* (Fig. 12) in which the superficial integument is smooth. *AE* 162 μm long, 223 μm wide. Epimeral processes large, flanking the base of the trochanters. Epimeral vesicles large, each with a slit at the surface. *GA* 149 μm long, 130 μm wide; *GO* 41 μm long and 20 μm wide, its distance to anterior margin of *GA* equalling 1.5 the *GO*'s length. Perigenital setae slender, the 4 pairs of setae arranged as illustrated (Fig. 12).

Gnathosoma 115 μm long, 90 μm wide. Tectum large, slightly tricuspid (Fig. 11). Basal pair of maxillary setae longer than apical pair of setae; 2 pairs of rostral setae being spur-like. Palps short. P-1 obscured by lateral lamellae (Fig. 13). Second palpal segment short, 2.4 longer than high, with a ventral bristle but no distinct ventral knob (Fig. 14). Terminal segment slightly less than half the length of the 2nd segment.

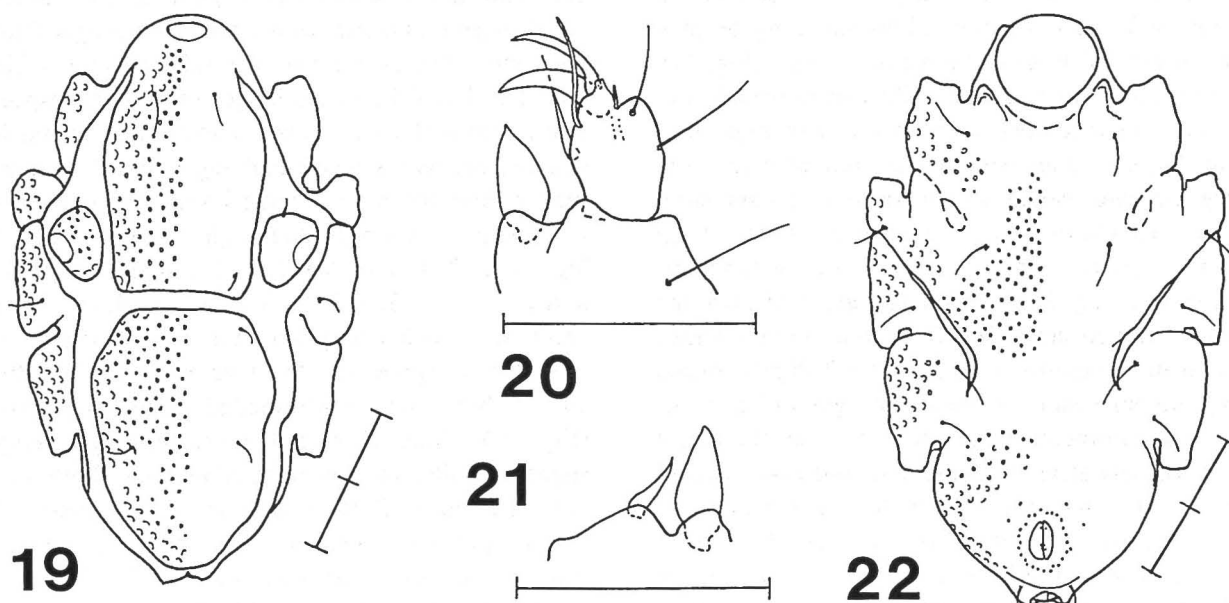
Leg I about as long as leg II (Figs. 15, 16). Insertion of legs almost equidistant. All telofemora short, 1.2 longer than high, with ventrolateral and ventromedial carinae. Telofemur I hardly longer than basifemur I and only slightly longer than trochanter I. Telofemur II scarcely longer than

basifemur and trochanter II. Legs III and IV rather equal in general facies, with trochanters longer than telofemora and even tibiae. All tibiae clavate. Tibia I-IV 1.7, 1.6, 2.0 and 2.0 longer than high, respectively. Basal third of tibia I narrow and cylindrical, the segment's distal half high, about 3 times higher than the base. Tarsus I very short, almost rectangular, 1.4 longer than high. Leg chaetotaxy: leg I, 1, 2, 2, 4, 5, 6; leg II, 1, 2, 3, 4, 5, 6; legs III and IV, 1, 1, 2, 3, 5, 5. IV-3 with both dorsal setae short, III-3 with 1 very long and 1 short seta (Fig. 17). Ventral spine on tibia I very short (Fig. 20), with a blunt tip; ventromedial bristle spine-like (Fig. 21). Tibia II with the ventral spine being slightly smaller than ventromedial spine, both spines bipectinate. Both ventral spines on tibiae III and IV pectinate. Ventral spine on tarsus I tapering; solenidion short and rod-like, hardly 5 μm long, famulus within a flap-like lamella. Tarsus II with small membranes of claw fossa; medial membrane with about 6 μm long solenidion on its inner flank.

Median claw on tarsus I stouter than the slender, scythe-shaped lateral claws. Posterior tarsi with minute median claw and slender lateral claws. Lateral claws with accessory process but without pecten.

Male : Idiosoma 325-376 μm long. *AD* and *OC* slightly larger than in female (relative to width and insertion of dorsal setae) (Fig. 19). *AE* and *GA* broadly fused; posterior *PE* and *GA* fused (Fig. 22). Arrangement of porose and smooth areolae similar to that in female. *GO* 25 μm long; 4 outlying *pgs* plus 27 *pgs* arranged close around the *GO*. Spermatopositor extending slightly beyond the ring of *pgs*.

Remarks : *Simognathus gibberosus* with its rounded *OC*, short but high telofemora and short ventral spine on tibia I is most similar to *Simognathus glaber* Bartsch, 1986, a species recorded from New Zealand (BARTSCH, 1986). *S. gibberosus* is distinguished from *S. glaber* in having: an *AD* 1.6 longer than wide, almost truncate anterior *PD*, gable-like smooth area on *AE* with superficial integument smooth, shorter *GA* (female), insertion of legs almost equidistant, no ventral knob on second palpal segment.



FIGS. 19-22 : *Simognathus gibberosus* n. sp.

19. — Idiosoma, dorsal, male. 20. — Posterior tibia and tarsus I, lateral, female (medial setae and claw omitted). 21. — Detail of posterior tibia I, medial, female. 22. — Idiosoma, ventral, male. (Each scale division equals 50 μ m)

Simognathus gracilis n. sp.

(Figs. 23-32)

Material examined : Holotype female (WAM), Rottneest Island, Duffield Ridge, medium to coarse sand, 30 m depth, 17 January 1991.

Paratype male (WAM), type locality.

One female, 2 males (author's collection), type locality.

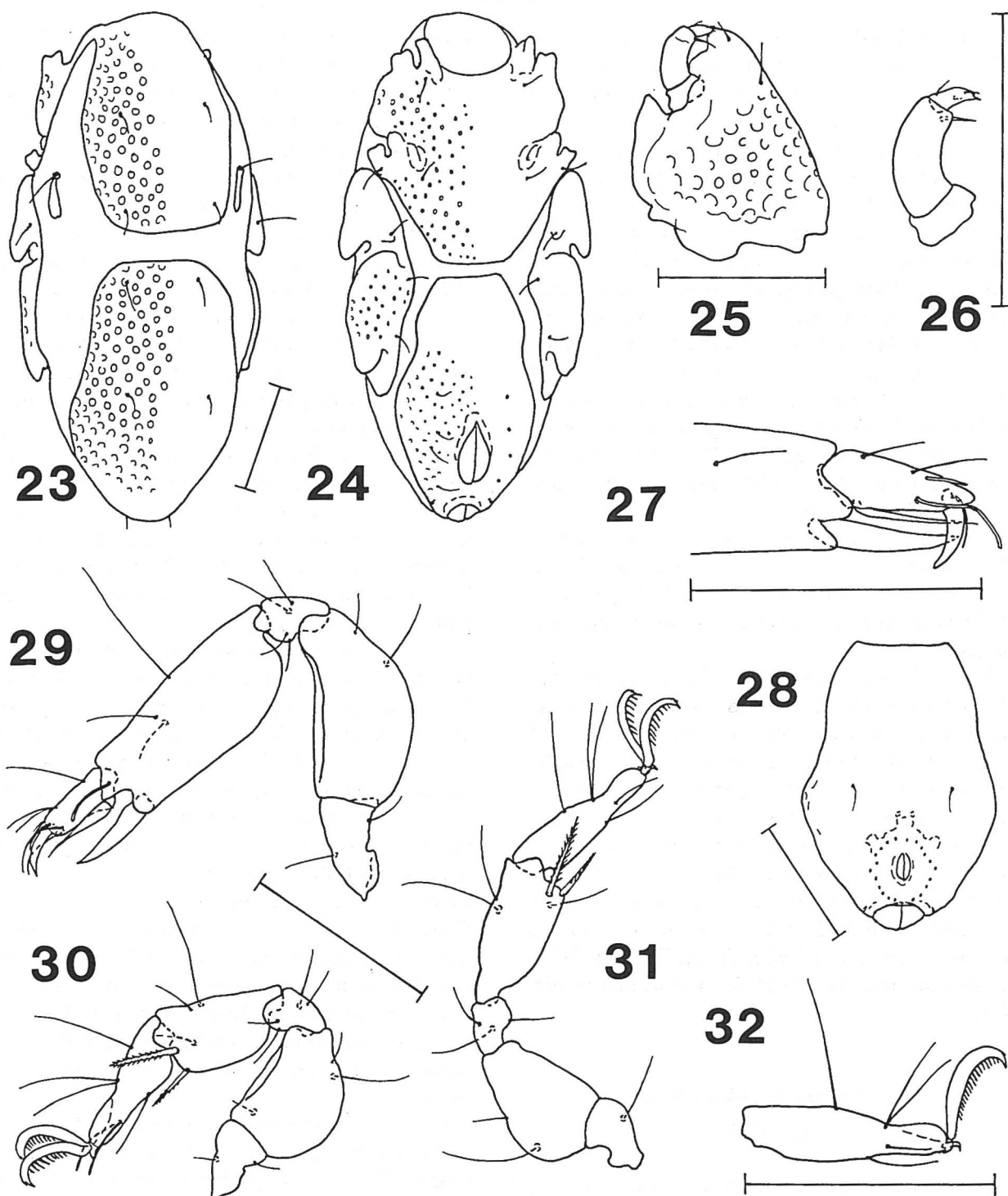
Female : Idiosoma length 180-240 μ m, holotype 240 μ m. Dorsal plates delicate, with small foveae and with dense porosity. *AD* rectangular, 105 μ m long. *OC* 17 μ m long, 5 μ m wide, more or less obscured by the coarsely striated integument. *PD* 121 μ m long. Setae *ds-1* and *ds-3* inserted on the *AD*, *ds-1* distinctly posterior to level of insertion of leg I, *ds-3* clearly removed from posterior margin of *AD*. Setae *ds-2* on small sclerites just anterior to the *OC* (Fig. 23). Setae *ds-4* and *ds-5* on the *PD*, *ds-4* removed from anterior margin of *PD*. Interval between *ds-4* less than that between *ds-5*. Setae *ds-6* in marginal position.

AE sculptured with foveae which are distinct near

the margin but faint in the median plate. *AE* 90 μ m long. Lateral and medial epimeral processes flanking the base of trochanters I and II. Epimeral vesicles with rather long slit. Anterior *PE* (*EIII*) with very faint foveae. Indentation between *EIII* and *EIV* deep. Ventral seta on *EIII* inserted on small cone-like knob (Fig. 24). *GA* 115 μ m long ; integument in anterior portion rather smooth, in posterior portion foveate. *GO* 28 μ m long, removed from anterior margin of *GA* for 2.4 the *GO*'s length.

Gnathosoma 73 μ m long. Rostrum almost conical. Palps short (Fig. 25). Second palpal segment 2.35 longer than high. Ventral knob lacking (Fig. 26). Third palpal segment short, about as long as the second segment's height and 0.4 the latter's length.

Integument of the legs rather smooth. All telofemora longer than basifemora. Telofemur I 2.1 longer than high. Tibia I elongate, 2.4 longer than high, its cylindrical base very short, less than one-tenth of the segment's length (Fig. 29). Telofemur II slightly longer and higher than tibia II (Fig. 30). Tibia III somewhat longer than III-3, IV-5 as



FIGS. 23-32 : *Simognathus gracilis* n. sp.

23. — Idiosoma, dorsal, female. 24. — Idiosoma, ventral, female. 25. — Gnathosoma, lateral, male. 26. — Palp, male. 27. — Posterior tibia and tarsus I, lateral, male (medial setae and claw omitted). 28. — Genitoanal plate, male. 29. — Basifemur-tarsus I, medial, female. 30. — Basifemur-tarsus II, medial, female. 31. — Basifemur-tarsus III, ventromedial, female. 32. — Tarsus IV, medial, female. (Each scale division equals 50 μ m)

long as IV-3. III-3, III-5, IV-3 and IV-5 1.5, 2.1, 1.8, 2.3 longer than high respectively. Tarsus I 2 times longer than high, highest within the basal half. Leg chaetotaxy : leg I, 1, 2, 2, 4, 5, 6 ; leg II, 1, 2, 3, 4, 5, 6 ; legs III and IV, 1, 1, 2, 3, 5, 5. Telofemur III with 1 long, more basally inserted seta and 1 short seta (Fig. 31) ; telofemur IV with 2 short setae inserted at almost the same level. Ventral spine on tibia I elongate, acutely pointed, not slowly tapering (Fig. 27) ; ventromedial bristle seta-like and curved. Ventral and ventromedial spines on tibiae II-IV bipectinate. Ventral spine on tarsus I tapering ; solenidion seta-like, adjacent to the flap-like lateral membrane. Tarsus II with 1 ventral bristle, long lateral and medial *pas* ; solenidion almost 10 μ m long. Tarsi III and IV (Fig. 32) each with 1 long ventral bristle and a smaller medial *pas* ; lateral *pas* lacking.

Median claw on tarsus I remarkably short, lateral claws bristle-like, shorter than median claw. Posterior tarsi with small median claw ; the large lateral claws each bear an accessory process and claw pecten.

Male : Idiosoma 198-232 μ m long. Sclerite with *ds-2* joined to *OC*. *GA* 110 μ m long, 75 μ m wide, *GO* 14 μ m long, 6 μ m wide, surrounded by a ring of 21 *pgs*. A pair of outlying *pgs* in about the middle of the plate (Fig. 28). Spermatopositor small, slightly surpassing the ring of *pgs*.

Remarks : *Simognathus gracilis* is distinguished from other species with almost reduced, elongate *OC* by length of leg I (tibia being about 2.4 longer than high), with the 3 dorsal setae removed towards mid of I-5, and tarsus I with the median claw being rather short and the lateral claws short and bristle-like.

Simognathus maculatus n. sp.

(Figs. 33-44)

Material examined : Holotype female (WAM), Rottneest Island, Bickley Point, seagrass *Amphibolis antarctica* densely covered with epifauna and epiflora, 0.5 m depth, 18 January 1991.

One female, Little Armstrong Bay, seagrass *Posidonia* sp., 0.5 m depth, 16 January 1991 ; 1 female,

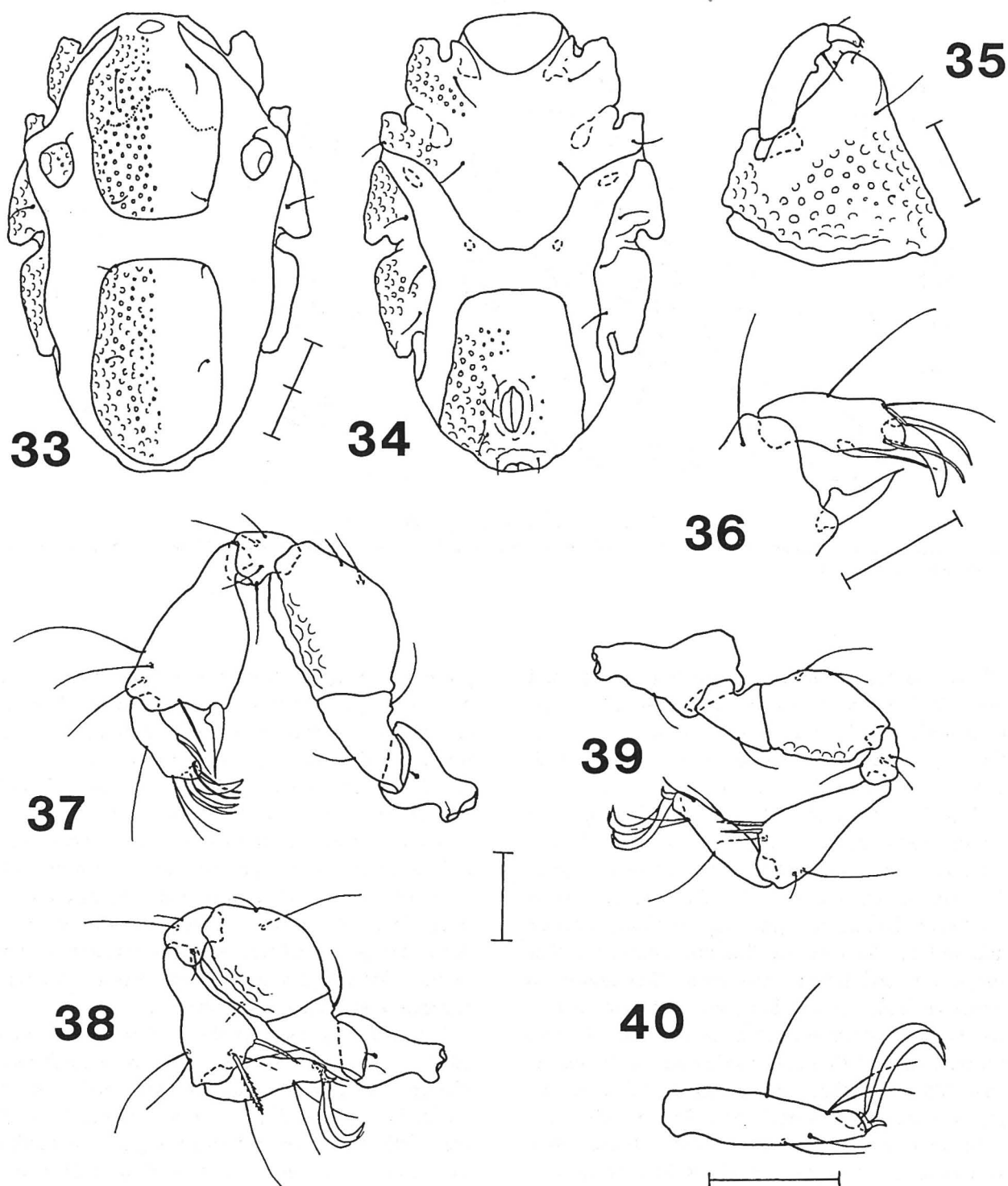
1 deutonymph, Nancy Cove, corals (*Pocillopora* sp.) from rocky platform, 0.5 m depth, 20 January 1991 ; 1 protonymph, Cape Vlamingh, red algae *Liagora* on rocky platform, 9 January 1991 (all in the author's collection).

Female : Idiosoma length 372-446 μ m, holotype 446 μ m long, 290 μ m wide. Dorsal plates with superficial foveae ; these are in deeper integumental layers surrounded by delicate canaliculi. *AD* 202 μ m long, 134 μ m wide ; with large anterior cornea. Integument in posterior *AD* with markedly brownish pigmentation (Fig. 33). *OC* 40 μ m long, 32 μ m wide, rounded, with foveae ; lateral cornea not set off distinctly from remainder of the plate. *PD* 200 μ m long, 130 μ m wide. Anterior margin rather truncate. Setae *ds-1* and *ds-3* on the *AD*, *ds-1* on a level with insertion of leg I, *ds-3* in posterolateral margin of the plate. Setae *ds-2* placed on minute sclerites adjacent to the *OC*. Setae *ds-4* in anterolateral margin of the *PD*, *ds-5* posterior to level of insertion of leg IV. Adanal setae in ventral position.

AE 167 μ m long, 260 μ m wide ; median portion of *AE* delicately porose, lateral areas with foveae (Fig. 34). Epimeral processes large, flanking basis of the trochanters. Posterior *AE* rounded. Epimeral vesicles very large. Two pairs of ventral sclerites within the striated integument between *AE* and *PE*. *GA* 179 μ m long, 142 μ m wide. Integument in anterior rectangular *GA* with delicate porosity ; remainder of the plate foveate. *GO* 47 μ m long, 24 μ m wide. *GO* surrounded by 8 *pgs*.

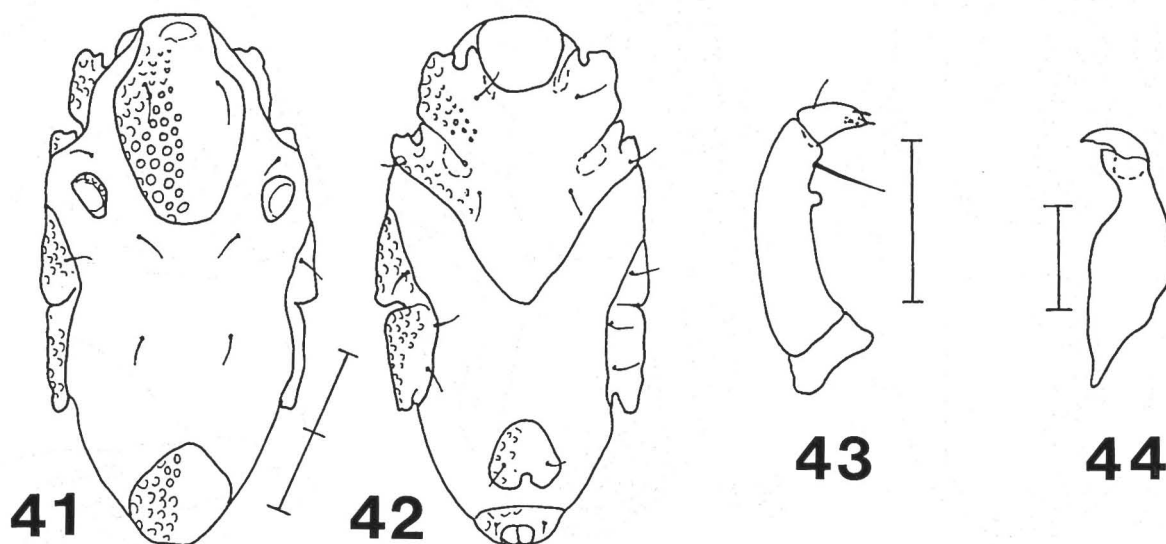
Gnathosoma 125 μ m long. Palps long when compared with length of gnathosoma (Fig. 35). Second palpal segment 4 times longer than high, with the ventral knob and the bristle separated (Fig. 43). Third palpal segment short, 0.3 of the second segment's length. Chelicera (Fig. 44) apically lightly serrate.

Leg I not markedly longer than leg II. Telofemora foveate. Tibia and telofemur I almost equal in length (Fig. 37) ; length/height ratio in tibia and telofemur I 1.8 and 1.5 respectively. Tarsus I 2.3 longer than high. Telofemur II about as long as tibia II (Fig. 38) ; telofemur II 1.4 longer than high, tibia II twice as long as high. Leg III (Fig. 39) with telofemur and tibia slightly shorter than those of leg



FIGS. 33-40 : *Simognathus maculatus* n. sp., female.

33. — Idiosoma, dorsal (brown pigmentation posterior to dotted line). 34. — Idiosoma, ventral. 35. — Gnathosoma, lateral. 36. — Posterior tibia and tarsus I, lateral (medial setae and claw omitted). 37. — Leg I, medial. 38. — Leg II, medial. 39. — Leg III, medial. 40. — Tarsus IV, medial. (Each scale division equals 50 μ m)



FIGS. 41-44 : *Simognathus maculatus* n. sp.

41. — Idiosoma, dorsal, deutonymph. 42. — Idiosoma, ventral, deutonymph. 43. — Palp, female. 44. — Chelicera, female. (Each scale division equals 50 μ m)

IV. Trochanter IV almost as long as telofemur and tibia IV. Telofemora III and IV about 1.5 longer than high, and III-5 and IV-5 2.4 and 2.5 longer than high respectively. Leg chaetotaxy : leg I, 1, 2, 2, 4, 5, 6 ; leg II, 1, 2, 3, 4, 5, 6 ; legs III and IV, 1, 1, 2, 3, 5, 5. Telofemur IV similar to III-3 but the 2 dorsal setae are almost equal in size. Ventral spine on tibia I tapering and with basal swelling (Fig. 36) ; ventromedial seta bristle-like, slender. Tarsus I with rod-like, about 6 μ m long solenidion inserted adjacent to the truncate famulus and the rather short, rounded lateral membrane. Solenidion on tarsus II similar in size, but placed on inner side of the medial membrane of claw fossa. Ventral bristles on tarsi III and IV long ; medial *pas* on tarsus III with blunt tip, that *pas* on tarsus IV tapering ; lateral *pas* absent on both tarsi (Fig. 39, 40).

Median claw on tarsus I much stouter than slender scythe-shaped lateral claws. Median claw on posterior tarsi small ; lateral claws slender, with an accessory process but without claw pecten.

Male : Not seen.

Juveniles : Idiosoma length of deutonymph 310 μ m. *AD* shorter than in female. Integument in

posterior *AD* lightly brown, this brown area not set off abruptly from anterior *AD*. *PD* (Fig. 41) much shorter than in female. *AE* with marginal portions foveate and median portion rather smooth (Fig. 42). *GP* much smaller than in female, with a single pair of *pgs*. Protonymph 272 μ m long.

Remarks : *Simognathus maculatus* is characterized by the brownish pigmentation on posterior *AD*, presence of large *OC*, integument in median *AE* being delicately porose, foveae present only marginally ; second palpal segment with ventral knob and bristle widely separated ; ventral bristle on tibia I tapering and with a basal swelling.

S. maculatus is most similar to *S. adriaticus*, Viets 1940, *S. hulingsi* Newell, 1984, *S. magellanicus* Newell, 1984, *S. minutus* (Hodge, 1863), and *S. similis* Bartsch, 1977. In *S. adriaticus* and *S. similis* the bristle on the second palpal segment is flanked by a knob. The female *GA* in *S. magellanicus* is much shorter and the lateral claws in this species have denticles along the dorsal flank. *S. minutus* has ovate *PD* and smaller *GA* (relative to the *GO*). The female of *S. hulingsi* has a longer *GA*.

Simognathus uniscutatus n. sp.

(Figs. 45-52)

Material examined : Holotype female (WAM), Rottneest Island, Nancy Cove, sediment from 3.5 m depth, 12 January 1991.

Female : Idiosoma length 322 μ m. *AD* and *PD* ornamented with wide foveae ; deeper integumental layers with numerous, very delicate canaliculi. *AD* almost rectangular, 137 μ m long, 105 μ m wide. *OC* reduced to small sclerites which are obscured by the striated integument (Fig. 45). *PD* 165 μ m long, 117 μ m wide, anterior margin truncate ; lateral margins divergent. Setae *ds-1* and *ds-2* inserted on the *AD*, *ds-2* on minute sclerites within the striated integument, *ds-4* and *ds-5* on the *PD*. Adanal setae inserted marginally.

AE and *GA* broadly fused, *PE* separated (Fig. 46). Ventral plates sculptured with foveae save a small transverse anteromedian portion. Epimeral processes on *AE* and *PE* large, flanking the bases of the trochanters. *GO* 42 μ m long, 20 μ m wide. Four pairs of *pgs* inserted as illustrated.

Gnathosoma 95 μ m long. Tectum small. Palps long (Fig. 47). Second palpal segment 3.4 longer than high ; ventrally with a knob, a bristle just anterior to the knob, and a pointed apical membrane (Fig. 48). Third palpal segment short, its length less than height of 2nd segment and slightly less than 1/4 of the 2nd segment's length.

Leg I larger than posterior legs. Length of telofemora III and IV subequal to that of trochanters. Telofemur I 2.2 longer than high ; tibia I almost twice as long as high (Fig. 50), its cylindrical base very short ; Tarsus I 1.7 longer than high. II-3, II-5, III-3, III-5 1.8, 2.0, 1.8, 2.2 longer than high respectively. Leg chaetotaxy : leg I, 1, 3, 2, 4, 5, 6 ; leg II, 1, 2, 3, 4, 5, 6 ; legs III and IV, 1, 1, 2, 3, 5, 5. The 2 dorsal setae on telofemur III unequal in size (Fig. 52) ; setae on telofemur IV similar in size and standing close together. Ventral spine on tibia I tapering, without a basal swelling (Fig. 49) ; ventromedial bristle slender, curved. Spines on tibiae II-IV bipectinate (Figs. 51, 52). Solenidion on tarsus I seta-like, about 13 μ m long, adjacent to elongate lateral membrane. Solenidion on tarsus II

about 10 μ m long. Tarsi II-IV each with a long ventral bristle.

Median claw on tarsus I large, scythe-shaped, lateral claws bristle-like. Lateral claws on posterior legs long, with accessory process and pecten.

Male : Not seen.

Remarks : The females of *Simognathus uniscutatus* are separated from all other species in having *AE* and *GA* fused whereas the *PE* are separated. Further characteristics, which may help to identify males and juveniles, are the rather long palps, with the second segment having a ventral knob and a pointed apical membrane, and the third segment being less than 1/4 as long as the 2nd segment, and leg I being larger than the other legs, with its telofemur and tibia about twice as long as high, and tibia having a short cylindrical base.

Simognathus variolosus n. sp.

(Figs. 53-62)

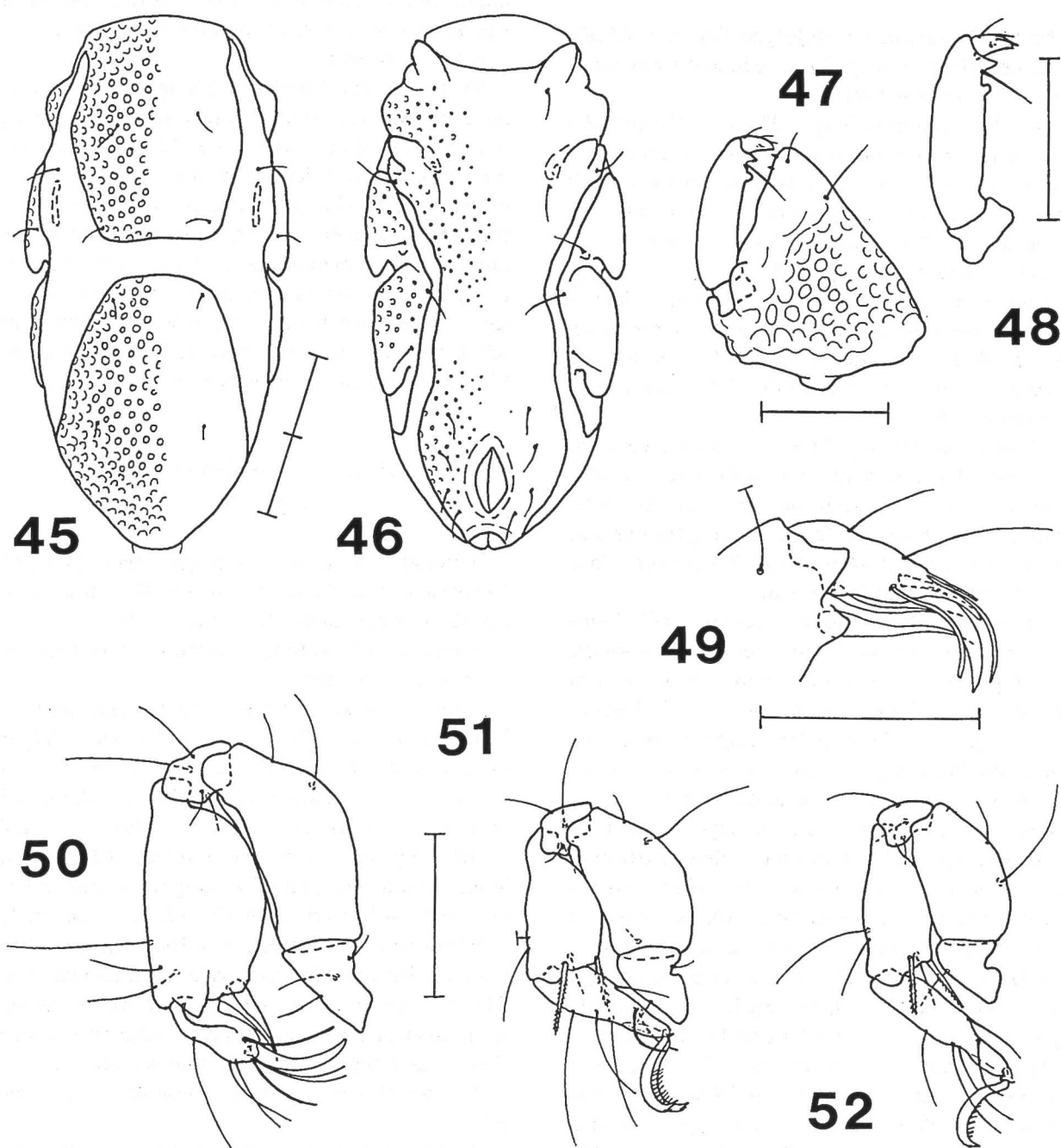
Material examined : Holotype male (WAM), Rottneest Island, Little Armstrong Bay, beach, 10 cm above water table, 16 January 1991.

Paratype male (author's collection), type locality.

Female : Not seen.

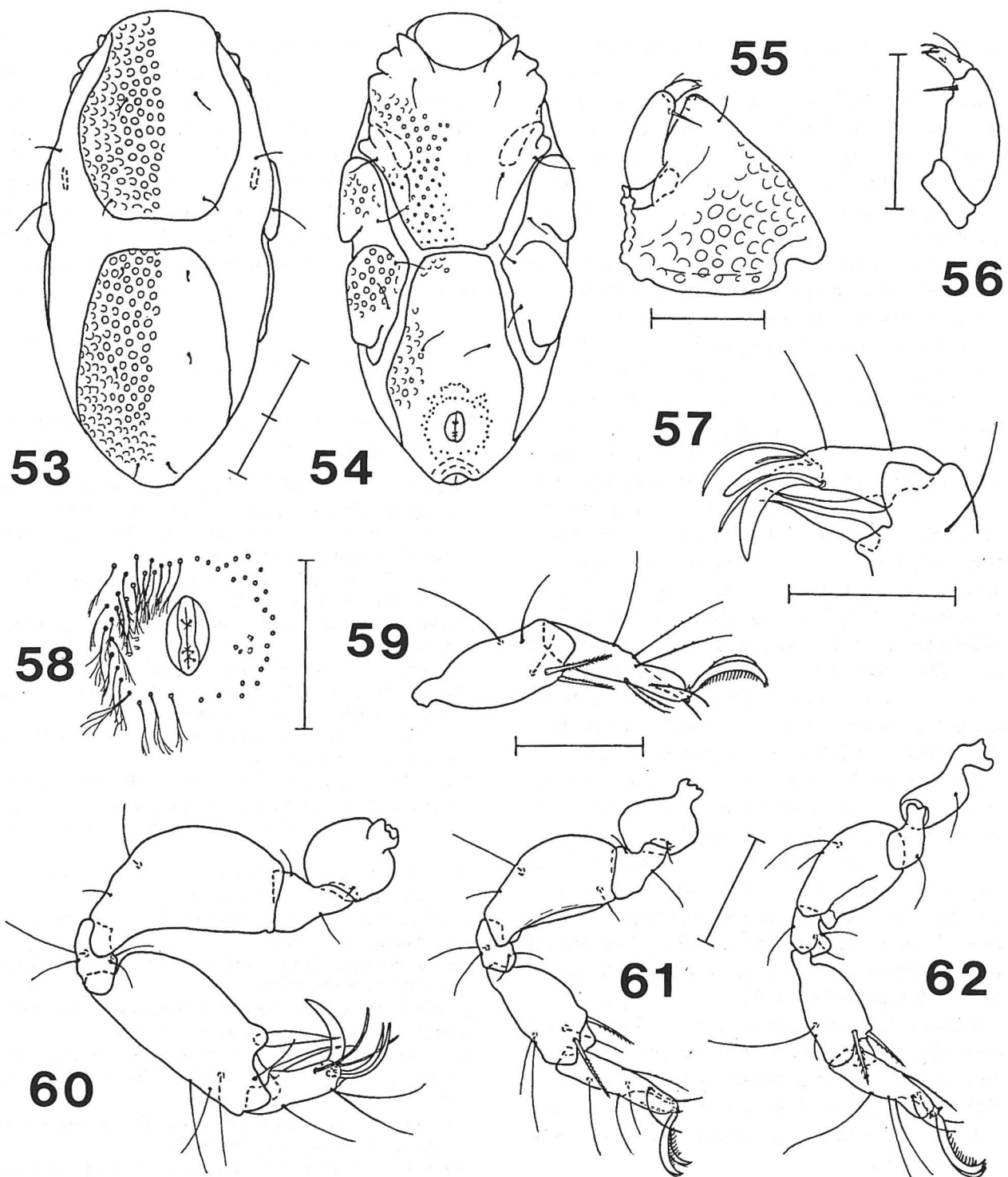
Male : Idiosoma length 353-358 μ m, that of holotype 358 μ m. Dorsal plates foveate ; deeper integumental layers with distinct porosity. *AD* 157 μ m long, 122 μ m wide ; widest at about 0.5 (relative to length of *AD*). *OC* reduced to small 17 μ m long and 7 μ m wide sclerites. *PD* 179 μ m long, 118 μ m wide ; anterior margin truncate. Setae *ds-1* and *ds-3* inserted on the *AD*, *ds-1* distinctly posterior to level of insertion of leg I. Setae *ds-2* on minute sclerites within the striated integument (Fig. 53), *ds-4* and *ds-5* on the *PD*, *ds-4* well removed from anterior and lateral margin. Interval between *ds-4* — *ds-4* slightly less than that between *ds-5* — *ds-5*. Adanal setae in dorsal position, within the *PD*.

Ventral plates coarsely porose ; lateral *AE* foveate, foveae vanishing towards the median plate. *AE* 140 μ m long, 148 μ m wide. Epimeral vesicles large, with long, superficial slit. Trochanters I medially and laterally flanked by scale-like epimeral



FIGS. 45-52 : *Simognathus uniscutatus* n. sp., female.

45. — Idiosoma, dorsal. 46. — Idiosoma, ventral. 47. — Gnathosoma, lateral. 48. — Palp. 49. — Posterior tibia and tarsus I, lateral (medial setae and claw omitted). 50. — Basifemur-tarsus I, medial. 51. — Basifemur-tarsus II, medial. 52. — Basifemur-tarsus III, medial. (Each scale division equals 50 μ m)



FIGS. 53-62 : *Simognathus variolosus* n. sp., male.

53. — Idiosoma, dorsal. 54. — Idiosoma, ventral. 55. — Gnathosoma, lateral. 56. — Palp. 57. — Posterior tibia and tarsus I, lateral (medial setae and claw omitted). 58. — Genital region. 59. — Tibia and tarsus IV, medial. 60. — Leg I, medial. 61. — Leg II, ventromedial. 62. — Leg III, medial. (Each scale division equals 50 μ m)

processes. *GA* 177 μ m long, 77 μ m wide, distance to anterior margin of *GA* equalling 5 times the *GO*'s length (Fig. 54). With 47 plumose *pgs* around the *GO* (Fig. 58) and 1 pair of outlying setae. Genital sclerites with 3 pairs of small subgenital setae.

Gnathosoma 95 μ m long. Second palpal segment 2.4 longer than high, with ventral carina but no knob (Fig. 56). Third palpal segment about 1/3 of the second segment's length. Tectum not scale-like but with a small and slender spur-like process.

Leg I longer and wider than posterior legs. Integument of telofemora smooth, not foveate. All telofemora longer than basifemora. All telofemora with ventrolateral and ventromedial carinae. Telofemora I and II both 1.9 longer than high. Tibia I about as long as telofemur I (Fig. 60); the former with very short cylindrical base, then bulging, being about 2.2 longer than high. Tarsus I about 2.4 longer than high. Tibia II shorter than telofemur II (Fig. 61), both about 1.9 longer than high. Leg chaetotaxy: leg I, 1, 2, 2, 4, 5, 6; leg II, 1, 2, 3, 4, 5, 6; leg III, 1, 1, 2, 3, 5, 6; leg IV, 1, 1, 2, 3, 6, 7. Telofemur III with 1 long and 1 short dorsal seta (Fig. 62); telofemur IV with 2 short setae inserted adjacent. Ventral spine on tibia I tapering, without basal swelling (Fig. 57); ventromedial bristle slender. Tarsus I with the stout, tapering ventral spine inserted within the basal half; solenidion seta-like, about 13 μ m long; adjacent membrane remarkably long and slender. Tarsus II with 3 dorsal setae, 1 slightly pilose ventral bristle and single lateral and medial *pas*; solenidion about 14 μ m long, inserted on inner flank of the medial membrane of claw fossa. Tarsi III and IV with 1 and 2 pilose ventral bristles respectively; both tarsi with single lateral and medial *pas* (Figs 59, 62).

Median claw on tarsus I stout and long, lateral claws slender. Posterior tarsi with minute, bidentate median claw and long lateral claws. These lateral claws bear delicate tines on the convex margin outover the accessory processes and pecten with numerous tines.

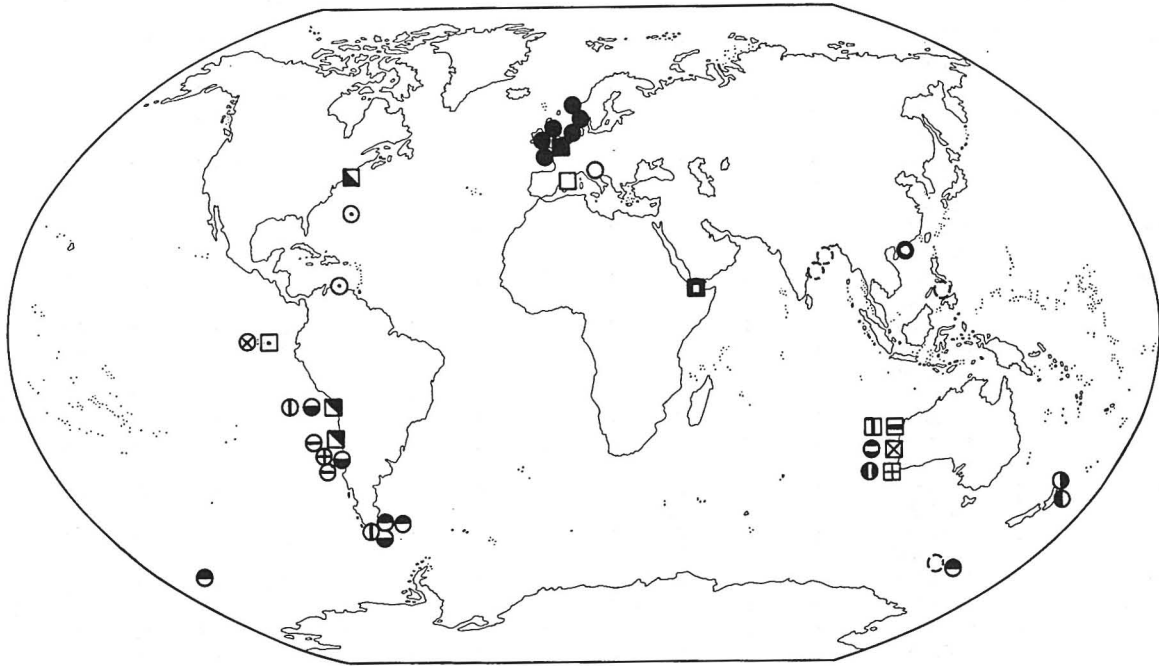
Remarks: *Simognathus variolosus* can be separated from majority of species on the basis of *OC* reduced and tarsus IV with 2 ventral setae and both lateral and medial parambulacral setae, a combination of characters which is shared with *S. leiomerus*

Trouessart, 1894 and *S. minor* Bartsch, 1979. *S. leiomerus* has posterior *AD* and anterior *PD* more rounded than *S. variolosus*, and *S. minor* is smaller in size. The ventral carina on the second palpal segment present in *S. variolosus* is not found in the other species. Males of *S. variolosus* bear a large number of plumose *pgs* and a pair of outlying setae, whereas *S. leiomerus* and *S. minor* have a small number of *pgs* close around the *GO* and no outlying setae.

NOTES AND KEY TO *SIMOGNATHUS*

At present, the genus *Simognathus* includes 24 species (Fig. 63), i.e.,

- adriaticus* Viets, 1940, Adriatic Sea, Mediterranean, amongst epiflora in shallow water (VIETS, 1940).
- andrei* Monniot, 1961, Mediterranean (MONNIOT, 1961) (may be a synonym of *leiomerus*).
- areolatus* Newell, 1984, Chile, gravel and hapteres from tidal zone (NEWELL, 1984).
- coutieri* Trouessart, 1899, northeastern Africa (TROUESSART, 1889).
- delicatulus* n. sp., southwestern Australia, lower beach.
- disparilis* Bartsch 1977, Galapagos Archipelago, lower tidal zone (BARTSCH and SCHMIDT, 1978).
- foveolatus* Bartsch 1991, southern China, sand, tidal low water zone (BARTSCH, 1991).
- fuscus* Viets, 1936, Caribbean area and Bermuda Island, algae, coral fragments and bottom silt, low water edge and sublittoral (VIETS, 1936; BARTSCH and ILIFFE, 1985).
- gibberosus* n. sp., southwestern Australia, sand and corallines from low water zone.
- glaber* Bartsch, 1986, northern New Zealand, from corallines (BARTSCH, 1986).
- glareus* Bartsch, 1986, northern New Zealand, from gravel (BARTSCH, 1986).
- gracilis* n. sp., southwestern Australia, sublittoral sand.
- hulingsi* Newell, 1984, Chile (NEWELL, 1984).
- leiomerus* Trouessart, 1894, European Atlantic coast, low water to sublittoral sand and algae (TROUESSART, 1894; BARTSCH, 1985).
- maculatus* n. sp., southwestern Australia, amongst sublittoral corals, epifauna and epiflora.
- magellanicus* Newell, 1984, Falkland Islands (Malvinas), southern Chile and southern Pacific Ocean, sublittoral (VIETS, 1952; NEWELL, 1984).
- minor* Bartsch, 1979, eastern North America, sand from low water zone (BARTSCH, 1979).
- minutus* (Hodge, 1863), northern Europe, North Sea and Atlantic Ocean (VIETS, 1956), sublittoral, from hold-



- | | | | | |
|--------------|----------------|--------------|---------------|---------------|
| ○ adriaticus | ● glaber | ● minutus | □ andrei | ■ leiomerus |
| ● areolatus | ● glareus | ● obtusus | ■ coutieri | ■ minor |
| ○ foveolatus | ● hulingsi | ⊗ similis | ▨ delicatulus | ■ pectinatus |
| ○ fuscus | ● maculatus | ⊕ subobtusus | ▨ disparilis | ⊗ uniscutatus |
| ● gibberosus | ● magellanicus | ○ sp. | ▨ gracilis | ▨ variolosus |

FIG. 63 : Geographical distribution of *Simognathus*.

fast. The specimens recorded from the Macquarie Island and eastern India (WOMERSLEY, 1937 ; RAO and GANAPATI, 1968) are certainly not conspecific with *S. minutus*.

obtus Newell, 1971, Chile, intertidal and subtidal coral-lines and coarse sand (NEWELL, 1984).

pectinatus Newell, 1984, Chile, sand and shell fragments (NEWELL, 1984).

similis Bartsch, 1977, Galapagos Islands, lower tidal zone (BARTSCH and SCHMIDT, 1978).

subobtus Newell, 1984, Chile, intertidal algae (NEWELL, 1984).

uniscutatus n. sp., southwestern Australia, sublittoral sediment.

variolosus n. sp., southwestern Australia, sand from just above low water level.

Characters of all species are summarized in a tabular key (Table 1). The key will both help to identify species and give a survey of range of variants. New species can easily be added to the key. Occasionally, different species may have identical formula, thus the description of a given species should carefully be studied to verify determination.

The tabular key includes both characters easily recognizable (though intermediate forms may be found) and characters which are thought to be of phylogenetic significance ; the key may help to recognize relationships.

The variants listed for a given species are mainly basing on published data (descriptions and figures).

character	1	2	3	4	5	6	7	8	9	10	11	12	13	14
species														
<i>adriaticus</i>	f 375-380 m 338	u	1	p	2	2	0	1	1	2.2	2.1	2.0	2.5	1/1
<i>andrei</i>	f 430	u	0	f	2	?	?	1	1	3.0	2.4	1.9	2.0	2/2
<i>areolatus</i>	f 390-436 m 355-385	u	1	f	2	2	4	?	2	?	1.4	1.5	2.6	?
<i>coutieri</i>	ca. 350	u	0	f	2	?	?	1	2	4.2	2.2	1.5	2.2	?
<i>delicatus</i>	f 250 m 241	u	0	p	2	2	2	h	2?	3.2	2.4	1.6	1.4	1/1
<i>disparilis</i>	f 370-427 m 407	u	0	p	2	2	2	1	2	2.5	2.1	2.2	2.6	2/1
<i>foveolatus</i>	f 350 m 322	u	1	f	2	2	5	1	2	2.5	1.8	1.9	2.1	1/1
<i>fuscus</i>	f 370	b	1	f	2	?	?	1	2	3.4	1.7	1.8	2.0	1/1
<i>gibberosus</i>	f 357-408 m 325-376	u	1	s	2	1	2	s	0	2.1	1.2	1.7	1.4	1/1
<i>glaber</i>	f 415	u	1	f	2	?	?	1	2	3.5	1.0	1.2	2.2	1/1
<i>glareus</i>	f 390	b	1	f	2	?	?	1	2	2.3	1.2	1.7	2.5	1/1
<i>gracilis</i>	f 180-240 m 198-232	u	0	f	2	2	2	s	0	2.5	2.1	2.4	2.0	1/1
<i>hulingsi</i>	f 418 m 365	u	1	p	2	2	4	?	1?	?	1.7	2.2	1.9	?
<i>leiomerus</i>	f 365-385 m 347-403	u	0	f	2	2	0	1	1	3.0	2.1	2.3	2.2	2/2
<i>maculatus</i>	f 372-442	b	1	p	2	?	?	1	2	3.4	1.5	1.8	2.3	1/1
<i>magellanicus</i>	f 486-557	u	1	f	2	?	?	1	2	4.5	1.6	1.7	3.1	1/1
<i>minor</i>	m 251-271	u	0	p	?	2	0	1	1	1.9	1.7	2.2	2.0	2/2
<i>minutus</i>	f 420-530	u	1	p	2	?	?	1	2	4.2	1.8	1.6	2.3	1/1
<i>obtus</i>	f 369 m 388	b	1	f	2	2	4	?	2	?	?	1.7	2.9	?
<i>pectinatus</i>	f 375	u	0	p	2	?	?	h	?	5.1	?	?	?	?
<i>similis</i>	f 311-313	u	1	p	2	?	?	1	1	2.4	2.1	2.3	2.0	1/1
<i>subobtus</i>	f 334-370	b	1	f	2	?	?	1	2	3.0	?	1.5	2.7	?
<i>uniscutatus</i>	f 322	u	0	f	1	?	?	1	2	4.4	2.2	1.9	1.7	1/1
<i>variolosus</i>	m 353-358	u	0	(f)	?	2	2	1	0	3.0	1.9	2.2	2.4	2/2

Characters and variants :

1. Length of female (f) and male (m) in μm .
2. *AD* : b = posterior area with dark-brown colouring. u = uniformly coloured.
3. *OC* : 0 = absent or reduced to elongate sclerite. 1 = present, triangular or rounded.
4. *AE* (or area representing *AE*) : f = marginal and median *AE* foveate. (f) = median *AE* punctate and very delicately foveate, marginal *AE* foveate. p = median plate punctate, not foveate ; marginal *AE* foveate. s = median *AE* foveate save for a delimited area which lacks foveae.
5. Female *AE* and *GA* : 1 = 1 plate, *AE* and *GA* fused. 2 = 2 plates, *AE* separated from *GA*.
6. Male *AE* and *GA* : 1 = 1 plate, *AE* and *GA* fused. 2 = 2 plates, *AE* separated from *GA*.
7. Male *GA*, number of outlying perigenital setae : 0 = no outlying setae present. 2 = 2 outlying setae. etc.
8. Length of palps relative to length of gnathosoma. s = palps shorter than 0.5 the gnathosoma's length. h = palps half the length of the gnathosoma. l = palps longer than half the gnathosoma.
9. Ventral knob on second palpal segment : 0 = no knob present. 1 = bristle with a knob. 2 = ventral knob separated from ventral bristle.
10. Palps, length of 2nd segment relative to apical segment.
11. Telofemur I : ratio length : height.
12. Tibia I : ratio length : height (length without articular lamellae).
13. Tarsus I : ratio length : height (length without membranes of claw fossa).
14. Tarsus IV, number of parambulacral setae and ventral setae. 1/1 = 1 parambulacral and 1 ventral seta. 2/1 = 2 parambulacral setae and 1 ventral seta. 2/2 = 2 parambulacral and 2 ventral setae.

TABLE 1 : Principal characters in species of the genus *Simognathus*.

Within the genus *Simognathus* two groups are easily separated, the *minutus* group, the representatives having large, triangular or rounded *OC*, generally with a cornea, and the *leiomereus* group, including species with the *OC* reduced, completely or to an elongate sclerite, more or less obscured by the striated integument, they lack corneae.

The *minutus* group includes the species *adriaticus*, *areolatus*, *foveolatus*, *fuscus*, *gibberosus*, *glaber*, *glareus*, *hulingsi*, *maculatus*, *magellanicus*, *minutus*, *obtusius*, *similis*, and *subobtusius*. The species *andrei*, *coutieri*, *delicatulus*, *disparilis*, *gracilis*, *leiomereus*, *minor*, *pectinatus*, *uniscutatus*, and *variolosus* belong to the *leiomereus* group. According to number of setae on tarsus IV, the *leiomereus* group s.l. can in turn be divided into sub-groups. Species of the *leiomereus* group s. str. (*andrei*, *coutieri*?, *leiomereus*, *minor*, *variolosus*) have tarsi IV with 3 dorsal, 2 ventral, and lateral and medial parambulacral setae. Another group includes species (*delicatulus*, *gracilis*, *uniscutatus*) with 3 dorsal seta, a single ventral and a single parambulacral setae on tarsus IV. *Simognathus disparilis* differs from the two just mentioned groups in having 3 dorsal setae, both lateral and medial parambulacral setae but only a single ventral seta.

A character easily recognized, though thought to be of no phylogenetic significance, is the dark-brown pigmentation of posterior *AD*. The pigmentation may fade in stored material.

GEOGRAPHICAL AND BIOLOGICAL SURVEY

The Western Australian fauna proved to be remarkably rich in species. Six species were found within a rather restricted area, in the littoral of an island, 15 km long and 10 km wide, under influence of subtropical water masses with rather constant and high salinity and a tidal range of about 1-1.5 m (KNOX, 1963; JEFFREY, 1981; PLAYFORD, 1988). In comparison, a single species is presently known from southern China (BARTSCH, 1992), two species from the Galapagos Islands (BARTSCH, 1977), and from the Mediterranean no more than two species are recorded, though the halacarid fauna in this warm water area has been studied intensely (VIETS, 1940; MONNIOT, 1962).

Noteworthy is the fusion of ventral plates. In the males of *S. gibberosus* is the AE broadly joined to the GA which in turn is fused to the posterior PE. In *S. uniscutatus*, known from a female only, are AE and GA fused forming an elongate ventral shield. The fusion of the plates is thought to be correlated with life in high energy shores, with the habitats exposed to strong wave action.

Two of the six species known from the Rottneest Island, *S. gibberosus* and *S. maculatus*, belong to the *minutus* group, the other species can be attributed to the *leiomereus* group s.l.

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