

1061

DESCRIPTION AND LIFE CYCLE
OF *SULADECTES HUGHESAE ANTIPODUS* SUBSPEC. NOV.
(ACARI : HYPODERATIDAE)
ASSOCIATED WITH *SULA BASSANA SERRATOR* GRAY
(AVES : PELECANIFORMES) IN NEW ZEALAND.

BY A. FAIN * and John M. CLARK **

SYSTEMATICS
ACARI
LIFE CYCLE
PARASITIC
GANNETS
NEW ZEALAND

SUMMARY : A new subspecies of *Suladectes hughesae* Fain, 1969, *S. hughesae antipodus* subsp. nov. (Acari : Hypoderatidae), is described from three gannet, *Sula bassana serrator* Gray, rookeries in New Zealand. The life cycle of this genus is described for the first time. Quiescent deutonymphs were found under the skin of these birds, whilst moulting deutonymphs and adult stages, females and males, were collected from their nests.

TAXONOMIE
ACARI
CYCLE ÉVOLUTIF
PARASITES
FOUS DE BASSAN
NOUVELLE ZÉLANDE

RÉSUMÉ : Une nouvelle sous-espèce de *Suladectes hughesae* Fain, 1969, *S. hughesae antipodus* subsp. nov. (Acari : Hypoderatidae) est décrite de *Sula bassana serrator* Gray de Nouvelle Zelande. Le cycle évolutif du genre *Suladectes* Fain, 1969 est décrit pour la première fois. Des deutonymphes quiescentes furent trouvées sous la peau de ces oiseaux alors que des hypopes en mue et des adultes mâles et femelles furent rencontrés dans les nids de ces oiseaux.

INTRODUCTION

A new subspecies of *Suladectes hughesae* Fain, 1969, *S. hughesae antipodus* ssp. n. is described from the gannet, *Sula bassana serrator* Gray, from New Zealand.

The parasitic quiescent deutonymphs (also called hypopi) were found in great number under the pectoral skin of the bird whilst deutonymphs in the moulting stage and adults, males and females, were collected from the nests and occasionally from the feathers of the birds. All the developmental stages were observed.

The family Hypoderatidae comprises at present about 70 valid species or subspecies and 30 genera or subgenera. Among these species five, belonging to two genera, were collected from

rodents, whilst all the others were found in association with birds (FAIN and LUKOSCHUS, 1977 and 1986).

Almost all the described species are known only from their quiescent deutonymph living in the subcutaneous tissues of their hosts. The complete life cycle in this group of mites is known for only one species *Hypodectes (Hypodectoides) propus* (Nitzsch, 1861), a common parasite of the pigeon (FAIN and BAFORT, 1966 and 1967).

In nine other species, all from birds, only a part of the life cycle has been observed and some stages still remain unknown.

In *Phalacroctes (Phalacroctes) whartoni* Fain, 1967, parasitic of Ciconiiformes, all the stages have been observed except the protonymph (FAIN and LUKOSCHUS, 1986).

* Institut royal des Sciences naturelles de Belgique, Rue Vautier, 29, 1040-Bruxelles.

** Dudley Rd. East, RD 6, Inglewood, Taranaki, New Zealand.

In *Phalacrodes* (*Frehelectes*) *gaudi* Fain and Beaucournu, 1972, parasitic in cormorants (Pelecaniformes), only the parasitic hypopi and the nidicolous tritonymphs with vestigial legs and gnathosoma have been described.

In *Neottialges* (*Pelecanectes*) *evansi* Fain, 1966, only three stages have been described: the hypopus parasitic in cormorants and the male and the active tritonymph, both living in the nests of these birds (FAIN and BEAUCOURNU, 1972).

In *Bubulcodectes brevitorsis* Fain and Lukoschus, 1986 only males and females containing larvae and a prelarva were observed from the nests of *Bubulcus ibis* (Ciconiiformes, Ardeidae).

Another species also known only from nidicolous stages (females, males and a protonymph) is *Neottialges* (*Heronidectes*) *mendezii* Fain and Lukoschus, 1986.

Finally, there are four species which are known only from either the nidicolous male (e.g. *Phalacrodes panamensis* Fain and Lukoschus, 1986 from the nest of *Bubulcus ibis* and *Hypodectes samsinaki* Fain and Lukoschus, 1986 from the nest of a wild pigeon), or from the nidicolous female (e.g. *Neotytoedectes mexicanus* OConnor, 1981 from the nest of *Glaucidium* sp. (Strigiformes) and *Gypsodectes verrucosus* Fain, 1984 from the nest of a vulture (Falconiformes)).

MATERIAL EXAMINED

Quiescent deutonymphs were collected by J.M.C. from the subcutaneous tissues from a female of the Australasian gannet *Sula bassana serrator*, found dead at sea in the coastal New Zealand waters, near Great Barrier Island, Hauraki Gulf, North Island, New Zealand. This bird was collected by Mr. I. HAYTON of New Plymouth, N.Z.

Deutonymphs either very young or in the moulting stage, as well as free males, females and larvae, were collected by Tullgren funnel from nest material in the three following N.Z. host nesting rookeries:

1. Gannet Island, Kawhia, Tasman Sea, 2 February, 1983 and 4 December, 1983;
2. Clova Bay, Malborough Sounds, 30 November, 1981;

3. Cape Kidnappers Saddle colony, Pacific Ocean, 22 November 1982 and 22 October, 1982.

Deutonymphs were also collected by insecticide dusting of the host plumage at the Cape Kidnappers Saddle rookeries (22 October, 1982).

All the rookery material was collected by Mr P. O'BRIEN of the N.Z. Ministry of Agriculture and Fisheries and preserved and held in the National Museum of New Zealand. All the measurements used here are in micrometers.

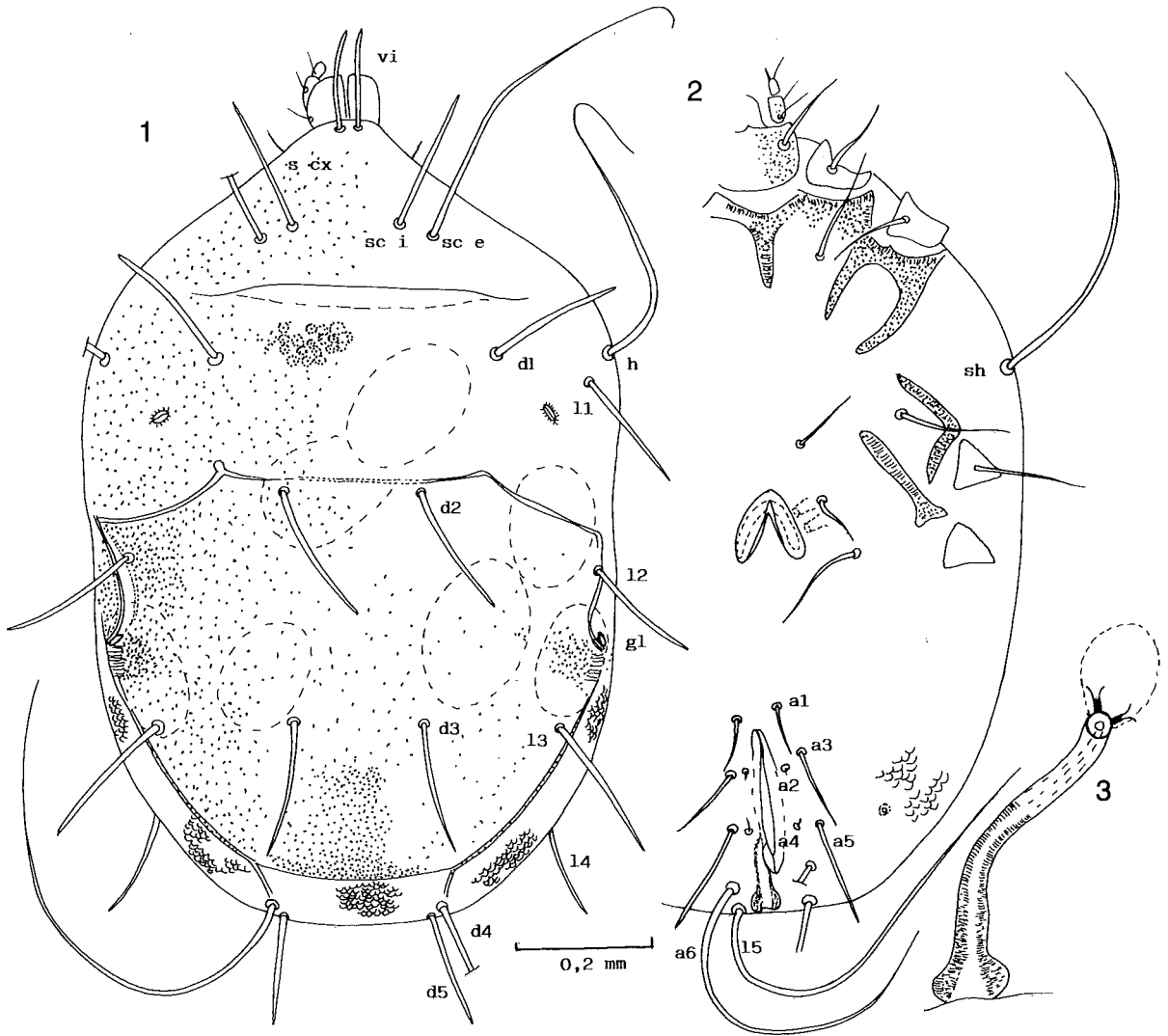
FAMILY HYPODERATIDAE Murray, 1877

Genus *Suladectes* Fain, 1969

This genus was created for a new species, *Suladectes hughesae* Fain, 1969 represented by deutonymphs found under the skin of a gannet, *Sula bassana* which died in London Zoo.

By the shape of the legs III and IV this genus belongs to the complex "*Neottialges*" and at first aspect it resembles the subgenus *Caloenectes* (Fain, 1966) characterized by the strong sclerotization of the idiosomal cuticle.

Suladectes is, however, clearly distinct from *Caloenectes* and from the other subgenera of *Neottialges*, in the quiescent hypopi by the absence of a sternum. The epimera I are either short and contiguous in the midline, or long but widely separated in midline by punctate cuticle. In the strongly sclerotized specimens these epimera are fused posteriorly with their respective epimerites to form at each side a closed, or almost closed, coxal I field. In *Caloenectes* and the other subgenera of *Neottialges* the epimera I are fused in the midline, forming a distinct sternum. Another character which separates *Suladectes* from *Caloenectes* is the presence in the former of a primary Y or T-shaped genital sclerite. In *Caloenectes* the area separating the genital papillae is punctate and more or less heavily sclerotized but there is no distinct primary sclerite. Moreover in *Suladectes* the genital papillae are widely apart and strongly divergent, which is not the case in *Caloenectes*. In males of *Suladectes* spines *p* and *q* of tarsus IV are strongly unequal, whilst in those of *Neottialges* these spines are equal or subequal.



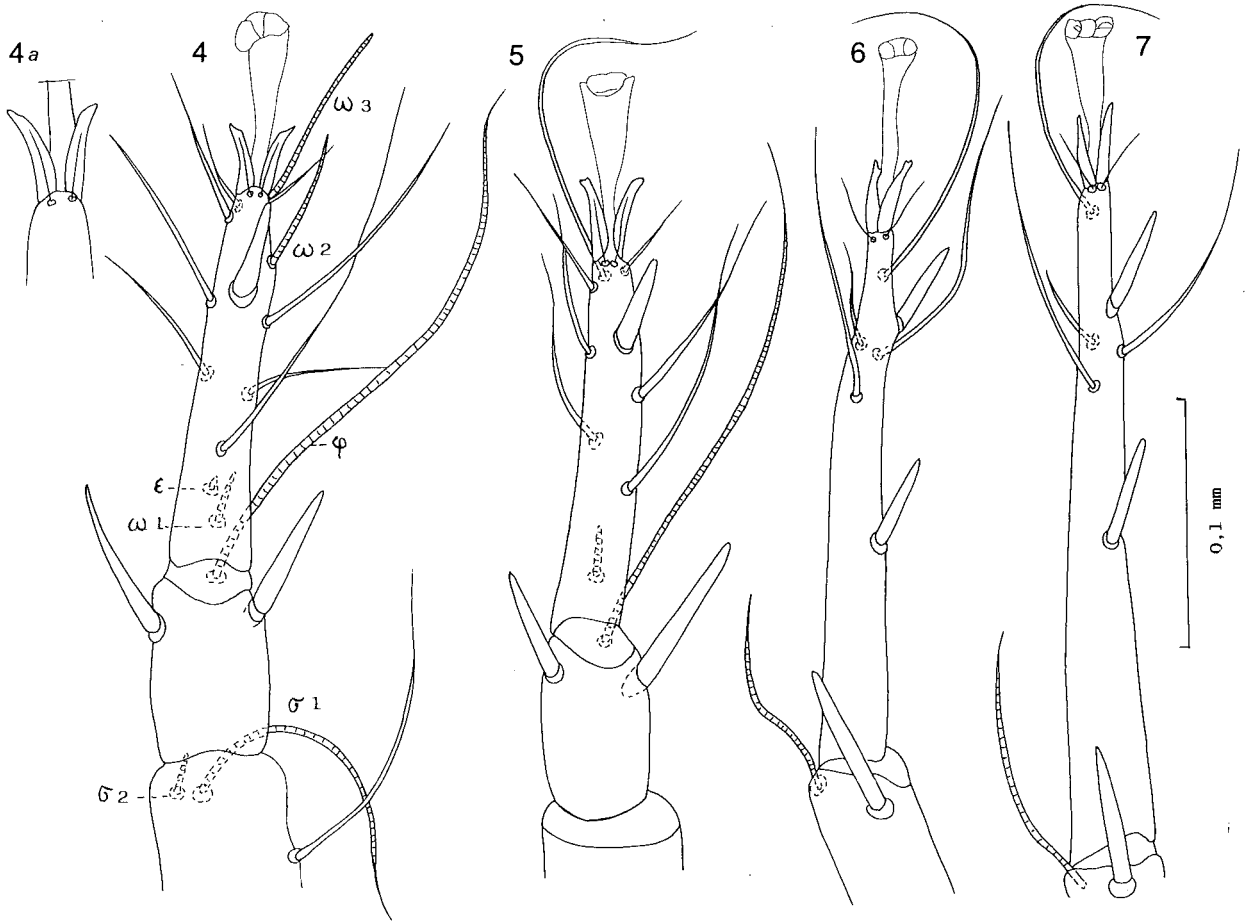
FIGS. 1-3 : *Suladectes hughesae antipodus* n.ssp. Female in dorsal (1) and ventral view (2) ; bursa copulatrix and spermatheca (3).

The genus *Suladectes* was previously represented by only the type species, *S. hughesae* Fain, 1969. We describe herein a new subspecies of *hughesae* from the Australasian gannet, *Sula bassana serrator* from New Zealand.

***Suladectes hughesae antipodus* subsp. nov.**

Female (figs. 1-7, 14-15) : Length and width of idiosoma in 4 paratypes : 1140 × 720 ; 1100 × 750 :

1080 × 700 ; 1050 × 744. *Dorsum* covered by 2 very finely punctate median shields (a propodonal and a hysteronotal). Postero-lateral regions finely verrucose. Sejugal furrow well developed. Oil gland apertures large, situated between setae *l2* and *l3*. Most of dorsal setae forming long cylindrical spines. Lengths of setae : *vi* 150 ; *sc i* 165 ; *sc e* 450 ; *dl* and *d2* 160 ; *d3* 180 ; *d4* 600 ; *d5* 150 ; *l1* and *l2* 180 ; *l3* 160 ; *l4* 120 ; *l5* 600 (ventral) ; *h* 450. *ve* lacking. *Venter* : Epimera I fused in a well developed sternum. Other epimera free.

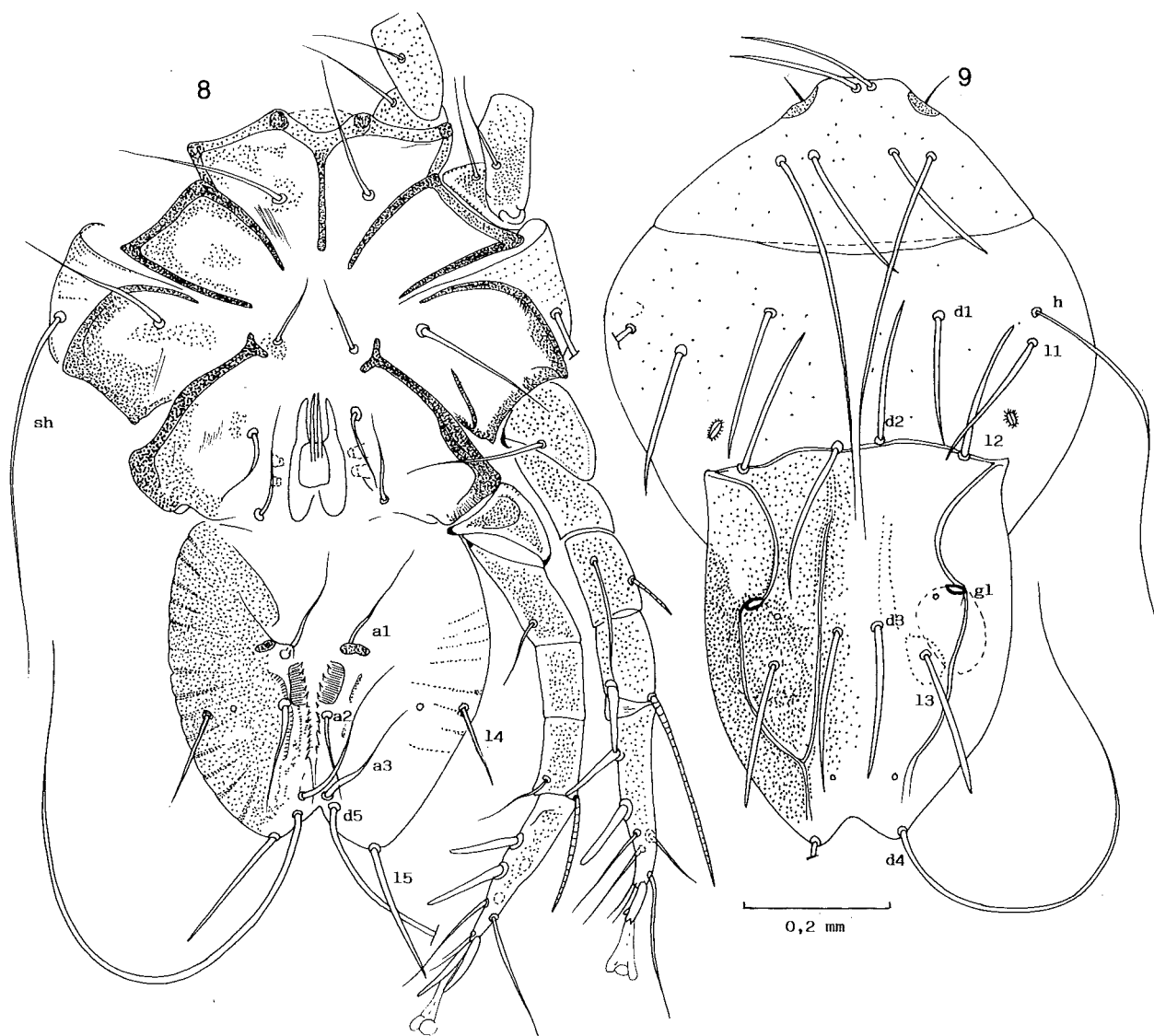


FIGS. 4-7 : *Suladectes hughesae antipodus* n.ssp. Female apical segments of leg I (4), leg II (5), leg III (6) and leg IV (7); apex of leg I in ventral, view, enlarged (4a).

Opisthogaster verrucose. Vulva situated between coxa IV and containing in the depth a large and thick sclerite in a inverted U. Setae *sh* 400. The 3 pairs of genital setae are 60-30 and 165 long. Anus pre-terminal, with 6 pairs of anal setae of which 2 pairs vestigial. Bursa thick, its opening at the ventral rear of the body, its first part strongly sclerotized. Chelicerae normal. Gnathosoma relatively small. Legs I to IV 435-438-510-578 long (excluding the pretarsi and the trochanters). Chaetotaxy of legs : tarsi I to IV with 13-12-10-10 setae. On tarsi I and II setae *u* and *v* are very thin and paramedian, *s* is a spine situated relatively far from the apex, *p* and *q* are spine, the other setae are thin. Tarsi II lacking setae *aa*. Tarsi III and IV with 4 spines and 6 thin setae.

Tibiae with 2-2-1-1 spines. *Solenidia* : $\omega 1$ short and basal ; $\omega 2$ (only present on tarsus I) situated close to seta *s* ; $\omega 3$ is apical. All tibiae with a long solenidion *phi*. Genu I with 2 very unequal solenidia *sigma*.

Male (figs 8, 9, 10-13) : A paratype is 1005 long and 495 wide. Cuticle as in the female except that the posterolateral regions and the opisthogaster are not verrucose and that the hysteronotum presents two large, lateral, sclerotized areas. Penis situated between coxae IV. Posterior region forming two lobes bearing two large copulation suckers 50 diameter. In almost all the specimens these lobes are turned inwards so that the suckers are facing each other. Legs as in female, except tarsus IV which bear 8 setae or spines and 2 small copulatory suckers.

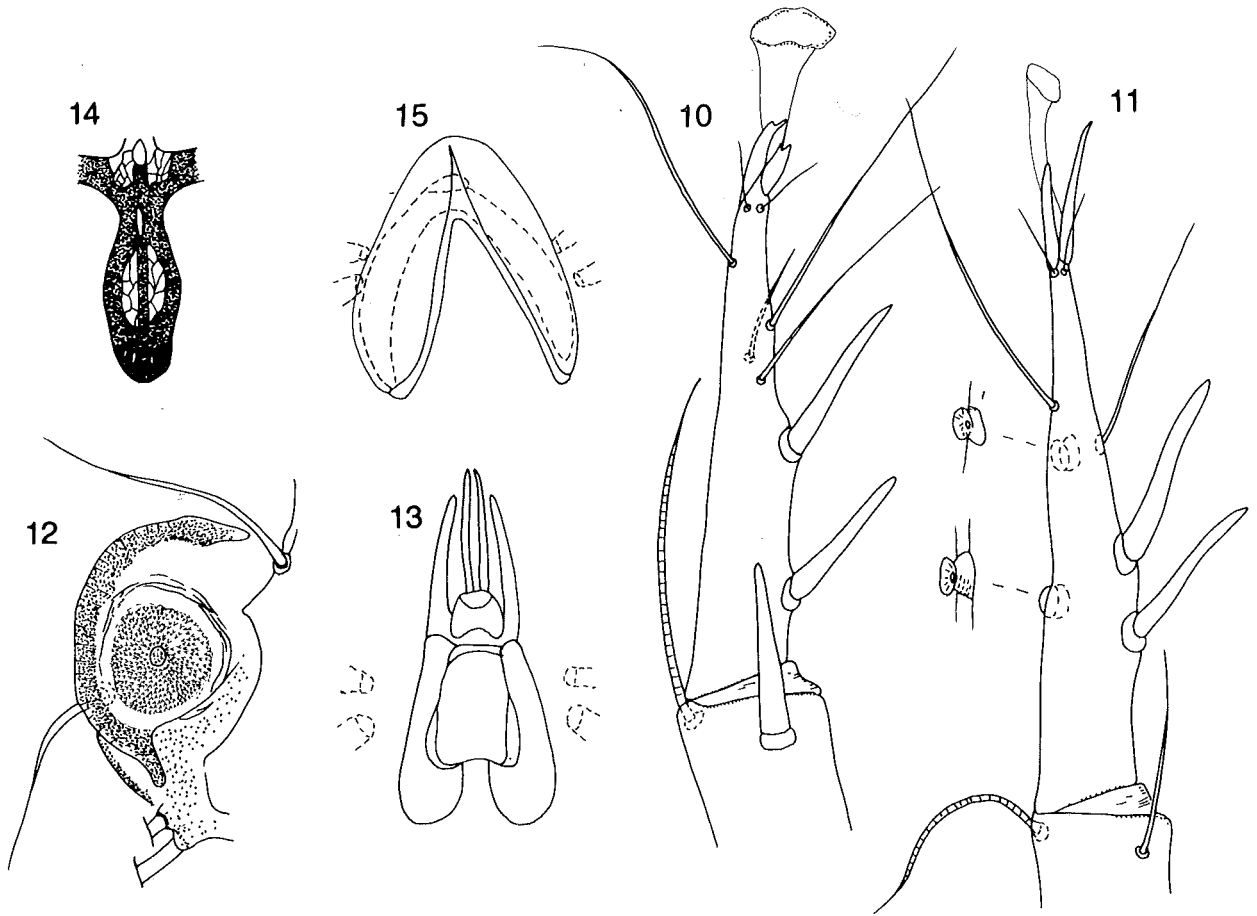


FIGS. 8-9 : *Suladectes hughesae antipodus* n.ssp. Male in ventral (8) and dorsal view (9).

Tritonymph : Most of the deutonymphs found free in the nest of the birds contained adults (males or females). All these adults were enveloped by a transparent membranous pouch, bearing two small conical membranous projections at one extremity. These pouches represent vestigial tritonymphs.

Large deutonymph (holotype) (figs 16-22) : Length and width 1980 × 900 ; in 4 paratypes 1800 × 840 ; 1800 × 720 ; 1680 × 770 ; 1590 × 720. Cuticle punctate and more or less strongly

sclerotized as in the typical form. Epimera not fused in the midline but remaining separated. In the most sclerotized specimens these epimera are fused posteriorly with the epimerites I at each side and form closed coxal fields separated in the midline by sclerotized cuticle. Median genital sclerite Y or T-shaped. Lengths of idiosomal setae (in holotype and 4 paratypes) : *vi* and *ve* lacking ; *sc e* 75-100 ; *sc i* 5-9 ; *d1* 25-40 ; *d2* 25-35 ; *d3* 25-30 *d4* 80-130 ; *d5* 6-10 ; *l1* 60-80 ; *l2* 25-30 ; *l3* 20-25 ; *l4* 5-10 ; *l5* 9-15 ; *h* 40-50 ; *sh* 30-40 ; *ga* and *gp* 15-20. Setae *cxI* and



FIGS. 10-15 : *Suladectes hughesae antipodus* n.ssp. Male : tarsus and apical part of tibia III (10) and IV (11); adanal sucker (12); penis (13). Female : pharynx (14) and vulva (15).

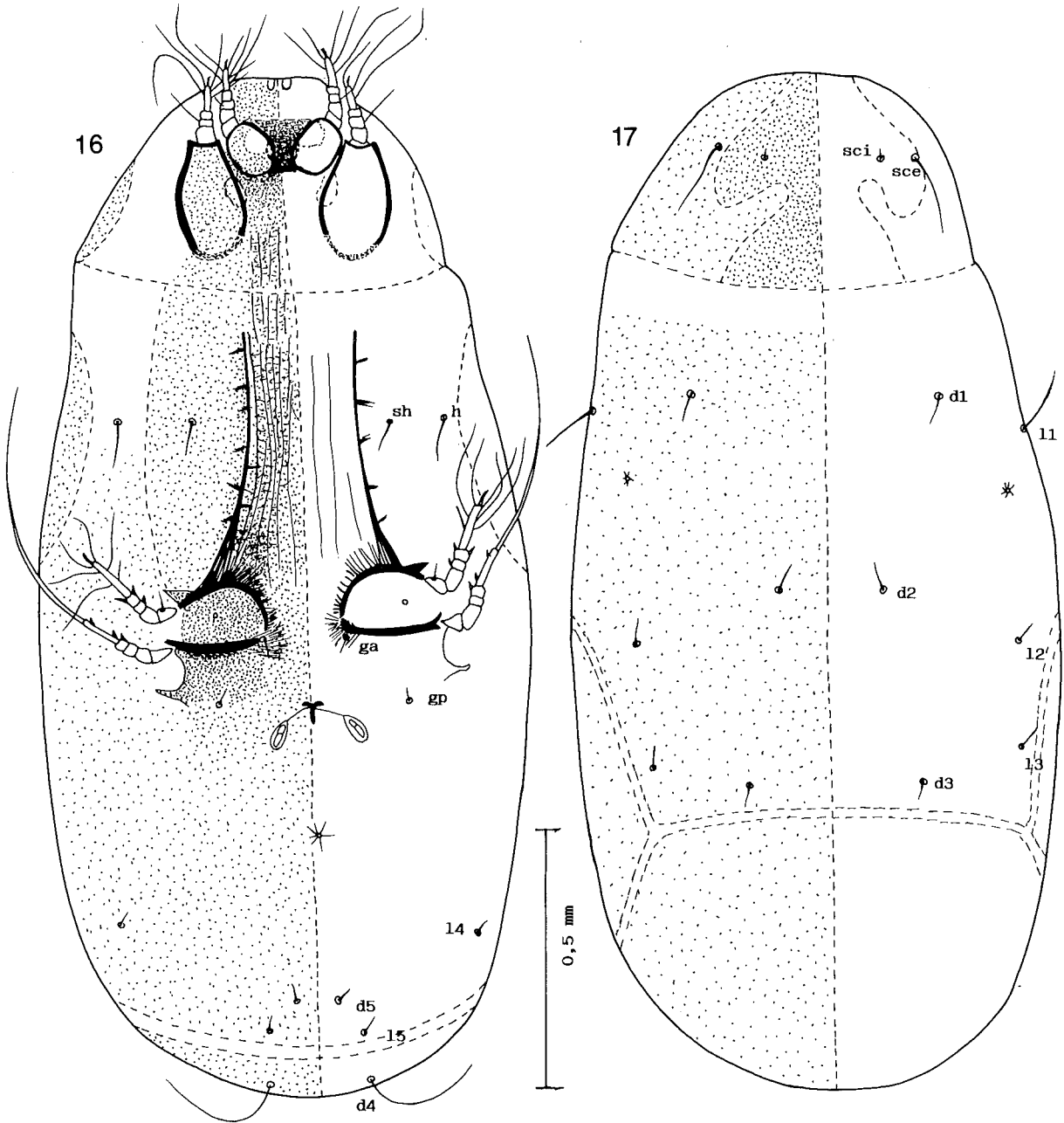
cxIII are lacking. Lengths of tarsi I to IV : 32-36-70-51. In 3 paratypes the tarsi III and IV are 70 to 72 and 50 to 53 long respectively. Chaetotaxy of legs and other characters as in the typical form.

Small deutonymph : In two nests (from Gannet Island and Cape Kidnappers) we found a few specimens of very small deutonymphs (length 200 to 220, width 120 to 125), which represent the infective stage of the species. They differ from the large tissular deutonymphs by their very small size and the presence of primitive epimera I to IV and sternum. All the other characters are identical to those of the large deutonymphs. Lengths of tarsi I-IV : 35-42-70-55 ; apical spine of tarsi I and II 12

to 15 long ; ; setae *d5*, *l5* and *d4* 9, 8 and 125 long respectively.

Protonymph : One of our small deutonymphs is still enclosed in its protonymphal skin. This protonymph closely resembles the larva, except that it has 4 pairs of legs instead of 3 pairs and that it has a few more setae. The idiosomal and leg setae are thin, except the setae *p* and *q* of tarsi which are spines. Gnathosoma badly oriented, but apparently small.

Larva : We have seen three larvae collected from nests of Gannet Island and Cape Kidnappers. One larva measures 250 × 150. Gnathosoma 24 long and 25 wide. Cheliceral digits very small. Setae of

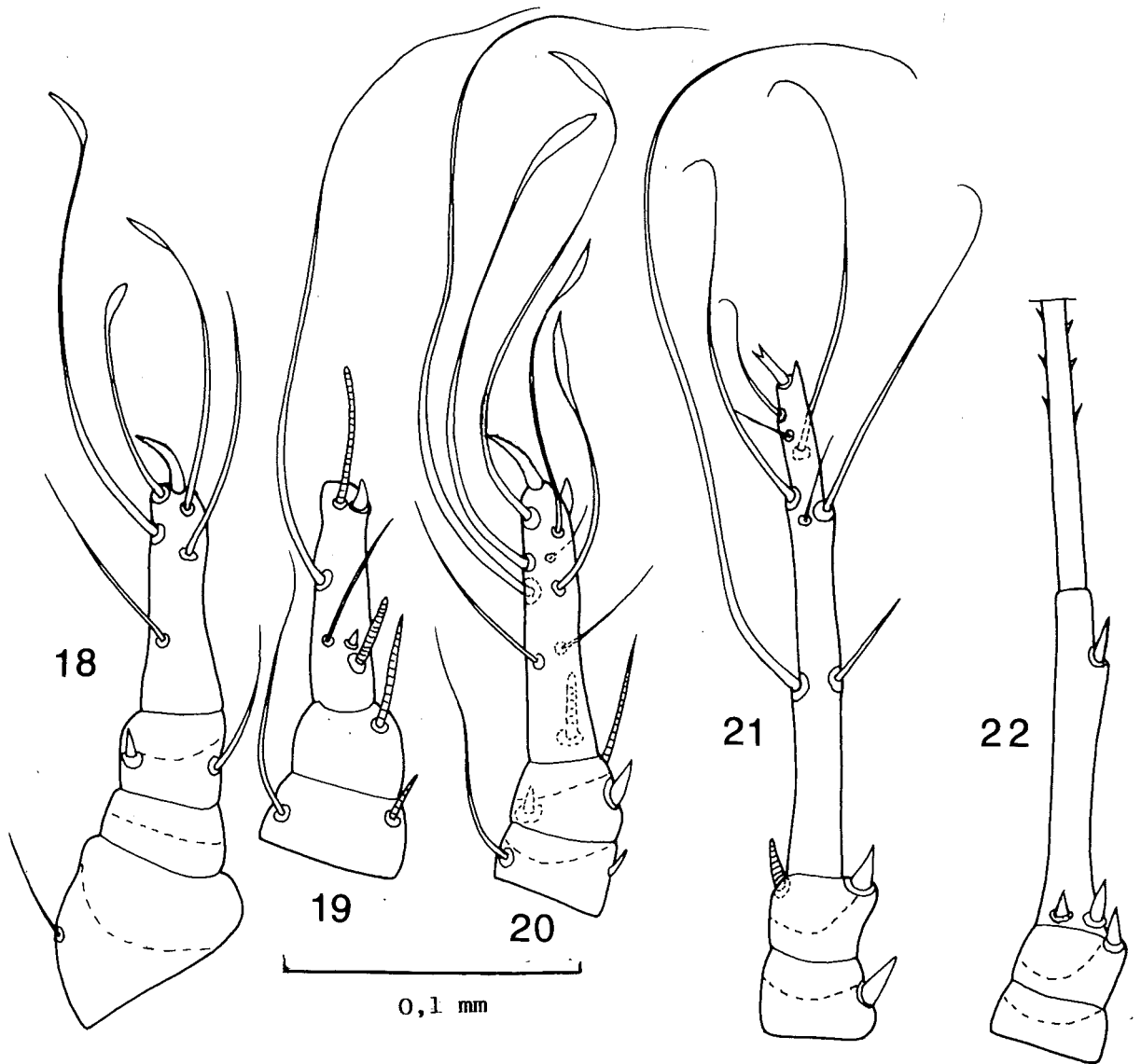


FIGS. 16-17 : *Suladectes hughesae antipodus* n.ssp. Deutonymph in ventral (16) and dorsal view (17).

legs and idiosoma as in protonymph. Coxae I with a pair of thin setae and a pair of very short Claparède's organs. Most of the female found free in the nests contained numerous eggs (up to 30 per female), some of them containing a fully develop-

ed larva. A few free larvae were found in some nests.

Prelarva : The prelarva is vestigial and represented by a transparent sacklike membrane, bearing



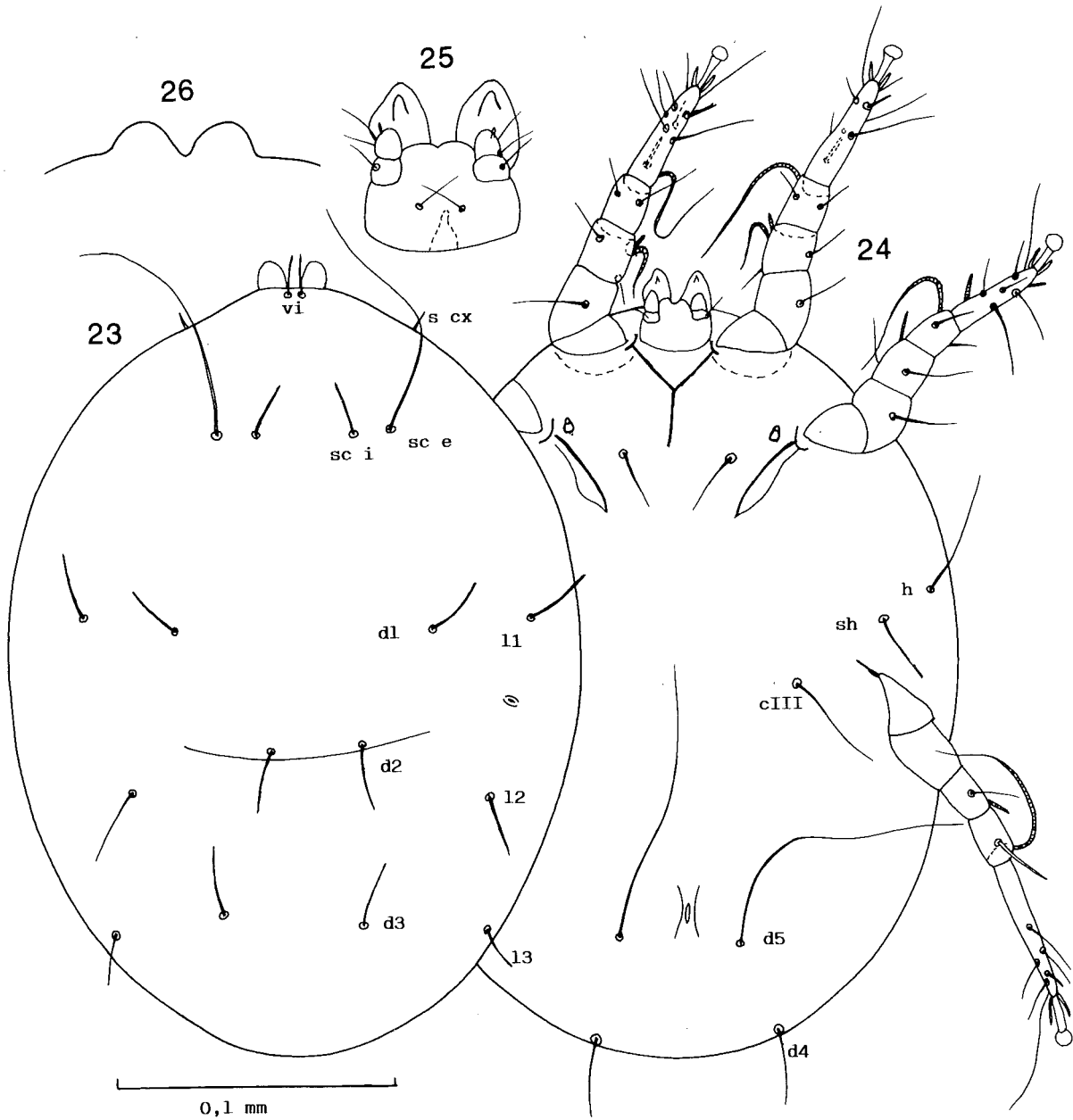
Figs. 18-22 : *Suladectes hughesae antipodus* n.ssp. Deutonymph : legs I ventrally (18) and dorsally (19); leg II (20), leg III (21), leg IV (22).

2 small conical and pointed appendages. These appendages become visible in the eggs a short before that the larvae are developed. They are ecdysing organs and probably serve to break the wall of the egg.

Remarks

1. *Suladectes hughesae antipodus* differs from the typical subspecies, in the hypopus, mainly by the

much shorter lengths of some idiosomal setae. We give herein the lengths of these setae in the typical form followed by the lengths in the new subspecies in parentheses (measurements made in holotype and in 4 paratypes for each of the subspecies) : *sc* e 120-150 (75-90); *d1* 110-120 (25-40); *d2* 80-90 (25-35); *d3* 50-90 (25-30); *d4* 125-150 (80-130); *d5* 70-90 (6-10); *l1* 110-140 (60-80); *l2* 50-75 (25-30); *l3* 33-40 (20-25); *l4* 5-8 (5-10); *l5* 8-9 (9-15); *h* 100-120 (40-50); *sh* 75-90 (30-40).



FIGS. 23-26 : *Suladectes hughesae antipodus* n.ssp. Larva in dorsal (23) and ventral view (24) ; gnathosoma ventrally (25). Tritonymphal skin : anterior extremity (26).

2. The adults in the genus *Suladectes* are the closest to those of the genus *Neottialges* at least in the subgenera where they are known, i.e. *Heronidectes*, *Ardeidectes* and *Pelecanectes*. However, in these subgenera the male tarsi IV bear 2 equal, large, apical spines (in *Suladectes* these spines are

unequal), and the propodonotum in the adults bears two, well-sclerotized, paramedian *shields* (they are lacking in *Suladectes*). Moreover, in *N. (Pelecanectes) evansi* the tritonymph is not vestigial as in *Suladectes*, but well developed and active. In *Heronidectes* only the male and female and in

Ardeidectes only the female are known, so that we have no idea about the morphology of the hypopus. The hypopi of *Suladectes* are closest to those of *Neottialges* (*Caloenectes*) and we might expect that their corresponding adults are also similar.

3. The infective stage of the mite is the small hypopus, only present in nests occupied by birds in their reproductive period. These hypopi penetrate actively through the skin of the nestlings soon after their birth. Gannets become adult and able to reproduce after a period of 4 to 5 years (WODZICKI, 1967). The mites therefore have to wait in the birds during this long period. Skin invasion of adult birds in their reproductive period seems improbable because the presence in them of an hormone (? prolactin) which induces the mobilization and the rejection of the tissular hypopi out of the body.

Types

Holotype deutonymph from the subcutaneous tissues of an Australasian gannet, *Sula bassana serrator* Gray, collected dead in coastal New Zealand waters, near Great Barrier Is. Hauraki Gulf, North Is. N.Z. (bird collected by Ian HAYTON, 15 september 1992).

Paratypes : 18 deutonymphs with same data as holotype ; 10 deutonymphs in moulting stages and found in the nest of the same bird from Gannet Is. ; 22 females (12 from Gannet Is., 5 from Clova Bay and 5 from Cape Kidnappers) and 8 males (1 from Gannet Is., 4 from Clova Bay, 3 from Cape Kidnappers) ; 5 small hypopi and 3 larvae from nests in Gannet Island or Cape Kidnappers.

Holotype, 3 deutonymph, 14 female and 13 male paratypes deposited in the National Museum of New Zealand. One deutonymph, one male and one female paratype in the British Museum (Natural History) London. Other paratypes in the Institut royal des Sciences naturelles de Belgique.

ACKNOWLEDGEMENTS

The authors wish to thank Riccardo PALMA of the National Museum of New Zealand for allowing access to their collection of material from three gannet rookeries. Mr O'BRIEN and Mr. I. HAYTON are thanked for collecting material.

Recently the junior author found, under the skin of a cadaver of an adult *Sula bassana serrator* from Taranaki beach, a young hypopus 360 μ m long, belonging to *Suladectes hughesae antipodus*. Moreover, several other small hypopi were recovered from the NaOH digest of the skin and feathers of a part of the same cadaver. These findings prove that adult birds can be infected by these young hypopi.

REFERENCES

- FAIN (A.), 1966. — Notes sur les acariens nidicoles à deutonymphe parasite tissulaire des oiseaux (Hypodectidae : Sarcoptiformes). (Note préliminaire). — Rev. Zool. Bot. afr. **74** : 324-330.
- FAIN (A.), 1967. — Les hypopes parasites des tissus cellulaires des oiseaux (Hypodectidae : Sarcoptiformes). — Bull. Inst. r. Sci. nat. Belg. **43**, n° 4 : 1-139.
- FAIN (A.), 1969. — Nouveaux hypopes parasites des tissus cellulaires d'oiseaux. — Bull. Ann. Soc. R. Ent. Belg. **105** : 91-102.
- FAIN (A.), 1984. — A new hypoderid mite from the nest of a vulture in South Africa. (Acari : Astigmata). — Rev. Zool. Bot. afr. **98** : 719-724.
- FAIN (A.) & BAFORT (J.), 1966. — Les hypopes parasitant les tissus cellulaires des pigeons sont les deutonymphes d'un acarien libre et pas celles d'un acarien plumicole. (Notre préliminaire). — Rev. Zool. Bot. Afr. **74** : 313-316.
- FAIN (A.) & BAFORT (J.), 1967. — Cycle évolutif et morphologie de *Hypodectes* (*Hypodectoides*) *propus* (Nitzsch, 1961), acarien nidicole a deutonymphe parasite tissulaire des pigeons. — Bull. Acad. r. Belgique. Classe des Sciences, 5° Sér. **53** : 501-533.
- FAIN (A.) & BEAUCOURNU (J. C.), 1972. — Observations sur le cycle évolutif de *Pelecanectes evansi* Fain et description d'une espèce nouvelle du genre *Phalacro-dectes* Fain (Hypoderidae, Sarcoptiformes). — Acarologia **13** : 374-382.
- FAIN (A.) & LUKOSCHUS (F. S.), 1977. — New endofollicular or subcutaneous hypopi from mammals (Acarina : Astigmata). — Acarologia, **19** : 485-493.
- FAIN (A.) & LUKOSCHUS (F. S.), 1986. — Observations on the life cycle of *Neottialges* (*Pelecanectes*) *evansi* Fain, 1966 and *Phalacro-dectes whartoni* Fain, 1967, with descriptions of new taxa (Acari, Hypoderatidae). — Systematic Parasitology, **8** : 291-316.

OCONNOR (B. M.), 1981. — A new genus and species of Hypoderidae (Acari, Astigmata) from the nest of an owl (Aves : Strigiformes). — *Acarologia*, **22** : 299-304.

OCONNOR (B. M.), 1985. — Hypoderatid mites associated with Cormorants (Aves : Phalacrocoracidae) with description of a new species. — *J. Med. Entom.* **22** : 324-331.

WODZICKI (K.), 1967. — The Gannets at Cape Kidnappers. 2. Dispersal and Movements. — *Trans. Roy. Soc. New Zeal. Zoology.* **9** : 17-31.

Paru en Décembre 1994.

