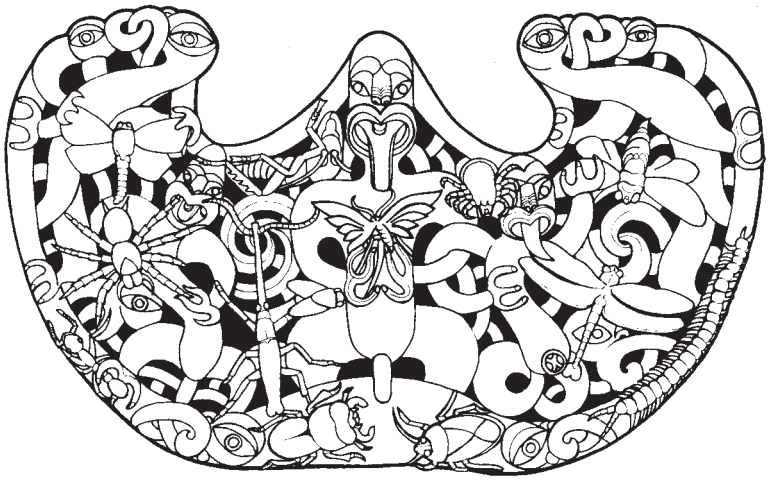


Fauna of New Zealand

Ko te Aitanga Pepeke o Aotearoa

Fauna of New Zealand
Ko te Aitanga Pepeke o Aotearoa

Number / Nama 56

Tyrophagus
(Acari: Astigmata: Acaridae)

Qing-Hai Fan

Institute of Natural Resources, Massey University, Palmerston North, New Zealand,
and College of Plant Protection, Fujian Agricultural and Forestry University,
Fuzhou 350002, China
fanqh@acarology.org
and
Zhi-Qiang Zhang
Landcare Research, Private Bag 92170, Auckland, New Zealand
ZhangZ@LandcareResearch.co.nz

Manaaki Whenua PRESS

Lincoln, Canterbury, New Zealand
2007

Cataloguing in publication

Fan, Qing-Hai.
Tyrophagus (Acari: Astigmata: Acaridae) / Qing-Hai Fan and Zhi-Qiang Zhang. — Lincoln, N.Z. : Manaaki Whenua Press, Landcare Research, 2007.
(Fauna of New Zealand, ISSN 011-5383 ; no. 56)
ISBN-13: 978-0-478-09386-5
ISBN-10: 0-478-09386-1

1. *Tyrophagus* — Classification. 2. *Tyrophagus* — Identification. I. Zhang, Zhi-Qiang, 1963- II. Title. III. Series.

UDC 595.42

Suggested citation:
Fan, Q.-H.; Zhang, Z.-Q. 2007. *Tyrophagus* (Acari: Astigmata: Acaridae). *Fauna of New Zealand 56*, 291 pp.

Prepared for publication by the series editor using computer-based text processing and layout at Landcare Research, Private Bag 92170, Auckland, New Zealand

Māori text by W. Te Rakihawea, Ngaruawahia.

Published by Manaaki Whenua Press, Landcare Research, P.O. Box 40, Lincoln, Canterbury, N.Z.
Website: http://www.mwpress.co.nz/

Printed by PrintLink Ltd, Wellington

Date of publication 4 June 2007

Front cover: *Tyrophagus communis* male (Illustrator: Qing-Hai Fan).

Publication of the *Fauna of New Zealand* series is the result of a research investment by the Foundation for Research, Science and Technology under contract number C09X0501.

POPULAR SUMMARY — HE WHAKARĀPOPOTOTANGA

Class **Arachnida**

Subclass **Acari**

Supraorder **Acariformes**

Order **Astigmata**

Family **Acaridae**

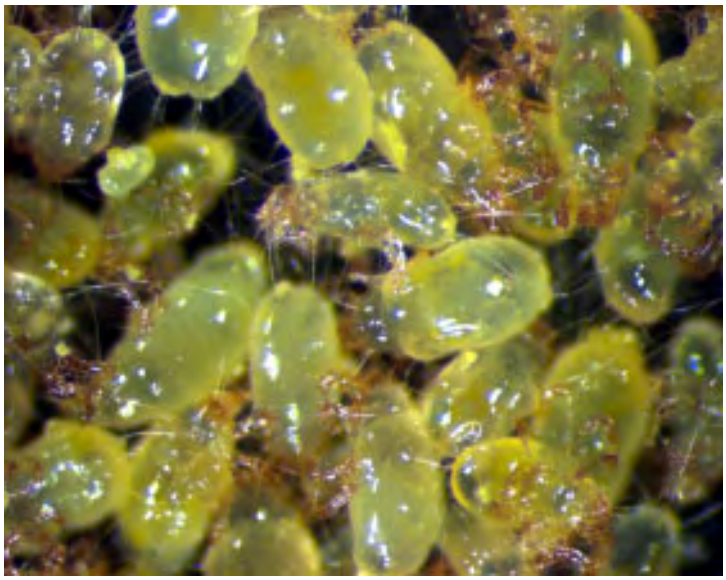


Illustration / Whakaahua: *Tyrophagus communis*

Tyrophagus mites

The genus *Tyrophagus* comprises a group of primarily fungivorous mites, including the mould mites, commonly found in stored food products and decaying organic matter. They are also associates of various insects, or inhabitants of vertebrate nests. They are the most abundant and economically important mites inhabiting stored food and products. Some *Tyrophagus* species are also facultatively phytophagous and can cause economic damage to plants, including both ornamental flowers and vegetables grown in greenhouses. *Tyrophagus* belongs to the supraorder Acariformes, order Astigmata, family Acaridae. Currently, it comprises about 35 species and is worldwide in distribution.

The life cycle commonly consists of the egg, larva, protonymph, tritonymph, and adult stages. The deutonymph is rarely present and has been recorded for one species only. Females of *Tyrophagus* can produce 100 to 700 eggs. Development from the egg to adult normally takes 1 to 3 weeks, depending on temperature.

In New Zealand, members of *Tyrophagus* was firstly recorded by Cockayne & Waters (1916) as chaff-mites, and later considered to be *Tyrophagus longior* by Robertson (1946), who also provided information on its distribution and host. In her revision of *Tyrophagus*, Robertson (1959) recorded four species from New Zealand. Up to now five species of *Tyrophagus* have been recognised as occurring in New Zealand.

(continued overleaf)

Ngā Pūwereriki *Tyrophagus*

Kei te puninga *Tyrophagus* ko te rōpū pūwereriki kai harore, ā, ko ngā pūwereriki pūhekaheka hoki ka kitea i ngā kai rokiroki me ngā ngaku pararopi pirau. He pānga o rātou ki ētahi pepeke, ki ngā whai tuaiwi noho kōhanga rānei. Ko rātou ngā pūwereriki tino mātinitini, whai pānga ōhanga ka noho ki ngā kai me ngā hua rokiroki. Ko ētahi momo *Tyrophagus* hoki he kaitipu taunga ki te noho ki ngā tūāhuatanga taiao ā, arā noa atu te raru ā-ohanga ka puta i a rātou ki te ao tipu, ki ngā putiputi whakapaipai me ngā huawhenua ka whakatupua ā-whare. Ka noho mai a *Tyrophagus* ki te pūtoi o runga o Acariformes, o te pūtoi Astigmata, o te whānau Acaridae. I tēnei wā, 35 ōna momo ā, e marara ana ki ngā tōpito katoa o te ao.

Ko tōna mataora ā, he hua, he kōhungahunga, he pokopoko tuatahi, he pokopoko tuatoru, he pakeke. Me uaua te pokopoko tuarua ka puta ā, kotahi noa iho te momo i mau e pēnei ana. Ka whānau te uwha *Tyrophagus* i ana hua 100 ki te 700. Nā runga i te pāmahana, ko tōna 1 ki te 3 wiki te whanaketanga mai i te hua ki te tūātipu pakeke.

I Aotearoa ko te tuhinga tuatahi mō ngāi *Tyrophagus* nā Cockayne rāua ko Walters (1916) i kīia ai he pūwereriki pāpapa rātou. Nō muri ka tapaina ko *Tyrophagus longior* e Robertson (1946) ā, nāna hoki ngā kōrero ki hea rātou

(haere tonu)

In this contribution species of the genus *Tyrophagus* present in New Zealand are comprehensively revised, along with species found in Australia and other Oceanian countries. Ten species, including two new species, are described and illustrated from New Zealand: *Tyrophagus communis* sp. n., *T. curvipenis* Fain & Fauvel, *T. longior* (Gervais), *T. macfarlanei* sp. n., *T. neiswanderi* Johnston & Bruce, *T. putrescentiae* (Schrank), *T. robertsonae* Lynch, *T. savasi* Lynch, *T. similis* Volgin and *T. vanheurni* Oudemans. Seven species, including three new species, are described and illustrated from Australia and Oceanian countries: *T. australasiae* (Oudemans), *T. javensis* (Oudemans), *T. pacificus* sp. n., *T. perniciosus* Zakhvatkin, *T. tropicus* Robertson, *T. womersleyi* sp. n. and *T. xenoductus* sp. n. In addition to the descriptions of five new species, the following nomenclatural changes are made: *Tyrophagus africanus* Meyer & Rodrigues, 1966 syn. n. of *Tyrophagus neiswanderi* Johnston & Bruce, 1965; *T. palmarum* Oudemans sensu Robertson, 1959 syn. n. of *T. vanheurni* Oudemans (revived). The species concepts of *T. putrescentiae* (Schrank) and *T. javensis* (Oudemans) are clarified. Identification keys to adult males and females are given, along with taxonomic references, hosts/habitats and distribution data of each species. This will help identification and facilitate requests for rapid quarantine decisions from trading partners.

Contributor **Qing-Hai Fan** was born in North China and educated in South China, graduating with a PhD in entomology from Fujian Agricultural University in 1996. From

(continued overleaf)

tītari ai me ō rātou manapou. I tana whakahoutanga o *Tyrophagus* Robertson (1959) i kōrerohia ngā momo e whā o Aotearoa. I taua wā e rima ngā momo o *Tyrophagus* e mōhiotia ana ka kitea i Aotearoa.

Ki tēnei tānga kōrero ko ngā momo o te puninga *Tyrophagus* kei Aotearoa, he mea titiro whānui me ngā momo anō hoki ka kitea i Ahitereiria me ētahi atu whenua o Oceania. Tekau ngā momo, e rua he momo hou, nō Aotearoa katoa, i whakaahuatia ā-kupu, ā-pikitia: *Tyrophagus communis* sp. n., *T. curvipenis* Fain & Fauvel, *T. longior* (Gervais), *T. macfarlanei* sp. n., *T. neiswanderi* Johnstone & Bruce, *T. putrescentiae* (Schrank), *T. robertsonae* Lynch, *T. savasi* Lynch, *T. similis* Volgin, *T. vanheurni* Oudemans. E whitu ngā momo, e toru he momo hou, nō Ahitereiria me ngā whenua Oceania i whakaahuatia ā-kupu, ā-pikitia: *T. australasiae* (Oudemans), *T. javensis* (Oudemans), *T. pacificus* sp. n., *T. perniciosus* Zakhvatkin, *T. tropicus* Robertson, *T. womersleyi* sp. n., me *T. xenoductus* sp. n. I tua atu i ngā whakaahuatanga o ngā momo hou e rima, ko ngā huringa tapaingoa e whai ake nei: *Tyrophagus africanus* Meyer & Rodrigues, 1966 syn. n. o *Tyrophagus neiswanderi* Johnstone & Bruce, 1965; *T. palmarum* Oudemans sensu Robertson, 1959 syn. n. o *T. vanheurni* Oudemans (i whakahoutia). Kua āta whakamāramatia ngā ariā o te momo *T. putrescentiae* (Schrank) me te momo *T. javensis* (Oudemans). Kua homai ngā tohu tautuhi i ngā toa pakeke i ngā uwha pakeke, kua oti ngā tohutoro whakarōpū, ngā nōhanga me ngā raraunga tītaringa mō ia momo. Ka āwhina tēnei i te taha tautuhinga ā, ko ngā tono a ngā hoa tauhokohoko mō ngā whakatau wehenga ārai mate ka tere te whakautua.

I whānau mai a **Qing-Hai Fan** i Haina ki te Raki, ka kuraina ki Haina ki te Tonga, me te whiwhi i tana Tākutanga mātai pepeke i te Whare Wānanga Ahuwhenua Fujian i te tau 1996. Mai i te tau 1985 ki te 2001, ka noho ia ki ngā tūranga o te pūkenga āwhina, te pūkenga, me te pūkenga tōrua i taua Whare Wānanga anō. Mai i te tau 2002, he ahorangi mātai pepeke ia i te Whare Wānanga Ahuwhenua, Whakatipu Rākau Fujian. Ko te Tauārai Tipu, te Mātai Pepeke Ahuwhenua, te Mātai Pepeke Noho Tāone me te Mātai Pūwereriki ētahi o ngā kaupapa kua whakaakona e ia. I te tau 2001 me te 2002, i a ia e toro ana i te Whare Wānanga o Queensland i Ahitereiria, ka mahi tahi rāua ko Tākuta David E. Walter ki te tirotiro i ngā pūwereriki o Ahitereiria. I te tau 2003 ka rere mai ki Aotearoa, ka rangahau i ngā pūwereriki 'pātaka porotaka' i te taha o Tākuta Zhi-Qiang Zhang, i raro i te maru o Manaaki Whenua. Kātahi ia ka mahi hei kairangahau i Te Kunenga ki Pūrehuroa, he āta tirotiro tāna i te pūwereriki *Varroa* e

(haere tonu)

1985 to 2001 he served as an assistant lecturer, lecturer, and associate professor in Fujian Agricultural University. He has been a professor of entomology at Fujian Agricultural and Forestry University since 2002. He has taught courses including Plant Quarantine, Agricultural Entomology, Urban Entomology, and Acarology. From 2001 to 2002, as a visiting scientist in Queensland University, Australia, he worked on Australian mites with Dr David E. Walter. He came to New Zealand in 2003 to study bulb mites with Dr Zhi-Qiang Zhang as an acarologist in Landcare Research, and then worked on the devastating honeybee pest, *Varroa* mite, as a research associate at Massey University. He is the Production Editor of Systematic & Applied Acarology. He has written more than 60 journal papers on the systematics, biology, and control of mites and insects. He published a book on the Australasia and Oceania bulb mites, and a monograph on Raphignathoidea in the *Fauna of New Zealand* series in collaboration with Dr Zhang. His main interests are the systematics of mites (especially the superfamilies Raphignathoidea, Tetranychoidea, and Acaroidea) and pest management.

Contributor **Zhi-Qiang Zhang** was born in Shanghai, China and educated at Fudan University (Shanghai), graduating in 1985 with a BSc in Zoology. He began his studies

(continued overleaf)

patupatu ana i ngā pī-miere. Ko ia te ģtita Waihanga o Systematic and Applied Acarology. He nui ake i te 50 ngā tuhinga hautaka kua oti i a ia e pā ana ki ngā whakapapa, te koiora, me te here i ngā pūwereriki me ētahi atu pepeke. Kua whakaputaina e rāua ko Tākuta Zhi-Qiang Zhang tētahi pukapuka e pā ana ki ngā pūwereriki pātaka porotaka o Ahitereiria me Te Moana-nui-a-Kiwa. Ko ngā kaupapa e ngākau nuitia ana e ia, ko ngā whakapapa pūwereriki (me tino kōrero i konei ko ērā o ngā whānau nui Raphignathoidea, Tetranychoidea, me Acaroidea), me te here i ngā rauropi kino.

I whānau mai a **Zhi-Qiang Zhang** i Shanghai, i Haina, ka whai i te mātauranga i te Whare Wānanga Fudan (Shanghai). Nō te tau 1985 ka whiwhi ia i tana Tohu Paetahi, ko te Mātauranga Kararehe te kaupapa. Ka tīmata tana rangahau i ngā whakapapa me te koiora pūwereriki i te Kura Paerua, i te Whare Wānanga Fudan, i te tau 1985, ā, ka haere tonu ana akoranga paerua mai i te 1988 ki te 1992 i te Whare Wānanga o Cornell, i Ithaca, Te Āporo Nui. I reira ka riro i a ia tana Tākutatanga mātai pepeke, ko te kaupapa whāiti, ko te taupuhi kaiao o ngā pūwereriki konihi me ngā hanga ka kainga e rātou. Mai i te tau 1992 ki te 1994, ka mahi ia hei kaimātai pepeke taupuhi kaiao i te Whare Wānanga o Oregon, i Corvallis, Oregon, i runga i tētahi kaupapa here ā-koiora i te tarutaru, he mea whakataki nā Tākuta Peter McEvoy. Mai i te tau 1994 ki te 1999, he kaimātai pūwereriki ia mā te CAB Pūtahi Mātai Pepeke o te Ao, i te Whare Pupuri Taonga o te Ao Tūroa, i Rānana. I a ia e mahi ana mā CAB International, ko ia anō te Āpiha Hangarau o te BioNET-INTERNATIONAL mai i te 1998 ki te 1999. I te tau 1999, ka neke ia ki Aotearoa, ā, mai i tērā wā, ko ia te kaimātai pūwereriki o Manaaki Whenua, e whakapau kaha ana ki ngā whakapapa me te koiora pūwereriki.

He paewai rangahau hōnore a Tākuta Zhang i te Whare Pupuri Taonga o te Ao Tūroa, he ahorangi turuki ia i te Whare Wānanga Fudan, he ahorangi hōnore anō ia i te Kura Tiketike Fujian mō ngā Mātauranga Ahuwhenua (Fujian, China). Inā kē te maha o ngā tuhinga aronga whāiti kua puta i a ia e pā ana ki te pūwereriki, he neke atu i te 100 ana tuhinga, he mea arotake e tētahi atu, e pā ana ki ngā whakapapa, te taupuhi kaiao me te here i ngā hanga kino o te ao angawaho. Ko ia te ētita, me tētahi o ngā mema o ngā poari ētita o te maha atu o ngā hautaka o te ao e aro whāiti ana ki te mātai pūwereriki, te mātai pepeke, me te mātauranga kararehe. Ko ia anō te Perehitene o te Systematic & Applied Acarology Society, ā, kei runga ia i te Komiti Whāiti o te Whakarauikatanga Mātai Pūwereriki o te Ao.

Translation by **W. Te Rakihawea**

on mite systematics and biology at the Graduate School, Fudan University, in 1985, and then continued his postgraduate studies between 1988 and 1992 at Cornell University, Ithaca, New York, where he received his PhD in entomology for research on mite predator-prey ecology. Between 1992 and 1994 he worked as a postdoctoral insect ecologist at Oregon State University, Corvallis, Oregon, on biological weed control. From 1994 to 1999 he was the acarologist with CAB International Institute of Entomology based in the Natural History Museum in London. While employed at CAB International he also served as a Technical Officer of the BioNET-INTERNATIONAL from 1998 to 1999. In 1999, he moved to New Zealand and has since been the acarologist for Landcare Research, working on mite systematics and biology in the New Zealand Arthropod Collection. Dr Zhang holds an honorary research fellowship at the Natural History Museum, an adjunct professorship at Fudan University and Hebei Normal University (Shijiazhuang, China), and an honorary professorship at Fujian Academy of Agricultural Sciences (Fujian, China). He has published several monographs on mites and more than 150 refereed papers on arthropod systematics, ecology, and pest management. He is the editor and an editorial board member of several international journals of acarology, entomology, and zoology. He is the President of the Systematic & Applied Acarology Society and is also on the Executive Committee of the International Congress of Acarology. In August 2006 he was elected to the International Commission on Zoological Nomenclature as a commissioner.

ABSTRACT

Tyrophagus (Acari: Acaridae) are primarily fungivorous mites commonly found in stored food products and decaying organic matter. They are also associates of various insects, or inhabitants of vertebrate nests. They are the most abundant and economically important mites inhabiting stored food and products. Some *Tyrophagus* species are also facultatively phytophagous and can cause economic damage to plants, including both ornamental flowers and vegetables grown in greenhouses.

In this contribution, *Tyrophagus* mites of New Zealand are comprehensively revised, along with species found in Australia and other Oceanian countries. This will assist identification and facilitate requests for rapid quarantine decisions from trading partners. Ten species, including two new species, are described and illustrated from New Zealand: *Tyrophagus communis* sp. n., *T. curvipenis* Fain & Fauvel, *T. longior* (Gervais), *T. macfarlanei* sp. n., *T. neiswanderi* Johnston & Bruce, *T. putrescentiae* (Schrank), *T. robertsonae* Lynch, *T. savasi* Lynch, *T. similis* Volgin, and *T. vanheurni* Oudemans. Seven species, including three new species, are described and illustrated from Australia and Oceanian countries: *T. australasiae* (Oudemans), *T. javensis* (Oudemans), *T. pacificus* sp. n., *T. perniciosus* Zakhvatkin, *T. tropicus* Robertson, *T. womersleyi* sp. n., and *T. xenoductus* sp. n. Identification keys to adult females and males are given, along with taxonomic references, hosts/habitats and distribution data of each species.

In addition to the descriptions of five new species, the following nomenclatural changes are made: *Tyrophagus africanus* Meyer & Rodrigues, 1966 syn. n. of *Tyrophagus neiswanderi* Johnston & Bruce, 1965; *T. palmarum* Oudemans sensu Robertson, 1959 syn. n. of *T. vanheurni* Oudemans (revived). The species concepts of *T. putrescentiae* (Schrank) and *T. javensis* (Oudemans) are clarified.

Keywords: Acari, Astigmata, Acaridae, taxonomy, keys, New Zealand, Australia, Oceanian countries, quarantine.

Fan, Qing-Hai; Zhang, Zhi-Qiang 2007. *Tyrophagus* (Acari: Astigmata: Acaridae). *Fauna of New Zealand 56*, 291 pp.

Received: 30 November 2005. Accepted: 10 March 2006.

CHECKLIST OF TAXA

CONTENTS

ACKNOWLEDGEMENTS

This project could not have been completed without the help and assistance of many colleagues.

We thank the following colleagues/organisations for the loan of specimens for study:

Dr Henri M. Andre (Musée royal de l'Afrique Centrale, Tervuren, Belgium),

Dr Anne Baker (Natural History Museum, London, U.K.),

Dr Alex Fain (Institut royal des Sciences naturelles de Belgique, Belgium),

Mrs Olwyn Green and Mr Alan Flynn (National Plant Pest Reference Laboratory, Ministry of Agriculture and Forestry in Lincoln and Auckland, New Zealand),

Dr Bruce Halliday (Australian National Insect Collection, CSIRO, Canberra, Australia),

Dr David Hirst (South Australian Museum, Adelaide, Australia),

Dr John T. Jennings (Waite Insect & Nematode Collection, University of Adelaide, Adelaide, Australia),

Dr Hans Klompen (Ohio State University Museum, Columbus, Ohio, U.S.A.),

Dr Peter Lillywhite (Museum of Victoria, Melbourne, Australia),

Dr Erik J. van Nieukerken (Nationaal Natuurhistorisch Museum (Naturalis), Leiden, Netherlands),

Mr Luke Halling (Australian Quarantine and Inspection Service, New South Wale, Australia),

Mr Bill Crowe (Australian Quarantine and Inspection Service, Queensland, Australia),

Dr Ronald Ochoa (National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A.),

Dr Peter J. Schwendinger (Muséum d'Histoire Naturelle de Genève, Geneva, Switzerland),

Dr Eddie A. Ueckermann (Plant Protection Research Institute, South Africa),

Mr John Clark (CPIT, Faculty of Health and Sciences, Christchurch, New Zealand),

We thank Rosa Henderson, Trevor Crosby, Peter Buchanan, and Anne Austin (Landcare Research, New Zealand) for reading an earlier version of this manuscript. We are especially grateful to Bruce Halliday (CSIRO, Canberra, Australia), Nicholas Martin (Crop & Food Research, Auckland, New Zealand), and Don Griffiths (UK) for reviews and criticisms of the manuscript.

We are deeply indebted to Dr Qiao Wang (Massey University) for continuing collaboration and support of our research and especially personal support to the senior author.

Major funding for this research was received from Ministry of Agriculture and Forestry, New Zealand under MAF Science Policy, Project FMA122. This project was also funded in part by a contract (CO9X0501) from the Foundation for Research, Science and Technology, New Zealand.

INTRODUCTION

The genus *Tyrophagus* Oudemans belongs to the family Acaridae of the suborder Astigmata. Most species are fungivorous and occur commonly in stored food products and decaying organic matter. Some species are also facultatively phytophagous. Many other species are associates of various insects, or inhabitants of vertebrate nests.

The Acaridae is a large family of worldwide distribution. About 400 species of acarid mites belonging to some 90 genera are known in the world and many others are yet to be discovered, especially in tropical areas.

Tyrophagus is one of the most important members of the Acaridae. They are the most abundant and economically important mites inhabiting stored food and products (Hughes 1976). Some *Tyrophagus* species can cause economic damage to plants, including both ornamental flowers and vegetables grown in greenhouses (Zhang 2003). *Tyrophagus neiswanderi* was found feeding on foliage of greenhouse cucumbers (Johnston & Bruce 1965, Nakao & Kurosa 1988). *Tyrophagus perniciosus* and *T. similis* were observed attacking spinach, melon, cucumber, pumpkin, and maize in the field (Nakao & Kurosa 1988).

Since the erection of the genus *Tyrophagus* by Oudemans (1924a), nearly 60 names have been proposed under the genus *Tyrophagus*. Most of them are treated as synonyms (Griffiths 1979). The number of valid names at present is 35. Zakhvatkin (1941) first revised the genus.

Two other major subsequent revisions were carried out by Robertson (1959) and Samšiòák (1962). It was Griffiths (1979) who first introduced the concept of trying to understand the relationship between the phenotype and the genotype and undertook hybridisation experiments to determine the limits of morphospecies. Other important taxonomic contributions were made by Johnson & Bruce (1965), Fain (1976, 1977, 1985), and Lynch (1989). The genus is in serious need of an updated revision to allow clarification of species limits and accurate identification.

In New Zealand, tyrophagid mites have long been considered serious household pests. Cockayne & Waters (1916) first recorded *Tyrophagus longior* (as *Tyroglyphus longior*) attacking fodder. Robertson (1946) historically reviewed the studies on *Tyrophagus longior* and provided distribution and host information. In 1959 she recorded 4 species from New Zealand: *Tyrophagus communis* (as *T. putrescentiae*), *T. longior*, *T. similis* (as *T. oudemansi*), and *T. vanheurni* (as *T. palmarum*), in her comprehensive revision of the genus. Up to now 5 species (including *T. neiswanderi*) were known to occur in New Zealand.

Economic importance and context for this volume

Unidentified mites in this genus can pose problems for access to markets for horticultural crops and stored foodstuffs when intercepted by an importing country; however, there is no comprehensive account of this genus for New Zealand and Australia. This monograph revises the taxonomy of *Tyrophagus* in New Zealand, Australia, and other Oceanian countries including Cook Is., Fiji, Niue Is., Papua New Guinea, Samoa, Solomon Is., Tokelau Is., Tonga, Tuvalu, and Vanuatu.

We provide user-friendly identification keys to species using morphological characters of the adults, both males and females, with additional worldwide distribution data for each species. The key and distribution information can be used by MAF to facilitate rapid quarantine decisions by trading partners.

Life cycle

The life cycle consists of the egg, larva, protonymph, deutonymph, tritonymph, and adult stages. The deutonymph, usually known as the hypopus, is rarely present, being dependent on environmental and biotic conditions, and has been recorded for one species only. Development from the egg to adult normally takes 1–3 weeks, depending on temperature. Many acarid mites are very highly fecund, for example, *Tyrophagus* females can produce between 100 and 700 eggs.

METHODS AND CONVENTIONS

Methods

All measurements were made from slide-mounted specimens using stage-calibrated ocular micrometers on an interference-phase contrast microscope. Chelicerae were measured from the basal articulations to the tips of movable digits. Idiosomal lengths were measured from the anterior margins to the posterior margins. Idiosomal widths were measured at the maximum width of the idiosoma between leg II and III. Dorsal body setae were measured from the alveoli to tips. Legs were measured from the bases of trochanters to the tips of claws. Femora of legs were measured from the ventral junction between the trochanter and femur to the junction between the femur and genu. Genua were measured from the junction between the femur and genu to the junction between the genu and tibia. Tibiae were measured from the junction between the genu and tibia to the junction between the tibia and tarsus. Tarsi were measured from the basal margins to the tips of claws. Setae, spines, and solenidia on legs were measured from the alveoli to tips. All measurements are given in micrometers; for convenience, the symbol μm is omitted throughout the descriptions. Line drawings were made in pencil using a camera lucida attachment on a microscope and inked with Rotring Rapidograph Pens. Images were taken using a Leica microscope and edited with the Automontage program if necessary.

In the material examined, n/n indicates number of slides/number of specimens. Measurements x (y–z): x is the measurement of the specimens (most are holotype or neotype) from which the figure was drawn; y–z is the range of measurements. Female or male means the adult of each sex.

The terminology of idiosomal chaetotaxy follows Griffiths *et al*. (1990) and the terminology of palp and leg chaetotaxy follows that of Grandjean (1939) and Griffiths (1970). The terminology of the copulatory organ follows that of Klimov & O'Connor (2003) and Fan & Zhang (2004).

Conventions

Depositories and collection acronyms

ANIC Australian National Insect Collection, CSIRO, Canberra, Australia

AQIS/NSW Australian Quarantine and Inspection Service, New South Wales, Australia

AQIS/QLD Australian Quarantine and Inspection Service, Queensland, Australia

ARC-PPRI ARC-Plant Protection Research Institute, Pretoria, South Africa

ASCU Agricultural Scientific Collections Unit, Orange Agricultural Institute, NSW Agriculture, Orange NSW, Australia

BMNH Natural History Museum, London, U.K.

IRScNB Institut royal des Sciences naturelles de Belgique, Brussels, Belgium

MAF/A Ministry of Agriculture and Forestry, Auckland, New Zealand

MAF/L Ministry of Agriculture and Forestry, Lincoln, New Zealand

MRAC Musée royal de l'Afrique Centrale, Tervuren, Belgium

MV Museum of Victoria, Melbourne, Australia

NPPRL National Plant Pest Laboratory, Ministry of Agriculture and Forestry of New Zealand

NZAC New Zealand Arthropod Collection, Landcare Research, Auckland, New Zealand

OSM Ohio State University Museum, Columbus, Ohio, U.S.A.

RMNH Nationaal Natuurhistorische Museum (Naturalis) [formerly Rijksmuseum van Natuurlijke Historie], Leiden, Netherlands

SAM South Australian Museum, Adelaide, Australia

USNM National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A.

WINC Waite Insect & Nematode Collection, University of Adelaide, Adelaide, Austalia

Under material examined, the New Zealand collection data is categorised under the area codes of Crosby *et al*. (1998), and Australian collection data is arranged under State abbreviations, such as WA for Western Australia; these are arranged alphabetically.

List of abbreviations

1a coxal-sternal setae associated with bases of legs I

3a innermost (first) pair of coxal-sternal setae associated with bases of legs III

3b second pair of coxal-sternal setae associated with bases of legs III

4a coxal-sternal setae associated with bases of legs IV

aa proximal seta on tarsi I

ad_1 first pair of adanal setae

ad_2 second pair of adanal setae

ad_3 third pair of adanal setae

ba mid-dorsal seta on tarsi I and II

c_1 innermost (first) pair of setae in first series or row on hysterosoma

c_2 second pair of setae in first series or row on hysterosoma

c_3 fourth pair of setae in first series or row on hysterosoma

cG anteriorly-located seta on genua I and II

cha cheliceral seta

c_p third pair of setae in first series or row on hysterosoma

d subdistal dorsal seta on tarsi

d_1 innermost (first) pair of setae in second series or row on hysterosoma

d_2 second pair of setae in second series or row on hysterosoma

e subdistal dorsal conical spine or seta on tarsi

e_1 innermost (first) pair of setae in third series or row on hysterosoma

e_2 second pair of setae in third series or row on hysterosoma

elcp supracoxal seta of palp

f subdistal lateral seta on tarsi

f_2 setae in fourth series or row on hysterosoma

g genital setae

gla opisthonotal glands

gT anteriorly-located seta on tibiae I and II

h_1 innermost (first) pair of setae in fifth series or row on hysterosoma

h_2 second pair of setae in fifth series or row on hysterosoma

h_3 third pair of setae in fifth series or row on hysterosoma

hT posterior-located seta on tibiae I and II

ia anterior pair of cupules (lyrifissures) on dorsal hysterosoma

ih caudal pair of cupules (lyrifissures) on hysterosoma

im middle pair of cupules (lyrifissures) on dorsal hysterosoma

ip posterior pair of cupules (lyrifissures) on dorsal hysterosoma

kT ventral seta on tibiae III and IV

la anteriorly-located mid-lateral seta on tarsi I and II

m subcapitular setae

mG posterior-located seta on genua I and II

nG ventral seta on genu III

pR seta on trochanters I and II

ps_1 first pair of pseudanal setae

ps_2 second pair of pseudanal setae

ps_3 third pair of pseudanal setae

r	mid-lateral seta on tarsi III and IV
ra	posterior-located mid-lateral seta on tarsi I and II
sce	external pair of scapular setae
sci	internal pair of scapular setae
scx	supracoxal setae of leg I
sR	seta on trochanter III
ve	external pair of vertical setae
vF	ventral seta on femora I and II
vi	internal pair of vertical setae
w	mid-ventral seta on tarsi III and IV
wa	mid-ventral seta on tarsi I and II
wF	ventral seta on femur IV
ε	famulus at base of solenidion (ω_1) on tarsus I
φ	solenidion on tibia
σ	solenidion on genua II and III
σ'	anteriorly-located solenidion on genu I
σ"	posterior-located solenidion on genu I
ω	proximal solenidion on tarsi II
ω_1	proximal solenidion on tarsi I
ω_2	basal solenidion on tarsus I
ω_3	distal solenidion on tarsus I

DESCRIPTIONS

Genus *Tyrophagus* Oudemans

Tyrophagus Oudemans, 1924a: 250.
Coelognathus Turk, 1953: 81.

Type species: *Acarus putrescentiae* Schrank, 1781; designated by Oudemans, 1924.

Diagnosis. **Adult**. Idiosoma saccate, 300–600 long, whitish to semitransparent. Dorsum with 4 pairs of prodorsal setae and 12 pairs of hysterosomal setae, all dorsal setae barbed. External vertical setae obviously long, situated at anterior lateral margins of prodorsal shield. Internal scapular setae longer than external scapular setae. Hysterosomal setae c_1 and d_1 or d_2 shorter than distance to setae in next row. Supracoxal setae *scx* usually bearing pectinations, rarely smooth. Distal part of Grandjean's organ finger-like, rarely barbed.

Legs light brown. Tarsi I–IV slender, more than twice as long as wide. Dorsal distal spine *e* on tarsi I–II slender. Proral setae on tarsi I–II thin, longer than unguinal setae. Tarsus I with 2 long distal setae and 1 distal solenidion (ω_3), tarsi II–III each with 2 long distal setae, tarsus IV with 2 long distal setae in female and 1 long distal seta in male.

Description. **Adult female** (Fig. 1–5). *Gnathosoma* (Fig. 3). Chelicerae chelate, having a small ventral seta (*cha*) at base of distal digits; *cha* distally pointed or bifurcate. Basal part of palp fused to infracapitulum, bearing a lateral spine-like palpal supracoxal seta (*elcp*); *elcp* smooth or barbed. Distal part of palp having 2 segments, basal segment bearing 2 simple setae; the other segment bearing 1 simple seta, 1 solenidion and 1 button-like ventral eupathidium. Infracapitulum with a pair of whip-like ventral setae (*m*).

Idiosoma (Fig. 1–2). Prodorsum with a shield, 4 pairs of prodorsal setae (*vi*, *ve*, *sci,* and *sce*), and 1 pair of lateral sclerites. Prodorsal shield punctate, and its posterior margin straight, or broadly round or convex. Internal vertical setae (*vi*) situated at anterior margin of prodorsal shield, moderately barbed and close to each other. External vertical setae (*ve*) more than 1/2 of *vi*, obviously barbed, situated at anterior lateral margins of prodorsal shield, about in same alignment with *vi*. Scapular setae (*sci* and *sce*) situated behind prodorsal shield, moderately barbed; internal scapular setae (*sci*) obviously longer than external scapular setae (*sce*). Basal part of lateral sclerite with a narrow supracoxal gland opening and distal part with a finger-like Grandjean's organ. Supracoxal setae (*scx*) often with pectinations, rarely smooth, lateral to base of sclerite. Hysterosoma with 12 pairs of barbed setae (c_1, c_2, c_p, c_3, d_1, d_2, e_1, e_2, f_2, h_1, h_2, and h_3), 4 pairs of lyrifissures (*ia*, *im*, *ip*, and *ih*) and 1 pair of opisthonotal glands; setae c_1 and c_3 obviously short, c_3 situated ventrolaterally; d_2 often about as long as c_1, rarely twice as long as c_1; d_1 often obviously longer than c_1, c_3, and d_2, rarely as long as c_1; e_2 and f_2 situated dorsolaterally or ventrolaterally; h_2 situated posteriorly and h_3 situated ventroposteriorly. Lyrifissures *ia* situated posteriorad of c_2; *im* close to d_2, dorsolaterally or ventrolaterally; *ip* close to f_2; *ih* in ventral side, lateral to anal opening. Gland opening (*gla*) posteriorad of d_2. Coxae fused with ventral idiosoma, each bounded by a sclerotised apodeme. Left and right apodemes of coxae I fused together along midline. A pair of thin sclerotised sejugal apodemes present between coxae II and coxae III. Coxa I with 1 seta (*1a*), coxa III with 2 setae (*3a* and *3b*), and coxa IV with 1 seta (*4a*). Genital opening present between coxae III and IV, with 2 pairs of genital papillae covered by genital valves and 1 pair of genital setae (*g*). Genital folds present. Anal opening posteriorad of genital opening, with 6 pairs of setae (ad_3, ps_3, ad_2, ad_1, ps_2, and ps_1), ps_3 often slightly longer than or about as long as $ad_{1–3}$, ps_2 and ps_1 obviously longer than $ad_{1–3}$ and ps_1. Copulatory opening posterior to anal opening, supported by a small selerotised pad that varies in shape, and leads into a spermathecal duct of various lengths and dimensions. The duct opens

into the sac-like inner part of the spermatheca. The sac being attached to and supported by a collar of chitinised material and bearing paired Y-shaped, funnel-like sclerites, usually sited at the opposite points of a circumference and to which the paired ovarial sacs are attached. Each funnel terminates in a very fine tube through which spermatozoa can travel from the reservoir of the spermathecal sac into the ovary proper (Fig. 3).

Legs (Fig. 5). Light brown. Tarsi I–IV slender, more than twice as long as wide. Dorsal distal seta *e* on tarsi I–II thin, setiform. Proral setae on tarsi I–II thin, longer than unguinal setae. Tarsus I with 2 long distal setae and 1 distal solenidion (ω_3), tarsi II–IV each with 2 long distal setae. Setae on trochanters, femora, and tarsi smooth; setae on genua and tibiae barbed. Chaetotaxy of legs (I–IV): coxae 1, 0, 2, 1; trochanters 1, 1, 1, 0; femora 1, 1, 0, 1; genua 2 + 2σ, 2 + 1σ, 1 + 1σ, 0; tibiae 2 + 1φ, 2 + 1φ, 1 + 1φ, 1 + 1φ; tarsi 7 + 1 dorsal setiform spine + 5 ventral conical or setiform spines + 3ω + 1ε, 6 + 1 dorsal setiform spine + 5 ventral conical or setiform spines + 1ω, 4 + 1 dorsal setiform spine + 5 ventral conical or setiform spines, 4 + 1 dorsal setiform spine + 5 ventral conical or setiform spines.

Adult male (Fig. 6–10). Similar to adult female except: genital opening situated between coxae IV; aedeagus present; with a pair of anal suckers; without adanal setae; tarsus IV having 2 suckers. Complement of setae on legs as in adult female except tarsi IV with 3 + 1 dorsal setiform spine + 5 ventral conical or setiform spines.

Tritonymph (Fig. 11–14). Similar to adult female except: genital folds absent; adanal setae absent. Complement of setae on legs as in adult female.

Deutonymph. This stage is often suppressed except in one species, *Tyrophagus formicetorum* Volgin (Fain & Chmielewski 1987). Body highly sclerotised, dorsoventrally flat. Gnathosoma reduced. Chelicerae absent. Idiosomal setae small. Setae *scx* situated ventrally. With 2 pairs of genital papillae and 1 pair of genital setae. Ventral hysterosomal area forming an anal attachment organ, which bears 6 pairs of attachment structures (modified setae). Solenidion σ" on genu I absent. Solenidion ω_3 on tarsi I proximal. Some of the distal setae on tarsi foliate. Complement of setae on legs as in adult female except tarsi I–IV with 9 + 3ω + 1ε(?), 9 + 1ω(?), 8, 8.

Protonymph (Fig. 15–18). Similar to adult female except: ventral setae *3a* and *4a* absent; genital folds absent; with 1 pair of genital papillae; adanal setae absent; solenidion ω_3 on tarsi I absent; trochanter IV to tibia IV nude. Chaetotaxy of legs (I–IV): coxae 1, 0, 1, 0; trochanters 0, 0, 0, 0; femora 1, 1, 0, 0; genua 2 + 2 σ, 2 + 1 σ, 1 + 1 σ, 0; tibiae 2 + 1 φ, 2 + 1 φ, 1 + 1 φ, 0; tarsi 7 + 1 dorsal setiform spine + 5 ventral conical or setiform spines + 2 ω + 1ε, 6 + 1 dorsal setiform spine + 5 ventral conical or setiform spines + 1 ω, 4 + 1 dorsal setiform spine + 5 ventral conical or setiform spines, 3 + 1 dorsal setiform spine + 5 ventral conical or setiform spines.

Larva (Fig. 19–22). Similar to adult female except: hysterosoma with 10 pairs of setae (f_2 and h_3 absent); ventral setae *3a* and *4a* absent; without genital opening, genital setae and genital papillae; pseudanal and adanal setae absent; with 3 pairs of legs (leg IV absent); with 1 pair of Claparède organs between coxae I–II; solenidia ω_2 and ω_3 on tarsi I absent. Chaetotaxy of legs (I–III): coxae 0, 0, 0; trochanters 0, 0, 0; femora 1, 1, 0; genua 2 + 2 σ, 2 + 1 σ, 1 + 1 σ; tibiae 2 + 1 φ, 2 + 1 φ, 1 + 1 φ; tarsi 7 + 1 dorsal setiform spine + 5 ventral conical or setiform spines + 1 ω + 1ε, 6 + 1 dorsal setiform spine + 5 ventral conical or setiform spines + 1 ω, 4 + 1 dorsal setiform spine + 5 ventral conical or setiform spines.

Key to stages of *Tyrophagus* Oudemans

1 With 4 pairs of legs; hysterosoma with 12 pairs of setae (f_2 and h_3 present) (Fig. 1); Claparède organs absent; genital papillae present (1 or 2 pairs) (Fig. 2) 2

—With 3 pairs of legs; hysterosoma with 10 pairs of setae (f_2 and h_3 absent); Claparède organs present, located between coxae I–II (Fig. 20); genital papillae absent (Fig. 20) ..... larva

2 Body saccate; gnathosoma developed, chelicerae chelate (Fig. 3A); ventral hysterosoma without an anal attachment organ; genu I with 2 solenidia (Fig. 5A) 3

—Body highly sclerotised, dorsoventrally flat; gnathosoma reduced, chelicerae absent; ventral hysterosoma with an anal attachment organ; genu I with only 1 solenidion ..... deutonymph

3 With 2 pairs of genital papillae (Fig. 2); ventral setae *3a* and *4a* present; solenidion ω_3 on tarsus I present (Fig. 5A); femur IV and tibia IV not nude 4

—With 1 pair of genital papillae (Fig. 16); ventral setae *3a* and *4a* absent; solenidion ω_3 on tarsus I absent (Fig. 18A); femur IV and tibia IV nude .... protonymph

4 Genital folds present; with either spermatheca (Fig. 2) or aedeagus (Fig. 7) ..... (adult) 5

—Genital folds absent; without spermatheca or aedeagus (Fig. 12) ..... tritonymph

5 With aedeagus (Fig. 7); without spermatheca; hysterosoma with a pair of anal suckers (Fig. 7); without adanal setae; tarsus IV with 2 suckers (Fig. 10D) .... adult male

—Without aedeagus but with spermatheca (Fig. 2); without anal suckers; with 3 pairs of adanal setae; tarsus IV without suckers (Fig. 5D) ..... adult female

Key to adult females of *Tyrophagus* of Australasia and Oceania (including known world distributions)

1 Hysterosomal setae d_2 long, 1.6–1.9× length of c_1 (Fig. 149); setae *elcp* slender (Fig. 45B, 151B) 2

—Hysterosomal setae d_2 short, as long as or slightly longer than c_1 (Fig. 1); setae *elcp* stout (Fig. 3B) 3

2 Adanal setae ad_1 more than 2× length of pseudanal setae ps_3 (Fig. 151G); spermathecal duct long and thin, expanding slightly in last quarter of its length, not forming a cylindrical tube (Fig. 152D); Africa, China, Germany, India, Malaysia, Nigeria, Samoa, West Africa ..... (p. 48)…***T. tropicus*** Robertson, 1959

—Adanal setae ad_1 as long as pseudanal setae ps_3 (Fig. 46B); spermathecal duct narrowing suddenly so that final quarter of its length forms a narrow cylindrical tube before entering the sac (Fig. 45G); New Zealand. ..... (p. 26)… ***T. macfarlanei* sp. n.**

3 Reproductive apparatus very small, spermathecal duct slender and short (Fig. 70G–H, 122B–D), base of spermathecal sac just larger than circumference of spermathecal duct (Figs. 122B–D, Plates 11C, 12C) 4

—Reproductive apparatus considerable, spermathecal duct moderate or large (Fig. 3H–I), base of spermathecal sac medium length or longer, transversally expanded, obviously larger than spermathecal duct (Fig. 4C, Plate 10A) 5

4 Seta *r* of tarsus IV spiniform (Fig. 123D); anterolateral corners of prodorsal shield without pigmented areas — the 'eyespots' (Fig. 121F); Australia, Ecuador, Indonesia, Panama, Philippines, Singapore, Thailand ... . (p. 42)…***T. javensis*** (Oudemans, 1916)

—Seta *r* of tarsus IV setiform (Fig. 72D); prodorsal shield bearing a pair of faint eyespots (Fig. 70C); New Zealand, Thailand, U.S.A. .... (p. 32)…***T. robertsonae*** Lynch, 1989

5 Prodorsal shield bearing a pair of eyespots (Fig. 3F, Plate 1A) 6

—Prodorsal shield without pigmented eyespots (Fig. 35D, Plate 3A) 13

6 Base of spermathecal sac small, forming a pair of triangular, sclerotised structures (Fig. 166G, Plate 13D); tarsus I ω_1 and tarsus II ω long slender tube for its entire length, terminating into a distinctly pointed tip (Fig. 167C–D); Tonga ..... (p. 51)…***T. xenoductus* sp. n.**

—Base of spermathecal sac considerable, varying in shape from flatly banded (Fig. 3H–I, Plate 11B) to funnel-shaped (Fig. 50F–G, Plate 11A); tarsus I ω_1 and tarsus II ω terminating into a round tip (Fig. 4D–E) 7

7 Adanal setae ad_1 1.2–1.3× longer than ad_2 (Fig. 132B); Cook Is, Fiji, Niue, Samoa, Tonga .... (p. 44)…***T. pacificus* sp. n.**

—Adanal setae ad_1 shorter than or about as long as ad_2 (Fig. 4C) 8

8 Base of spermathecal sac funnel-shaped, spermathecal duct without a neck at its distal half (Fig. 50F–G, 80E, Plate 11D) 9

—Base of spermathecal sac flat, spermathecal duct with a neck at its distal half (Fig. 3H–I, Plate 10A) 10

9 Seta d_1 long, 2.4 (2.2–2.5)× length of c_1 and 2.8 (2.7–2.9)× length of d_2 (Fig. 78); tarsus I ω_1 and tarsus II ω stout, expanded slightly medially (Fig. 81D–E); medial 1/4 of posterior margin of coxal plate II strongly concave (Fig. 81A); New Zealand; U.K. .... (p. 34)…***T. savasi*** Lynch, 1989

—Seta d_1 short, 1.5 (1.5–1.8)× length of c_1 and 1.6 (1.6–2.1)× length of d_2 (Fig. 48); tarsus I ω_1 and tarsus II ω slender, parallel sided tubes (Fig. 51D–E); medial 2/3 of posterior margin of coxal plate II strongly concave (Fig. 51A); Australia, China, Germany, Japan, Mexico, Netherlands, New Zealand, Poland, South Africa, Switzerland, U.K., U.S.A. .... (p. 27)…***T. neiswanderi*** Johnston & Bruce, 1965

10 Proximal part of spermathecal duct slender, nearly cylindrical (Fig. 25F, 161G–H); coxal plate II broad, its posterior margin convex (Fig. 26A, 162A) 11

—Proximal part of spermathecal duct gradually widened (Fig. 3H–I, 61B–C); coxal plate II medium sized, its posterior margin not covex (Fig. 4A, 61A) 12

11 Seta *r* of tarsus IV setiform (Fig. 27D); shaft of supracoxal seta *scx* slender, tapering from base to apex (Fig. 25D, Plate 5B); tarsus I ω_1 and tarsus II ω slender (Fig. 26D–E); Australia, New Zealand, France, Portugal ..... (p. 22)…***T. curvipenis*** Fain & Fauvel, 1993

—Seta *r* of tarsus IV spiniform (Fig. 162D); shaft of supracoxal seta *scx* widened at bases of pectinations (Fig. 161E, Plate 5O); tarsus I ω_1 and tarsus II ω stout (Fig. 162C–D); Australia .... (p. 50)…***T. womersleyi* sp. n.**

12 Coxal plate II with a sinuous posterior margin so that the plate narrows sharply along the distal 1/3 (Fig. 61A, Plate 7B); distal 2/3 of tarsus I ω_1 obviously widened (Fig. 61D); Australia, China (mainland, Taiwan), Ecuador, Germany, Japan, Netherlands, New Zealand, U.S.A. ..... (p. 30)…***T. putrescentiae*** (Schrank, 1781)

—Coxal plate II a broad triangle, posterior margin nearly straight (Fig. 4A, Plate 6A); distal 1/4 of tarsus I ω_1 widened (Fig. 4D); Africa, Argentina, Australia (mainland, Lord Howe I., Norfolk I.), Brazil, Chile, China (mainland, Hong Kong, Taiwan), Cook Is, Crete, Ecuador, Fiji, Greece, Germany, India, Indonesia, Italy, Jamaica, Japan, Madagascar, Malta, Netherlands, New Zealand, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Is, Spain, Thailand, Tokelau Is, Tonga, Turkey, U.K., U.S.A., Vanuatu, West Africa ..... (p. 18)…***T. communis* sp. n.**

13 Setae d_1 long, more than 2× length of c_1, their alveoli situated close to c_1 (Fig. 99, 139) 14

—Setae d_1 short, less than 2× length of c_1, their alveoli situated approximately midway between those of c_1 and e_1 (Fig. 33, 88) 15

14 Spermathecal duct very broad along its entire length, sclerites of oviduct widely spaced (Fig. 142C, Plate 13A); tarsus I ω_1 short, stout and clavate (Fig. 142D); setae *w* and *r* of tarsus IV spiniform (Fig. 143D); Australia, Bulgaria, U.K., Germany, Japan, Kazakhstan, Netherlands, Russia, Turkey, U.S.A. ..... (p. 46)…***T. perniciosus*** Zakhvatkin, 1941

—Spermathecal duct slender, sclerites of oviduct narrowly spaced (Fig. 101G–H, Plate 12B); tarsus I ω_1 slender, expanded medially giving a 'banana' shape (Fig. 102D); setae *w* and *r* of tarsus IV setiform (Fig. 103D); Australia, Netherlands, New Zealand, Tuvalu, U.K. ..... (p. 38)…***T. vanheurni*** Oudemans, 1924

15 Hysterosomal setae c_1, d_1, and d_2 present as microsetae, less than 1/3 distance between c_1 and d_1 (Fig. 88); tarsus I ω_1 (Fig. 91D, F, Plate 14I) and tarsus II ω (Fig. 91E, G, Plate 15I) stout and obviously clavate; Australia, Belgium, China, Faroe Is., France, Germany, Iran, Iceland, Italy, Japan, Mexico, Netherlands, New Zealand, Romania, South Africa, Sweden, U.K., U.S.A., Yemen ..... (p. 36)…***T. similis*** Volgin, 1949

—Hysterosomal setae d_1 about 1.3–1.8× as long as c_1 and d_2 (Fig. 33); tarsus I ω_1 (Fig. 36C, Plate 14C) and tarsus II ω (Fig. 36D, Plate 15C) long slender parallel sided tubes, never expanded distally; Australia, Belgium, Bulgaria, Canada, Denmark, Ecuador, Egypt, England, Faroe Is, Finland, France, Germany, Greece, India, Indonesia, Ireland, Italy, Netherlands, New Zealand, Philippines, Poland, Sweden, U.K., Uruguay, U.S.A. ..... (p. 24)…***T. longior*** (Gervais, 1844)

Note: Female of *T. australasiae* (Oudemans, 1916) is unknown. According to male characters, presumably it is similar to *T. communis* sp. n. and *T. putrescentiae* (Schrank, 1781).

Key to adult males of *Tyrophagus* of Australasia and Oceania (including world distributions)

1 Setae d_2 very long, 1.7–1.9× length of c_1 (Fig. 154); *elcp* long and slender (Fig. 156B); Africa, China, Germany, India, Malaysia, Nigeria, Samoa, West Africa ..... (p. 48)…***T. tropicus*** Robertson, 1959

—Setae d_2 short, about as long as or slightly longer than c_1 (Fig. 6); *elcp* strong (Fig. 8B) 2

2 Prodorsal shield with a pair of pigmented eyespots (Fig. 8F, Plate 16A); lateral arms supporting aedeagus turned outwards (Fig. 8G, Plate 25A) (varying in *T. robertsonae*, Plate 26E, F) 3

—Prodorsal shield without pigmented eyespots (Fig. 40D, Plate 16C); lateral arms supporting aedeagus turned inwards (Fig. 41B, Plate 25E) (except *T. javensis*, Plate 28A) 11

3 Aedeagus with 1 major curve from lateral view (Fig. 55K, 75F, Plate 26B) 4

—Aedeagus with 2 major curves from lateral view, S-shaped (Fig. 65J, Plate 25B) 7

4 Supracoxal seta *scx* strong, its shaft widened at bases of pectinations (Fig. 55E–F, Plate 20D) 5

—Supracoxal seta *scx* slender, tapering from base to tip (Fig. 171E, Plate 20F) 6

5 Seta d_1 long, 2.4 (2.2–2.5)× length of c_1 (Fig. 83); tarsus I ω_1 and tarsus II ω stout, expanded slightly medially (Fig. 86C–D); New Zealand; U.K. ..... (p. 34)…***T. savasi*** Lynch, 1989

—Seta d_1 short, 1.5 (1.5–1.8)× length of c_1 (Fig. 53); tarsus I ω_1 and tarsus II ω slender slender, parallel-sided tubes (Fig. 56E–F); Australia, China, Germany, Japan, Mexico, Netherlands, New Zealand, Poland, South Africa, Switzerland, U.K., U.S.A. ..... (p. 27)…***T. neiswanderi*** Johnston & Bruce, 1965

6 Aedeagus very small (12–13) (Fig. 75E, F, Plate 26E, F); tarsus I ω_1 distally clavate (Fig. 76C–D); New Zealand, Thailand, U.S.A. ..... (p. 32)…***T. robertsonae*** Lynch, 1989

—Aedeagus relatively long (15–16) (Fig. 171G, Plate 29D); tarsus I ω_1 long slender tube for its entire length, terminating into a distinctly pointed tip (Fig. 172D–E); Tonga ..... (p. 51)…***T. xenoductus* sp. n.**

7 Shaft of *scx* slender, tapering from base to apex (Fig. 30C–D, Plate 20B); tarsus I ω_1 and tarsus II ω slender (Fig. 31C–F); Australia, New Zealand, France, Portugal ..... (p. 22)…***T. curvipenis*** Fain & Fauvel, 1993

—Shaft of *scx* strong, widened where pectinations begin (Fig. 8D–E, Plate 20A); tarsus I ω_1 and tarsus II ω relatively strong (Fig. 9D–E) 8

8 Aedeagus long (25 µm), its distal 1/3 bent at an angle less than 50° to its median part in unfolded position (Fig. 136E, Plate 28D); coxal plate II broad and posteriorly convex (Fig. 137A, Plate 23D); Cook Is, Fiji, Niue, Samoa, Tonga ..... (p. 44)…***T. pacificus*** **sp. n.**

—Aedeagus not very long (<20 µm), its distal 1/3 bent at an angle more than 70° to its median part in unfolded position (Fig. 8I, Plate 25B); coxal plate II not posteriorly convex (Fig. 9A, Plate 21A) 9

9 Coxal plate II narrows sharply along the distal 1/3 (Fig. 66A, Plate 22A); distal 1/3 of aedeagus bent at an angle about 80–100° to its median part (Fig. 65J, Plate 26D); distal 2/3 of tarsus I ω_1 widened (Fig. 66C, E, G); Australia, China (mainland, Taiwan), Ecuador, Germany, Japan, Netherlands, New Zealand, U.S.A. .... (p. 30)…***T. putrescentiae*** (Schrank, 1781)

—Coxal plate II a broad triangle, posterior margin nearly straight (Fig. 9A, Plate 21A); distal 1/3 of aedeagus bent at an angle more than 110° to its median part (Fig. 8I, Plate 25B); distal 1/4 of tarsus I ω_1 slightly widened (Fig. 9D) 10

10 Shaft of *scx* broadly widened at bases of pectinations (Fig. 8D–E, Plate 20A); tarsus I ω_1 slightly widened from base to tip (Fig. 9D); Africa, Argentina, Australia (mainland, Lord Howe I, Norfolk I), Brazil, Chile, China (mainland, Hong Kong, Taiwan), Cook Is, Crete, Ecuador, Fiji, Greece, Germany, India, Indonesia, Italy, Jamaica, Japan, Madagascar, Malta, Netherlands, New Zealand, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Is, Spain, Thailand, Tokelau Is, Tonga, Turkey, U.K., U.S.A., Vanuatu, West Africa .... (p. 18)…***T. communis*** **sp. n.**

—Shaft of *scx* slightly widened at bases of pectinations (Fig. 111D–E, Plate 20J); tarsus I ω_1 obviously widened from base to tip (Fig. 112B); Indonesia .... (p. 40)…***T. australasiae*** (Oudemans, 1916)

11 Aedeagus large, prominently long (Fig. 40E, Plate 25F) or broad (Fig. 95G, Plate 27C), more than 20 ì m . 12

—Aedeagus very small, less than 17 ì m (Fig. 106H–I, 126E, Plate 28B) 14

12 Aedeagus slender (Fig. 40E, Plate 25F); tarsus I ω_1 and tarsus II ω slender and cylindrical (Fig. 41C–D); Australia, Belgium, Bulgaria, Canada, Denmark, Ecuador, Egypt, England, Faroe Is., Finland, France, Germany, Greece, India, Indonesia, Ireland, Italy, Netherlands, New Zealand, Philippines, Poland, Sweden, U.K., Uruguay, U.S.A. ..... (p. 24)…***T. longior*** (Gervais, 1844)

—Aedeagus broad (Fig. 95G, 146G, Plate 27C); tarsus I ω_1 and tarsus II ω stout and clavate (Fig. 96C–D, 147C–D) 13

13 Hysterosomal setae c_1, d_1, and d_2 present as microsetae, less than 1/3 distance between c_1 and d_1 (Fig. 93); internal diameter of aedeagus tapering rapidly from distal end to midlength (Fig. 95G); setae *r* and *w* of tarsus IV positioned distal to distal sucker *e* (Fig. 97D, Plate 33D); Australia, Belgium, China, Faroe Is., France, Germany, Iceland, Iran, Italy, Japan, Mexico, Netherlands, New Zealand, Romania, South Africa, Sweden, U.K., U.S.A., Yemen ..... (p. 36)…***T. similis*** Volgin, 1949

—Hysterosomal setae d_1 long, far exceeding beyond bases of c_1 and e_1, about 4.0 (3.2–4.0)× length of c_1 and 3.4 (2.9–3.4)× length of d_2 (Fig. 144); internal diameter of distal 3/4 of aedeagus broad (Fig. 146G); setae *r* and *w* of tarsus IV positioned between basal and distal suckers (Fig. 148D, Plate 35A); Australia, Bulgaria, England, Germany, Japan, Kazakhstan, Netherlands, Russia, Turkey, U.S.A. .... (p. 46)…***T. perniciosus*** Zakhvatkin, 1941

14 Setae *w* and *r* of tarsus IV situated between suckers (Fig. 128. D), *r* spiniform (Fig. 128D); tarsus I ω_1 clavate (Fig. 127C); Australia, Ecuador, Indonesia, Panama, Philippines, Singapore, Thailand .... (p. 42)…***T. javensis*** (Oudemans, 1916)

—Setae *w* and *r* of tarsus IV situated anteriorad of distal sucker (Fig. 108D), *r* setiform (Fig. 108D); tarsus I ω_1 expanded medially giving a 'banana' shape (Fig. 107C); Australia, Netherlands, New Zealand, Tuvalu, U.K. .... (p. 38)…***T. vanheurni*** Oudemans, 1924

Note: Males of *T. macfarlanei* sp. n. and *T. womersleyi* sp. n. are unknown.

Species present in New Zealand

***Tyrophagus communis* sp. n.**

Fig. 1–22, Plates 1A, 5A, 6A, 10A, 14A, 15A, 16A, 20A, 21A, 25A, B, 30A, 31A, 32A

Tyrophagus putrescentiae (Schrank, 1781); Robertson, 1959: 157 (partim, misidentification); Hughes, 1976: 51.

Diagnosis. **Female**. Eyespots present; *scx* moderately or broadly expanding from the base to beginning of pectinations then tapering gradually to a fine point, in all, the shaft bears 8–14 pectinations, varing in lenth from short to long; d_1 about 2.7 (2.7–2.9)× length of c_1 and 2.4 (2.0–2.4)× length of d_2; d_2 about 1.1 (1.1–1.5)× length of c_1; coxal plates I beyond apex of prosternal apodeme; coxal plates II broadly triangular, posterior margin very slightly concave, distal point of triangle stands slightly proud of apodeme apex. Spermathecal duct narrowing rapidly from copulatory opening for a distance about 1.2 (0.8–1.2)× distance between sclerites of oviducts, forming a neck and then gradually widening to base of spermathecal sac over a distance about 1.5× distance between sclerites of oviducts, sclerotised base of spermathecal sac nearly flat or bending slightly forwards. Tarsus I ω_1 slightly widened at apex, tarsus II ω slightly widened at apex; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 2.8 (2.5–2.8)× length of c_1 and 2.3 (2.0–2.3)× length of d_2; d_2 about 1.2 (1.0–1.2)× length of c_1; aedeagus with two obvious curves, S-shaped, distal 1/3 reversely curved, tapering from base to tip, internal diameter linear, lateral arms supporting aedeagus turning outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 2.3 (2.2–2.3).

Description. **Female** (Fig. 1–5, Plates 1A, 5A, 6A, 10A, 14A, 15A)

Idiosoma. 432 (357–454) long, 285 (203–291) wide. Chelicera 90 (79–93) long, cheliceral seta *cha* conical, 5 (4–6) long, subcapitular setae *m* 36(28–40), palpal supracoxal seta *elcp* 12 (10–12) long, dorsal palptibial seta 26 (19–27), lateral palptibial seta 16 (10–17), dorsal palptarsal seta 13 (8–13), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield nearly pentagonal and tapering gradually from external vertical setae to posterior edege; 76 (68–79) long, 95 (77–97) wide between *ve-ve*. Eyespots present. Grandjean's organ finger-like, its basal lobe with 3 (2–5) small spiniform teeth. Supracoxal seta *scx* moderately or broadly widened where pectinations begin, shaft bears 10 (8–14) long or short pectinations, 35 (33–40) long. Ratios: *vi*: *ve* = 1.6 (1.5–1.8), *sci*: *sce* = 1.4 (1.4–1.5), *sci–sci*: *sci–sce* = 1.1 (1.0–1.2). Lengths of setae: *vi* 92 (73–101), *ve* 57 (37–60), *sci* 177 (126–186), *sce* 126 (88–133); distances: *vi–vi* 15 (11–16), *vi–ve* 40 (29–44), *sci–sci* 35 (32–38), *sci–sce* 31 (25–34). Hysterosomal setae d_1 about 2.7 (2.7–2.9)× length of c_1 and 2.4 (2.0–2.4)× length of d_2; d_2 about 1.1 (1.1–1.5)× length of c_1; lengths of setae: c_1 35 (25–37), c_2 184 (152–190), c_p 162 (132–171), c_3 42 (36–44), d_1 95 (73–100), d_2 40 (37–46), e_1 277 (257–288), e_2 162 (154–177), f_2 279 (261–289), h_1 281 (232–299), h_2 319 (284–332), h_3 252 (224–264); distances: c_1-c_1 102 (78–107), c_1-d_1 70 (50–74), d_1–d_1 35 (25–38), d_2–*gla* 50 (39–56), d_1–e_1 81 (63–89), e_1–e_1 111 (75–122). **Venter**. Coxal plate I beyond apex of prosternal apodeme; coxal plates II broadly triangular, posterior margin very slightly concave, distal point of triangle stands slightly proud of apodeme apex (rarely, found to be strongly concave on one side). Setae *1a* 1.1 (0.9–1.2)× length of coxal plate II, 60 (47–66), *3a* 31 (22–33); *3b* 3.5 (3.3–3.7)× length of *3a*, 108 (76–111); *g* 25 (15–27), *4a* 90 (63–97). Pseudanal setae ps_1 1.4 (1.3–2.1)× as long as ps_2, 189 (162–201) long, ps_2 4.6 (4.2–5.1)× length of ps_3, 137 (83–142) long, ps_3 30 (18–30). Adanal setae ad_1 23 (14–23), ad_2 21 (14–21), ad_3 20 (12–21). Copulatory opening 5 (5–7) in diameter, spermathecal duct narrowing rapidly from copulatory opening for a distance about 1.2 (0.8–1.2)× distance between sclerites of oviducts, forming a neck and then gradually widening to base of spermathecal sac over a distance about 1.5× distance between sclerites of oviducts, sclerotised base of spermathecal sac nearly flat or bending slightly forwards, distance between sclerites of oviducts 17 (13–20).

Legs. **Leg I**. 211 (188–223) long; femur I 51 (46–53), *vF* simple, 55 (42–57) long; genu I 36 (28–38), σ' 40 (24–45), σ" 22 (13–27), Iσ': σ" = 1.5 (1.5–2.0), *cG* 38(35–340), *mG* 53 (37–55); tibia I 32 (29–32), φ 108 (101–108), *gT* 35 (32–38), *hT* 41 (35–44); tarsus I 83 (71–87) long, 20 (18–21) wide, ω_1 slightly widened at apex, 15 (15–16) long, ε 4 (4–4.5), ω_2 5 (5–6), ω_3 19 (19–23), distance between *aa* and ω_1 about 13 (10–13), *aa* 22 (19–23) long, *ba* 20 (20–24), *wa* 46 (32–48), *ra* 32 (25–33), *la* 21 (20–23), *d* 36 (32–38), *e* 7 (5–7), *f* 18 (15–19), *s* 5 (5–6), *u* and *v* 4 (4–5), *p* and *q* 6 (6–7), empodium 17 (15–20), claw 15 (13–16). **Leg II**. 195 (174–203) long; femur II 51 (42–54), *vF* 65 (47–65); genu II 40 (37–42), σ 18 (18–19), *cG* 38 (33–40), *mG* 50 (45–53); tibia II 30 (27–30), φ 108 (101–114), *gT* 34 (32–38), *hT* 41 (33–44); tarsus II 83 (71–88) long, 19 (18–20) wide, ω slightly widened at apex, 17 (17–19) long, *ba* 29 (23–30), *wa* 40 (37–44), *ra* 30 (24–33), *la* 23 (19–25), *d* 30 (26–35), *e* 6 (6–7), *f* 13 (11–15), *s* 5 (5–6), *u* and *v* 4 (4–5), *p* and *q* 6 (6–7), empodium 15 (13–17), claw 13 (12–13). **Leg III**. 217 (177–221) long; femur III 42 (36–43); genu III 33 (30–34), σ 17 (13–19), *nG* 56 (43–57); tibia III 34 (26–35), φ 96 (92–111), *kT* 52 (41–58); tarsus III 92 (78–102) long, 14 (14–17) wide, *w* 35 (29–39), *r* 30 (21–33), *d* 33 (30–

33), *e* 6 (6–7), *f* 28 (21–29), *s* 5 (5–6), *u* 4, *v* 5 (5–6), *p* and *q* 3 (2–4), empodium 15 (13–16), claw 12 (12–14). **Leg IV**. 248 (218–253) long; femur IV 50 (44–53), *wF* 49 (41–62); genu IV 43 (38–44); tibia IV 40 (32–42), φ 82 (82–101), *kT* 34 (30–41); tarsus IV 99 (85–103) long, 13 (13–15) wide, *w* setiform, 31 (29–32) long, *r* setiform, 21 (15–22) long, *d* 40 (29–43), *e* 5 (5–6), *f* 30 (26–35), *s* 5 (5–6), *u* 4, *v* 5 (5–6), *p* and *q* 3 (2–3), empodium 14 (13–16), claw 13 (12–13).

Male (Fig. 6–10, Plates 16A, 20A, 21A, 25A, B, 30A, 31A, 32A)

Idiosoma. 429 (371–437) long, 280 (209–283) wide. Chelicera 85 (82–85) long, cheliceral seta *cha* conical, 6 (4–7) long, subcapitular setae *m* 34 (34–36), palpal supracoxal seta *elcp* 18 (11–20) long, dorsal palptibial seta 16 (14–16), lateral palptibial seta 12 (10–13), dorsal palptarsal seta 12 (8–13), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield as in female, 71 (68–72) long, 85 (75–89) wide between *ve-ve*. Eyespots present. Grandjean's organ as in female, 12 (11–13) long; supracoxal seta *scx* 32 (31–33) long. Ratios: *vi*: *ve* = 1.8 (1.8–2.0), *sci*: *sce* = 1.7 (1.6–1.7), *sci–sci*: *sci–sce* = 1.1 (1.1–1.2). Lengths of setae: *vi* 91 (87–93), *ve* 50 (42–52), *sci* 189 (169–192), *sce* 111 (92–117); distances: *vi–vi* 12 (11–13), *vi–ve* 35 (30–38), *sci–sci* 30 (30–36), *sci–sce* 28 (25–30). Hysterosomal setae d_1 about 2.8 (2.5–2.8)× length of c_1 and 2.3 (2.0–2.3)× length of d_2; d_2 about 1.2 (1.0–1.2)× length of c_1; lengths of setae: c_1 30 (28–33), c_2 205 (171–212), c_p 178 (132–183), c_3 35 (32–37), d_1 85 (71–90), d_2 35 (29–337), e_1 287 (282–290), e_2 206 (203–211), f_2 301 (313–332), h_1 307 (305–310), h_2 315 (308–317), h_3 286 (283–292); distances: c_1–c_1 95 (93–102), c_1–d_1 58 (56–62), d_1–d_1 33 (31–35), d_2–*gla* 55 (51–57), d_1–e_1 85 (75–89), e_1–e_1 96 (90–97). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 1.1 (1.0–1.1)× length of coxal plate II, 54 (43–57); *3a* 29 (18–31); *3b* 3.4 (3.0–5.1)× length of *3a*, 99 (91–100); *g* 22 (17–24), *4a* 89 (88–93). Aedeagus with two obvious curves, S-shaped, distal 1/3 reversely curved, tapering from base to tip, 17 (16–18) long, internal diameter linear; lateral arms supporting aedeagus turning outwards. Anal slit 65 (63–67) long, distance between anterior rim of anal slit and posterior margin of aedeagus 20 (16–23). Anal suckers about 24 (21–26) in diameter; anal discs 4 (4–4.5) in diameter, distances between right and left discs 30 (27–32). Pseudanal setae ps_1 about 1.6 (1.6–1.9)× length of ps_2, 225 (219–229) long, ps_2 9.2 (8.4–9.2)× length of ps_3, 138 (117–145) long, ps_3 15 (14–17); ps_2–ps_2 1.7 (1.7–1.9)× distance ps_1–ps_1, ps_1–ps_1 30 (29–34), ps_2–ps_2 64 (61–66).

Legs. **Leg I**. 202 (198–205) long; femur I 51 (49–52), *vF* simple, 53 (51–55) long; genu I 37 (36–38), σ' 37 (30–44), σ" 21 (17–23), Iσ': σ" = 1.8 (1.2–2.4), *cG* 39 (37–40), *mG* 53 (49–55); tibia I 30 (29–31), φ 102 (98–111), *gT* 34 (33–36), *hT* 35 (34–37); tarsus I 80 (73–87) long, 19 (17–20) wide, shape of ω_1 as in female, 14 (13–15) long, ε 3 (3–4), ω_2 5 (4–5), ω_3 22 (21–24), distance between *aa* and ω_1 about 13 (11–14), *aa* 19 (14–21) long, *ba* 22 (20–24), *wa* 45 (37–48), *ra* 33 (29–35), *la* 21 (17–23), *d* 35 (33–38), *e* 6 (6–7), *f* 16 (14–18), *s* 5, *u* and *v* 4, *p* and *q* 6, empodium 17 (16–18), claw 14 (13–16). **Leg II**. 200 (197–203) long; femur II 48 (47–51), *vF* 59 (57–61); genu II 38 (32–40), σ 20 (19–21), *cG* 33 (25–36), *mG* 44 (43–47); tibia II 28 (27–31), φ 103 (90–109), *gT* 34 (33–35), *hT* 36 (34–36); tarsus II 79 (71–82) long, 18 (16–19) wide, ω as in female, 15 (15–16) long, *ba* 24 (22–24), *wa* 30 (21–31), *ra* 32 (29–34), *la* 22 (16–22), *d* 33 (27–35), *e* 6 (6–7), *f* 16 (14–17), *s* 5, *u* and *v* 4, *p* and *q* 6, empodium 16 (14–17), claw 13 (12–14). **Leg III**. 210 (200–221) long; femur III 43 (40–44); genu III 36 (35–38), σ 16 (15–16), *nG* 61 (59–61); tibia III 31 (27–36), φ 107 (103–111), *kT* 52 (50–54); tarsus III 86 (82–90) long, 13 (13–14) wide, *w* 35 (35–37), *r* 32 (30–32), *d* 33 (33–35), *e* 6 (6–7), *f* 31 (30–33), *s* 5 (5–6), *u* 4, *v* 5 (5–6), *p* and *q* 3, empodium 16 (14–17), claw 12 (12–14). **Leg IV**. 234 (231–239) long; femur IV 48 (44–50), *wF* 50 (47–53); genu IV 40 (36–42); tibia IV 33 (33–36), φ 98 (98–102), *kT* 38 (30–42); tarsus IV 90 (87–93) long, 14 (13–15) wide, *w* and *r* situated at level between suckers, *w* setiform, 33 (28–36) long, *r* setiform, 20 (16–22) long, distance between basal rim of tarsus IV and proximal sucker *d* 25 (24–26), between *d* and *e* 25 (24–26), between *e* and *f* 22 (21–24), ratio (a+b): c = 2.3 (2.2–2.3), *f* 35 (33–35), *s* 5 (5–6), *u* 4, *v* 5 (5–6), *p* and *q* 3, empodium 15 (14–17), claw 12 (12–14).

Tritonymph (Fig. 11–14)

Idiosoma. 331 long, 190 wide. Chelicera 60 long, movable digit 23, cheliceral seta *cha* conical, 3.5 long, subcapitular setae *m* 23, palpal supracoxal seta *elcp* 9 long, dorsal palptibial seta 16, lateral palptibial seta 10, dorsal palptarsal seta 8, palptarsal solenidion 4. **Dorsum**. Prodorsal shield as in female, 62 wide between *ve-ve*. Eyespots present. Grandjean's organ finger-like. Supracoxal seta *scx* 23 long, widening at bases of pectinations, shaft with 8 medium or short pectinations. Ratios: *vi*: *ve* = 1.5, *sci*: *sce* = 1.8, *sci–sci*: *sci–sce* = 1.2. Lengths of setae: *vi* 56, *ve* 37, *sci* 131, *sce* 74; distances: *vi–vi* 10, *vi–ve* 26, *sci–sci* 27, *sci–sce* 22. Hysterosomal setae d_1 about 2.6× length of c_1 and 2.6× length of d_2; d_2 about 1.0× length of c_1; lengths of setae: c_1 21, c_2 126, c_p 100, c_3 31, d_1 54, d_2 21, e_1 191, e_2 119, f_2 191, h_1 201, h_2 206, h_3 179; distances: c_1–c_1 73, c_1–d_1 47, d_1–d_1 29, d_1–e_1 63, e_1–e_1 78. **Venter**. Coxal plates I and II very faint. Setae *1a* 31, *3a* 16; *3b* 2.9× length of *3a*, 47; *g* 14, *4a* 47.

Pseudanal setae ps_1 2.1× as long as ps_2, 96 long, ps_2 4.2× length of ps_3, 46 long, ps_3 11. Adanal setae, male and female reproductive organs absent.

Legs. **Leg I**. 121 long; femur I 32, *vF* simple, 33 long; genu I 23, σ' 22, σ" 11, Iσ': σ" = 2.0, *cG* 18, *mG* 26; tibia I 18, φ 70, *gT* 20, *hT* 15; tarsus I 46 long, ω_1 slightly widened at apex, 13 long, ε 4, ω_2 4, ω_3 13, *aa* 8 long, *ba* 10, *wa* 15, *ra* 15, *la* 12, *d* 25, *e* 6, *f* 12, *s* 5, *u* and *v* 5, *p* and *q* 6, empodium 10, claw 11. **Leg II**. 113 long; femur II 32, *vF* 36; genu II 21, σ 7, *cG* 19, *mG* 22; tibia II 18, φ 73, *gT* 14, *hT* 16; tarsus II 42 long, ω slightly widened at apex, 12 long, *ba* 12, *wa* 15, *ra* 16, *la* 12, *d* 23, *e* 6, *f* 13, *s* 5, *u* and *v* 5, *p* and *q* 6, empodium 10, claw 11. **Leg III**. 124 long; femur III 17; genu III 21, σ 7, *nG* 28; tibia III 17, φ 66, *kT* 23; tarsus III 50 long, *w* 19, *r* 14, *d* 19, *e* 5, *f* 18, *s* 4.5, *u* 3, *v* 4, *p* and *q* 1.5, empodium 10, claw 10. **Leg IV**. 141 long; femur IV 29, *wF* 24; genu IV 25; tibia IV 12, φ 53, *kT* 19; tarsus IV 52 long, *w* 19, *r* 16, *d* 20, *e* 5, *f* 19, *s* 4, *u* 3, *v* 4, *p* and *q* 1, empodium 9, claw 10.

Protonymph (Fig. 15–18)

Idiosoma. 235 long, 108 wide. Chelicera 50 long, movable digit 17, cheliceral seta *cha* conical, 3 long, subcapitular setae *m* 18, palpal supracoxal seta *elcp* 8 long, dorsal palptibial seta 13, lateral palptibial seta 9, dorsal palptarsal seta 7, palptarsal solenidion 4. **Dorsum**. Prodorsal shield faint, 57 wide between *ve-ve*. Eyespots present. Grandjean's organ finger-like. Supracoxal seta *scx* 21 long, widening at bases of pectinations, shaft with 8–10 medium or short pectinations. Ratios: *vi*: *ve* = 1.6, *sci*: *sce* = 1.8, *sci–sci*: *sci–sce* = 1.0. Lengths of setae: *vi* 42, *ve* 27, *sci* 81, *sce* 45; distances: *vi–vi* 8, *vi–ve* 24, *sci–sci* 22, *sci–sce* 21. Hysterosomal setae d_1 about 1.9× length of c_1 and 1.9× length of d_2; d_2 about 1.0× length of c_1; lengths of setae: c_1 16, c_2 55, c_p 60, c_3 17, d_1 31, d_2 16, e_1 105, e_2 42, f_2 127, h_1 113, h_2 134, h_3 86; distances: c_1–c_1 58, c_1–d_1 35, d_1–d_1 19, d_1–e_1 43, e_1–e_1 43. **Venter**. Coxal plates I and II very faint; with 1 pair of genital papillae. Setae *3a* and 4*a* absent; *1a* 21, *3b* 29; *g* 10. Pseudanal setae ps_1 1.9× as long as ps_2, 28 long, ps_2 1.9× length of ps_3, 15 long, ps_3 8. Adanal setae, male and female reproductive organs absent.

Legs. **Leg I**. 90 long; femur I 25, *vF* simple, 22 long; genu I 16, σ' 14, σ" 10, Iσ': σ" = 1.4, *cG* 16, *mG* 16; tibia I 14, φ 52, *gT* 12, *hT* 11; tarsus I 35 long, ω_1 slightly widened at apex, 10 long, ε 3.5, ω_2 4, ω_3 absent, *aa* 8 long, *ba* 10, *wa* 13, *ra* 12, *la* 10, *d* 20, *e* 5, *f* 10, *s* 4, *u* and *v* 4, *p* and *q* 5, empodium 10, claw 9. **Leg II**. 83 long; femur II 25, *vF* 24; genu II 15, σ 6, *cG* 14, *mG* 13; tibia II 13, φ 51, *gT* 10, *hT* 12; tarsus II 32 long, ω slightly widened at apex, 7 long, *ba* 8, *wa* 12, *ra* 11, *la* 9, *d* 20, *e* 5, *f* 10, *s* 4, *u* and *v* 4, *p* and *q* 5, empodium 9, claw 9. **Leg III**. 92 long; femur III 20; genu III 14, σ 5.5, *nG* 20; tibia III 13, φ 49, *kT* 17; tarsus III 35 long, *w* 14, *r* 13, *d* 16, *e* 4, *f* 13, *s* 4, *u* 3, *v* 4, *p* and *q* 1, empodium 9, claw 9. **Leg IV**. 91 long; femur IV 17, *wF* absent; genu IV 13; tibia IV 13, φ and *kT* absent; tarsus IV 36 long, *w* 15, *r* 10, *d* 13, *e* 4, *f* absent, *s* 4, *u* 3, *v* 3.5, *p* and *q* 1, empodium 9, claw 8.

Larva (Fig. 19–22)

Idiosoma. 182 long, 108 wide. Chelicera 39 long, movable digit 14, cheliceral seta *cha* tiny, 2 long, subcapitular setae *m* 16, palpal supracoxal seta *elcp* 5 long, dorsal palptibial seta 9, lateral palptibial seta 6, dorsal palptarsal seta 5, palptarsal solenidion 2. **Dorsum**. Prodorsal shield and eyespots not observed, *ve-ve* 38. Grandjean's organ finger-like. Supracoxal seta *scx* slightly widened at bases of pectinations and barbed, 14 long. Ratios: *vi*: *ve* = 1.2, *sci*: *sce* = 2.3, *sci–sci*: *sci–sce* = 1.1. Lengths of setae: *vi* 31, *ve* 26, *sci* 52, *sce* 23; distances: *vi–vi* 5, *vi–ve* 19, *sci–sci* 20, *sci–sce* 18. Hysterosomal setae f_2 and h_3 absent; d_1 about 1.2× length of c_1 and 1.3× length of d_2; d_2 about 0.9× length of c_1; lengths of setae: c_1 13, c_2 30, c_p 45, c_3 17, d_1 16, d_2 12, e_1 71, e_2 19, h_1 119, h_2 58; distances: c_1–c_1 51, c_1–d_1 26, d_1–d_1 21, d_1–e_1 40, e_1–e_1 41. **Venter**. Without genital opening and papillae. Setae *3a*, *g* and 4*a* absent; *1a* 12, *3b* 25. Pseudanal setae and adanal setae absent.

Legs. **Leg I**. 74 long; femur I 18, *vF* simple, 19 long; genu I 13, σ' 12, σ" 5, Iσ': σ" = 2.4, *cG* 17, *mG* 11; tibia I 11, φ 43, *gT* 10, *hT* 9; tarsus I 30 long, ω_1 7 long, ε 3, ω_2 and ω_3 absent, *aa* 6 long, *ba* 7, *wa* 11, *ra* 10, *la* 6, *d* 11, *e* 4, *f* 6, *s* 3, *u* and *v* 2.5, *p* and *q* 3, empodium 8, claw 7. **Leg II**. 68 long; femur II 16, *vF* 20; genu II 11, σ 5, *cG* 13, *mG* 8; tibia II 10, φ 41, *gT* 9, *hT* 5; tarsus II 25 long, ω 6 long, *ba* 6, *wa* 11, *ra* 10, *la* 7, *d* 13, *e* 4, *f* 9, *s* 3, *u* and *v* 3, *p* and *q* 3.5,empodium 8, claw 7. **Leg III**. 80 long; femur III 15; genu III 12, σ 4.5, *nG* 19; tibia III 11, φ 43, *kT* 15; tarsus III 30 long, *w* 13, *r* 15, *d* 7, *e* 4, *f* 12, *s* 3, *u* 2, *v* 3, *p* and *q* 1,empodium 7, claw 7.

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: ND, AK, WO, HB, GB, WI, WI/WN, RI/WA, WN / MB, MC, OL.

Other countries: Africa, Argentina, Australia (mainland, Lord Howe I., Norfolk I.), Brazil, Chile, China (mainland, Hong Kong, Taiwan), Cook Is, Crete, Ecuador, Fiji, Greece, Germany, India, Indonesia, Italy, Jamaica, Japan, Madagascar, Malta, Netherlands, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Is, Spain, Thailand, Tokelau Is, Tonga, Turkey, U.K., U.S.A., Vanuatu, West Africa.

Material examined. Holotype, 66 paratypes, and 1515 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: agar tissue culture of orchids, almonds, asparagus, banana, bark scrapings, beans in kitchen cupboard, *Caladium*, calyx end of orange, caper seed, capsicum, chaff, *Cissus antarctica* seed, citrus, *Citrus limon*, cocoa beans, coconuts, *Coffea arabica*, *Colocasia esculenta* bulbs, copra, corn, *Cryptes baccarum*, cucumber leaf, culture of *Tribolium*, curry leaves, cycad palm seed, dahlia bulbs, damp grain, debris in container, decaying coconut, dormant bulb, dried fig, dried food, dried fruit, dried lychees, dried vegetable leaf, dust in grain silo, egg plant, feijoa, figs, food stuffs in household pantry, *Freesia* sp. bulb, garlic, gladioli bulbs, grain, hyacinth, buffet, *Iris* bulbs, kangaroo diet, kentia palm, lemon, *Lauris nobilis* leaves, lychee, matua on nutmeg, mixed grain-horse fodder-young stock foods, molactrate molasses blocks, mould in hazel nuts, *Muscari* bulbs, mushrooms, *Narcissus* bulbs, *Nipa* palm leaves, onions, orange, orchid plants, Orchidaceae, palm seeds, peanuts, persimmons, pimentos, pine tree seeds, pineapple, plant roots, *Plumeria* sp., potato, pollen from hive, *Ranunculus* bulb, raspberry jam, red dates, rice plant, roses, saint paulia, seed of *Acer pseudoplatanus*, seeds & spices, soil, soya bean, stored sorghum, strawberries, taro, *Theobroma cacao*, tomato, tulip bulbs, vanilla beans, vanilla pods, *Virgilia divaricata*, water chestnut (*Scirpus tuberosus*), wheat grain ex silo, wheat stores in lab, Ya pear, yams.

FUNGUS: fungus culture, *Sporotrichum*.

ANIMAL OR ANIMAL PRODUCTS: beehive, *Calolampra*, cheese, cheshire cheese, cockroach colony, cracks & floor, dead larva in wood of citrus borer, dead *Prionoplus reticularis* (Coleoptera: Cerambycidae), dried milk powder, dried shell fish, dust-bed, dust beneath banana leaf matting, fish house, glass surface in house, Gouda cheese, house, human urine, "Kai-iwi" foil wrapped cheese, kitchen in farmhouse, lab culture of Psocoptera, *Locusta migratoria*, mealworm culture, millipede (*Polyconoceris alaskis*), Nauphota (cockroach), pallet and bag scrapings, passalid beetle, rabbit, rooster feathers "Tintinhull", sheep faeces, silverfish culture, spoon from kitchen of a house, *Tineola biselliella*.

Etymology. The species name is from the Latin word *communis*, meaning common or shared by all or many, referring to the wide distribution and broad range of habitat and hosts.

Remarks. *Tyrophagus communis* closely resembles *T. putrescentiae* (Schrank) in prodorsal shield character, shape of supracoxal setae, solenidion ω on tarsus II, spermathecal duct in female, aedeagus and tarsus IV in male, but differs from the latter in coxal plates II broadly triangular, posterior margin very slightly concave, distal point of triangle stands slightly proud of apodeme apex (Fig. 3, 4, 9) rather than posterior margin of plate being strongly concave (Fig. 61, 66). It also differs from *T. putrescentiae* in the aedeagus being shorter and slightly curved (Fig. 8) rather than longer and obviously curved (Fig. 65). The supracoxal seta of *T. communis* tends to be wider at bases of pectinations (Fig. 3) compared with Fig. 65, and its solenidion ω_1 on tarsus I tends to be slightly widened at apex (Fig. 4, 9) rather than obviously widened (Fig. 61, 66).

Further, adult males are similar to the lectotype of *T. australasiae* designated by Robertson (1959) and to another male on the slide labelled "*Tyroglyphus australasiae* Oudemans 1915, ♂ dors., vent., No. 8, P6921, Op kop van gowia, Jamoer, (Nieuw Guinea), 6.8.1903, De Beaufort en Lorentz" in the characters of eyespots, shape of solenidia ω_1 of tarsus I and ω of tarsus II, structure of lateral arms supporting aedeagus, and position of suckers of tarsus IV, and shape of coxal plates II, but differs from the latter in shaft of supracoxal setae being obviously widened at point where pectinations begins, as well as having more (13–16) pectinations (Fig. 3) rather than slender and with less (8) pectinations (Fig. 111). Unfortunately, aedeagi of both males mounted on Oudemans' slide (No. 8, P6921) are folded dorsoventrally and females are unknown which limits the evidence for separating these two species (*communis* and *australasiae*). There are no differences between aedeagi of *T. communis* **sp. n.** and three males including a male designated as lectotype of *T. javensis* (Oudemans) by Robertson (1959) (misidentification, discussed under *T. australasiae* and *T. javensis*) on the slide labelled "*Tyroglyphus australasiae* Oudemans, ♂ dors., vent., lat., No. 6, P6610, Op eieren van *Plagiolepis longipes* (mier), Salatiga, Maart 1915, P.V.D. Goof". But solenidion ω_1 on tarsus I of *T. communis* **sp. n.** is slightly widened at apex (Fig. 9) rather than obviously widened in the latter (Fig. 117).

Robertson's figures of *T. putrescentiae* (Schrank) are based on the specimens in BMNH labelled "*Tyrophagus putrescentiae* (Schrank), 6♂♂, 11♀♀, ex cheese, Sutton Bonington, Leics., 20/10/50, P.L.R. Coll. No. 160(b)". After comparing with the neotype (No. 17, P6984) of *T. putrescentiae* designated by Robertson (1959) in the Oudemans collection (RMNH) we find that two distinct species are involved. Prior to this revision, it would have been difficult to separate this newly recognised species from *T. putrescentiae* Oudemans. Our new study of the coxal plate and apodeme in females and its application to species identification allows relatively easy separation of these two species. Many previous records of *T. putrescentiae* in the literature are likely to refer to *T. communis*. Because of this, it is impossible to provide a summary of distribution and biology information of this

new species based on literature at this time.

Our examination of a large number of specimens from many countries indicates that *T. communis* has a wider distribution than *T. putrescentiae*.

*Tyrophagus curvipeni*s Fain & Fauvel

Fig. 23–32, Plates 1B, 5B, 6B, 10B, 14B, 15B, 16B, 20B, 21B, 25C, D, 30B, 31B, 32B

*Tyrophagus curvipeni*s Fain & Fauvel, 1993: 95.

Diagnosis. **Female**. Eyespots prominent; *scx* slender, with 6–8 moderate or short pectinations; d_1 about 3.0 (2.7–3.0)× length of c_1 and 2.6 (2.6–2.8)× length of d_2; d_2 about 1.2 (1.0–1.2)× length of c_1; coxal plates I extending just beyond apex of apodeme; coxal plates II broadly triangular, extending distally beyond apex of apodeme II, with 1/3 of posterior margin slightly concave. Spermathecal duct narrowing gradually from copulatory opening for a distance about 1.5 (1.3–1.8)× distance between sclerites of oviducts and then extending to base of spermathecal sac over a distance about 2.8× distance between sclerites of oviducts, base of spermathecal sac r-shaped. Tarsus I ω_1 slender, cylindrical and slightly widened at apex, tarsus II ω slender, almost cylindrical; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 3.0 (3.0–3.2)× length of c_1 and 2.0 (2.0–2.3)× length of d_2; d_2 about 1.5 (1.3–1.5)× length of c_1; aedeagus with two obvious curves, S-shaped, distal 2/5 reversely curved, tapering from base to tip, internal diameter linear, lateral arms supporting aedeagus turning outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 3.5 (3.2–3.5).

Description. **Female** (Fig. 23–27, Plates 1B, 5B, 6B, 10B, 14B, 15B)

Idiosoma. 367 (367–479) long, 212 (212–241) wide. Chelicera 80 (80–91) long, cheliceral seta *cha* conical, 4 (4–5) long, subcapitular setae *m* 32 (32–37), palpal supracoxal seta *elcp* 11 (11–13) long, dorsal palptibial seta 26 (26–30), lateral palptibial seta 14 (14–18), dorsal palptarsal seta 12 (12–15), palptarsal solenidion 3 (3–4). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins behind eye spots strongly concave; 80 (80–85) long, 80 (80–85) wide between *ve-ve*. Eyespots present, prominent. Grandjean's organ finger-like, smooth, 16 (16–17) long, its basal lobe with 2–3 spiniform teeth. Supracoxal seta *scx* slender or slightly widened, tapering from base to tip, with 8(6–8) moderate or short pectinations, 28 (24–28) long. Ratios: *vi*: *ve* = 1.9 (1.7–2.0), *sci*: *sce* = 2.0 (2.0–2.1), *sci–sci*: *sci–sce* = 1.5 (1.2–1.5). Lengths of setae: *vi* 99 (76–103), *ve* 51 (45–52), *sci* 197 (169–211), *sce* 97 (84–99); distances: *vi–vi* 13 (11–14), *vi–ve* 34 (33–37), *sci–sci* 30 (28–33), *sci–sce* 20 (20–27). Hysterosomal setae d_1 about 3.0 (2.7–3.0)× length of c_1 and 2.6 (2.6–2.8)× length of d_2; d_2 about 1.2 (1.0–1.2)× length of c_1; lengths of setae: c_1 31 (29–33), c_2 229 (198–240), c_p 205 (191–221), c_3 51 (45–54), d_1 94 (79–99), d_2 36 (30–36), e_1 357 (329–371), e_2 289 (271–301), f_2 373 (366–403), h_1 417 (395–431), h_2 442 (402–449), h_3 293 (275–300); distances: c_1–c_1 74 (70–80), c_1–d_1 45 (41–48), d_1–d_1 24 (23–27), d_2–*gla* 47 (45–50), d_1–e_1 51 (48–54), e_1–e_1 59 (57–62). **Venter**. Coxal plates I extending just beyond apex of apodeme; coxal plates II broadly triangular, extending distally beyond apex of apodeme II, with 1/3 of posterior margin slightly concave. Setae *1a* 1.0 (1.0–1.1)× length of coxal plate II, 47 (46–50), *3a* 27 (25–27); *3b* 2.7 (2.7–2.8)× length of *3a*, 72 (69–75); *g* 22 (19–23), *4a* 78 (70–81). Pseudanal setae ps_1 1.8 (1.8–1.9)× as long as ps_2, 251 (233–267) long, ps_2 6.2 (5.7–6.2)× length of ps_3, 136 (125–144) long, ps_3 22 (22–24). Adanal setae ad_1 16 (15–17), ad_2 14 (14–16), ad_3 13 (12–14). Copulatory opening 7 (5–6) in diameter, spermathecal duct narrowing gradually from copulatory opening for a distance about 1.5 (1.3–1.8)× distance between sclerites of oviducts and then extending to base of spermathecal sac over a distance about 2.8× distance between sclerites of oviducts, base of spermathecal sac r-shaped, distance between sclerites of oviducts 17 (16–18).

Legs. **Leg I**. 187 (181–195) long; femur I 52 (49–54), *vF* simple, 44 (44–50) long; genu I 30 (29–33), σ' 44 (45–51), σ" 30 (28–31), Iσ': σ" = 1.5 (1.5–1.6), *cG* 38 (35–39), *mG* 43 (39–45); tibia I 31 (29–32), φ 109 (99–112), *gT* 36 (35–38), *hT* 37 (37–40); tarsus I 82 (79–84) long, 25 (22–25) wide, ω_1 slender, slightly widened at apex, 17 (16–18) long, ε 4 (3–4), ω_2 6.5 (6–7), ω_3 21 (19–23), distance between *aa* and ω_1 about 11 (9–12), *aa* 24 (24–27) long, *ba* 27 (25–28), *wa* 46 (44–48), *ra* 29 (29–33), *la* 28 (25–29), *d* 36 (35–38), *e* 5 (5–6), *f* 16 (15–17), *s* 6 (6–6.5), *u* and *v* 6 (6–7), *p* and *q* 7 (7–7.5), empodium 16 (14–17), claw 16 (15–17). **Leg II**. 194 (191–200) long; femur II 48 (45–55), *vF* 54 (50–55); genu II 35 (33–36), σ 24 (23–27), *cG* 34 (31–35), *mG* 44 (42–45); tibia II 31 (30–33), φ 118 (108–120), *gT* 32 (30–33), *hT* 41 (40–43); tarsus II 89 (85–92) long, 23 (22–25) wide, ω slender, nearly cylindrical, 23 (21–24) long, *ba* 26 (25–28), *wa* 44 (44–48), *ra* 35 (32–36), *la* 25 (25–27), *d* 35 (33–35), *e* 6 (5–6), *f* 16 (14–17), *s* 5 (5–6), *u* and *v* 4 (4–5), *p* and *q* 5 (5–6), empodium 14, claw 14 (14–15). **Leg III**. 175 (171–201) long; femur III 41 (39–44); genu III 31 (30–34), σ 18 (18–24), *nG* 42 (39–44); tibia III 27 (26–29), φ 119 (107–120), *kT* 44 (42–47); tarsus III 75 (74–81) long, 20 (17–22) wide, *w* setiform, 37 (36–41) long, *r* setiform, 32 (30–35) long, *d*

27 (25–31), *e* 6 (6–7), *f* 26 (24–30), *s* 5 (5–6), *u* 4 (4–4.5), *v* 6 (5–6), *p* and *q* 4 (3–4), empodium 13 (12–15), claw 12 (11–15). **Leg IV**. 222 (207–218) long; femur IV 46 (43–48), *wF* 43 (42–47); genu IV 38 (36–40); tibia IV 30 (30–33), φ 125 (115–125), *kT* 40 (37–42); tarsus IV 94 (88–97) long, 20 (17–20) wide, *w* setiform, 38 (36–40) long, *r* setiform, 22 (20–23) long, *d* 27 (25–29), *e* 6 (5–6), *f* 25 (23–27), *s* 6 (6–6.5), *u* 4 (4–5), *v* 6 (6–6.5), *p* and *q* 3 (2–3), empodium 14 (13–16), claw 15 (15–17).

Male (Fig. 28–32, Plates 16B, 20B, 21B, 25C, D, 30B, 31B, 32B)

Idiosoma. 321 (298–405) long, 205 (188–222) wide. Chelicera 62 (59–64) long, cheliceral seta *cha* conical, 4 (3–4) long, palpal supracoxal seta *elcp* 11 (11–12) long, subcapitular setae *m* 28 (26–33), dorsal palptibial seta 20 (18–21), lateral palptibial seta 13 (12–15), dorsal palptarsal seta 12 (12–15), palptarsal solenidion 3 (3–4).

Dorsum. Prodorsal shield as in female, 65 (58–65) long, 65 (65–70) wide between *ve*-*ve*. Eyespots prominent. Grandjean's organ as in female, 14 (13–15) long, supracoxal seta *scx* slender, with 6–8 pectinations, 27 (24–28) long. Ratios: *vi*: *ve* = 2.0 (1.9–2.0), *sci*: *sce* = 1.7 (1.7–2.0), *sci–sci*: *sci–sce* = 1.3 (1.2–1.3). Lengths of setae: *vi* 72 (67–81), *ve* 36 (35–40), *sci* 152 (144–178), *sce* 87 (75–89); distances: *vi–vi* 9 (9–12), *vi–ve* 30 (28–33), *sci–sci* 26 (25–27), *sci–sce* 20 (20–22). Hysterosomal setae d_1 about 3.0 (3.0–3.2)× length of c_1 and 2.0 (2.0–2.3)× length of d_2; d_2 about 1.5 (1.3–1.5)× length of c_1; lengths of setae: c_1 22 (21–24), c_2 227 (211–230), c_p 181 (172–181), c_3 42 (40–45), d_1 65 (62–77), d_2 32 (27–33), e_1 330 (328–341), e_2 230 (224–245), f_2 330 (315–339), h_1 362 (349–371), h_2 332 (327–345), h_3 281 (275–289); distances: c_1–c_1 70 (67–74), c_1–d_1 43 (39–45), d_1–d_1 25 (24–27), d_2–*gla* 30 (28–31), d_1–e_1 51 (48–55), e_1–e_1 77 (68–80). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 1.0 (0.9–1.0)× length of coxal plate II, 34 (33–34); *3a* 16 (16–18); *3b* 3.8 (3.6–3.8)× length of *3a*, 61 (58–61); *g* 15 (14–16), *4a* 54 (54–61). Aedeagus with two obvious curves, S-shaped, distal 2/5 reversely curved, tapering from base to tip, internal diameter linear, 24 (23–25) long; lateral arms supporting aedeagus turning outwards. Anal slit 53 (49–55) long, distance between anterior rim of anal slit and posterior margin of aedeagus 27 (25–28). Anal suckers about 19 (16–20) in diameter; anal discs 4 (3–4) in diameter, distances between right and left discs 33 (30–34). Pseudanal setae ps_1 about 2.9 (2.6–2.9)× length of ps_2, 168 (159–177) long, ps_2 4.4 (4.4–4.9)× length of ps_3, 57 (55–69) long, ps_3 13 (12–14); ps_2–ps_2 2.1 (2.1–2.2)× distance ps_1–ps_1, ps_1–ps_1 26 (25–27), ps_2–ps_2 55 (54–58).

Legs. **Leg I**. 158 (155–184) long; femur I 40 (39–43), *vF* simple, 41 (38–42) long; genu I 29 (28–30), σ' 35 (33–38), σ" 22 (21–24), Iσ': σ" = 1.6 (1.5–1.6), *cG* 34 (33–36), *mG* 36 (33–38); tibia I 25 (25–28), φ 101 (97–111), *gT* 31 (27–32), *hT* 30 (29–33); tarsus I 67 (65–70) long, 20 (19–22) wide, ω_1 cylindrical and slightly widened at apex, 16 (14–17) long, ε 4 (3–4), ω_2 6 (5–7), ω_3 20 (19–22), distance between *aa* and ω_1 about 6 (6–9), *aa* 16 (15–20) long, *ba* 23 (20–24), *wa* 25 (24–30), *ra* 29 (27–30), *la* 20 (19–22), *d* 30 (28–31), *e* 6 (6–7), *f* 14 (13–16), *s* 5 (5–5.5), *u* and *v* 4 (4–5), *p* and *q* 5 (5–6), empodium 12 (12–14), claw 12 (12–15). **Leg II**. 157 (151–160) long; femur II 40 (38–41), *vF* 48 (46–48); genu II 24 (23–24), σ 17 (16–19), *cG* 28 (27–30), *mG* 33 (31–34); tibia II 22 (21–23), φ 114 (108–120), *gT* 23 (22–24), *hT* 31 (28–32); tarsus II 66 (65–69) long, 20 (18–22) wide, ω cylindrical, 20 (19–21) long, *ba* 19 (18–20), *wa* 35 (33–39), *ra* 28 (26–29), *la* 21 (20–23), *d* 28 (27–31), *e* 5 (5–5.5), *f* 14 (11–16), *s* 5 (5–6), *u* and *v* 4 (4–5), *p* and *q* 5 (5–6), empodium 14 (13–15), claw 14 (12–15). **Leg III**. 171 (167–176) long; femur III 32 (31–34); genu III 27 (26–28), σ 13 (13–15), *nG* 41 (39–41); tibia III 23 (23–25), φ 137 (123–138), *kT* 37 (36–40); tarsus III 73 (68–76) long, 16 (16–19) wide, *w* setiform, 32 (31–35) long, *r* setiform, 24 (23–25) long, *d* 28 (28–30), *e* 6 (5–6), *f* 22 (19–22), *s* 5 (5–5.5), *u* 4 (4–5), *v* 5 (5–5.5), *p* and *q* 3 (3–3.5), empodium 12 (11–14), claw 11 (11–12). **Leg IV**. 185 (180–188) long; femur IV 38 (37–40), *wF* 33 (31–34); genu IV 30 (28–31); tibia IV 27 (27–28), φ 140 (135–146), *kT* 34 (33–37); tarsus IV 75 (69–75) long, 16 (15–17) wide, *w* and *r* situated at level between suckers, *w* setiform, 30 (29–33) long, *r* setiform, 18 (17–20) long, distances between basal rim of tarsus IV and proximal sucker *d* 28 (27–29), between *d* and *e* 17 (16–19), between *e* and *f* 13 (13–15), ratio (a+b): c = 3.5 (3.2–3.5), *f* 27 (27–29) long, *s* 5 (4–5), *u* 3 (3–4, *v* 5 (5–5.5), *p* and *q* 3 (3–3.5), empodium 12 (12–14), claw 11 (11–14).

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: KE / ND, AK, WO, BP, HB, WI, WN / NN, MC, SC, CO. Australia, France, Portugal.
BASED ON LITERATURE: Portugal (Fain & Fauvel 1993).

Material examined. Holotype, 5 paratypes, and 239 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: apples, bark of apricot, bark of cherry, bark of nectarine, barley, bird-of-paradise flower, black currents, black currant stem, calyx of Granny Smith apple in sooty mould in store, capsicum, *Coleophora* tubes, cucumber leaves, foliage of cherry, galls ex *Populus nigra* var. *italica*, garlic, unsprayed fruit/leaf of grapefruit, hydrangea leaf, kiwi fruit, leaves of Nashi, lemons, mandarin, mummified apricot fruit, mummified loquat fruit, onions, passion fruit, persimmon,

pollinia of *Cymbidium* sp., roots of clover, shallots, strawberries, tree onion bulbs.

ANIMAL OR ANIMAL PRODUCTS: coccid scale on *Buxus* sp., dead eggs & embryos of *Miomantis caffra*, dead larva of citrus borer in wood, dead larva of *Stathmopoda*, dead *Rattus norvegicus*, *Disonycha* and *Agasicles* beetles, dried milk powder, egg cluster of avondale spider, eggs of *Ceroplastes destructor*, honeybee, honeybee hive, nests of *Exuneura concinnula*, nest of sparrow, nest of *Sturnus vulgaris*, nest of swallow, nest of *Vespula germanica*, pallet and long scrapings, *Rattus exulans*.

Remarks. This species is similar to *T. communis* **sp**. **n**., *T. putrescentiae* (Schrank) and *T. pacificus* **sp**. **n**. in having a pair of eyespots on prodorsal shield and a S-shaped aedeagus in male, but differs from them in supracoxal seta *scx* being slender, tapering from base to tip (Fig. 30); spermathecal duct being narrow (Fig. 25); ω_1 on tarsus I is slender, slightly widened at apex (Fig. 26), ω on tarsus II slender, nearly cylindrical (Fig. 26). Its aedeagus (Fig. 30) is longer than that of *T. communis* (Fig. 8) and *T. putrescentiae* (Fig. 65), and shorter than that of *T. pacificus* (Fig. 136). The supracoxal seta *scx* of the majority of specimens collected from Australia and New Zealand is slightly thicker than that of specimens from Portugal.

Tyrophagus curvipenis has a very broad range of habitats and hosts as listed above. Crossing experiments were conducted using a population of *T. curvipenis* originating from a honey beehive in Auckland and the culture population of *T. communis* **sp**. **n**. from Bioforce Ltd in Pukekohe, Auckland. Copulating behaviour was observed but females of both species did not produce eggs, indicating that these two species are reproductively isolated (post-mating isolation).

Tyrophagus longior (Gervais)

(Fig. 33–42, Plates 1C, 5C, 6C, 10C, 14C, 15C, 16C, 20C, 21C, 25E, F, 30C, 31C, 32C)

Tyroglyphus longior Gervais, 1844: 262; Michael, 1903: 123.
Tyrophagus longior (Gervais, 1844); Zakhvatkin, 1941: 109; Robertson, 1959: 165; Samšiòák, 1962: 271; Hughes, 1961: 42; Hughes, 1976: 57.
Acarus dimidiatus Hermann, 1804; suppressed by ICZN 1985: 124.
Tyrophagus tenuiclavus Zakhvatkin, 1941: 109; Hughes, 1948: 23; Volgin, 1949: 386; synonymy by Robertson, 1959: 165.

Diagnosis. **Female**. Eyespots absent; *scx* slender, tapering from base to tip, with 8–12 short pectinations; d_1 about 1.3 (1.3–1.8)× length of c_1 and 1.5 (1.5–1.9)× length of d_2; d_2 about 1.0 (0.9–1.1)× length of c_1; coxal plates I triangular not reaching to posterior apex of prosternal apodeme; coxal plates II triangular with posterior margin slightly sinuous, distally not reaching apex of apodeme II. Spermathecal duct broad, widening gradually from midway to base of spermathecal sac, about 1.5 (1.5–1.9)× distance between sclerites of oviducts, base of spermathecal sac nearly flat or bending slightly backwards. Tarsus I ω_1 and tarsus II ω slender, almost cylindrical but tapering slightly from base to apex; setae *w* and *r* of tarsus IV spiniform.

Male. Eyespots absent, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 1.4 (1.2–1.4)× length of c_1 and 1.6 (1.4–1.6)× length of d_2; d_2 about 0.9 (0.8–0.9)× length of c_1; aedeagus with one major curve, narrowing gradually in basal half, distal end straight or slightly reversely curved, internal diameter linear; lateral arms supporting aedeagus turning inwards; setae *w* and *r* of tarsus IV spiniform; ratio (a+b): c = 0.7 (0.7–0.8).

Description. **Female** (Fig. 33–37, Plates 1C, 5C, 6C, 10C, 14C, 15C)

Idiosoma. 525 (525–541) long, 344 (344–347) wide. Chelicera 109 (109–112) long, cheliceral seta *cha* conical, 8 (8–10) long, subcapitular setae *m* 40 (40–44), palpal supracoxal seta *elcp* 15 (15–16) long, dorsal palptibial seta 32 (32–35), lateral palptibial seta 19 (19–20), dorsal palptarsal seta 15 (15–17), palptarsal solenidion 6 (5–6).

Dorsum. Prodorsal shield nearly rectangular, its lateral edeges slightly concave and posterior edeges braodly round; 89 (89–92) long, 105 (105–116) wide between *ve-ve*. Eyespots absent. Grandjean's organ finger-like and barbed, 20 (20–22), its basal lobe with 1 large trident and 2–3 small spiniform teeth. Supracoxal seta *scx* slender, tapering from base to tip, with 12 (8–12) short pectinations, 42 (42–45) long. Ratios: *vi*: *ve* = 1.7, *sci*: *sce* = 2.1 (1.9–2.1), *sci–sci*: *sci–sce* = 1.1 (1.1–1.2). Lengths of setae: *vi* 107 (100–107), *ve* 62 (60–62), *sci* 248 (238–248), *sce* 119 (119–128); distances: *vi–vi* 15 (15–16), *vi–ve* 45 (45–49), *sci–sci* 40 (40–42), *sci–sce* 35 (35–37). Hysterosomal setae d_1 typically not reaching to bases of e_1, about 1.3 (1.3–1.8)× length of c_1 and 1.5 (1.5–1.9)× length of d_2; d_2 about 1.0 (0.9–1.1)× length of c_1; lengths of setae: c_1 45 (45–50), c_2 280 (263–280), c_p 188 (188–196), c_3 41 (38–41), d_1 67 (67–88), d_2 45 (45–46), e_1 421 (413–421), e_2 212 (212–247), f_2 427 (427–433), h_1 408 (408–425), h_2 433 (433–446), h_3 369 (369–385); distances: c_1–c_1 132 (131–132), c_1–d_1 82 (72–82), d_1–d_1 61 (60–61), d_2–*gla* 50 (50–65), d_1–e_1 87 (87–90), e_1–e_1 136 (136–146). **Venter**. Coxal plates I triangular not reaching to posterior apex of prosternal apodeme; coxal plates II triangular with posterior margin slightly sinuous, distally not reaching apex of apodeme II. Setae *1a* 1.1 (0.9–1.1)× length of coxal plate II, 60 (58–60), *3a* 33 (31–33); *3b* 1.4 (1.4–1.6)× length of *3a*, 45 (45–51); *g* 27 (27–30), *4a* 77 (77–87). Pseudanal setae ps_1 2.0 (2.0–2.1)× as long as

ps_2, 258 (258–289) long, ps_2 4.3 (4.3–4.5)× length of ps_3, 129 (129–139) long, ps_3 30 (30–31). Adanal setae ad_1 31 (31–38), ad_2 32 (32–35), ad_3 25 (22–25). Copulatory opening 5 (5–6) in diameter, spermathecal duct broad, widening gradually from midway to base of spermathecal sac, about 1.5 (1.5–1.9)× distance between sclerites of oviducts, base of spermathecal sac nearly flat or bending slightly backwards, distance between sclerites of oviducts 14.

Legs. **Leg I**. 253 (253–258) long; femur I 65 (65–67), *vF* simple, 66 (65–66) long; genu I 50 (49–50), σ' 72 (72–75), σ" 41 (40–41), Iσ': σ" = 1.8 (1.8–1.9), *cG* 46 (46–47), *mG* 60 (59–60); tibia I 37 (35–37), φ 139 (139–144), *gT* 43 (43–45), *hT* 42 (42–45); tarsus I 113 (109–113) long, 31 (30–31) wide, ω_1 slender, almost cylindrical, 24 (22–25) long, ε 7 (6–8), ω_2 10 (10–11), ω_3 32 (32–33), distance between *aa* and ω_1 about 17 (16–17), *aa* 35 (35–36) long, *ba* 38 (36–38), *wa* 55 (55–67), *ra* 40 (40–41), *la* 31 (29–31), *d* 40 (40–42), *e* 10 (10–11), *f* 22 (21–22), *s* 8 (7–8), *u* and *v* 8 (7–8), *p* and *q* 9 (9–10), empodium 18 (16–18), claw 20 (20–22). **Leg II**. 261 (245–261) long; femur II 65 (59–65), *vF* 76 (76–86); genu II 41 (40–41), σ 34 (34–37), *cG* 43 (41–43), *mG* 53 (53–60); tibia II 34 (33–34), φ 158 (153–158), *gT* 40 (40–43), *hT* 45 (45–52); tarsus II 110 (105–110) long, 30 (29–30) wide, ω slender, nearly cylindrical, 25 (25–27) long, *ba* 38 (36–38), *wa* 56 (56–64), *ra* 38 (38–44), *la* 25 (25–32), *d* 39 (38–39), *e* 12 (10–12), *f* 24 (21–24), *s* 8 (7–8), *u* and *v* 8 (7–8), *p* and *q* 9 (9–10), empodium 17 (17–18), claw 24 (23–24). **Leg III**. 275 (255–275) long; femur III 52 (50–52); genu III 46 (42–46), σ 45 (28–45), *nG* 75 (75–85); tibia III 37 (35–37), φ 155 (155–166), *kT* 77 (77–83); tarsus III 123 (121–123) long, 24 (21–24) wide, *w* setiform, 45 (45–46) long, *r* setiform, 46 (36–46) long, *d* 45 (39–45), *e* 10 (9–10), *f* 25 (25–33), *s* 8 (7–8), *u* 7 (6–7), *v* 8 (7–8), *p* and *q* 5 (5–6), empodium 10, claw 14 (14–16). **Leg IV**. 312 (287–312) long; femur IV 55 (53–55), *wF* 63 (63–66); genu IV 57 (49–57); tibia IV 45 (42–45), φ 127 (127–143), *kT* 60 (60–67); tarsus IV 139 (138–139) long, 23 (22–23) wide, *w* spiniform, 59 (56–59) long, *r* spiniform, 23 (22–23) long, *d* 43 (39–43), *e* 9 (8–9), *f* 30 (30–32), *s* 8 (7–8), *u* 7 (6–7), *v* 8 (7–8), *p* and *q* 4 (4–5), empodium 14, claw 14 (14–15).

Male (Fig. 38–42, Plates 16C, 20C, 21C, 25E, F, 30C, 31C, 32C)

Idiosoma. 563 (408–563) long, 366 (217–366) wide. Chelicera 100 (81–109) long, cheliceral seta *cha* conical, 7 (6–7) long, subcapitular setae *m* 40 (36–40), palpal supracoxal seta *elcp* barbed, 14 (12–14) long, dorsal palptibial seta 31 (20–31), lateral palptibial seta 21 (14–21), dorsal palptarsal seta 19 (11–19), palptarsal solenidion 5 (4–5). **Dorsum**. Prodorsal shield as in female, 90 (65–90) long, 97 (82–97) wide between *ve*-*ve*. Eyespots absent. Grandjean's organ finger-shaped and sparsely barbed, basally with 4–6 spiniform teeth, 14 (13–14) long, supracoxal seta *scx* slender, 41 (29–41) long, with 8 (8–10) short pectinations. Ratios: *vi*: *ve* = 1.5 (1.5–1.7), *sci*: *sce* = 2.2 (1.5–2.2), *sci–sci*: *sci–sce* = 1.3 (1.2–1.5). Lengths of setae: *vi* 111 (71–111), *ve* 72 (43–72), *sci* 286 (175–286), *sce* 131 (77–147); distances: *vi–vi* 16 (12–16), *vi–ve* 41 (35–41), *sci–sci* 43 (30–45), *sci–sce* 32 (25–32). Hysterosomal setae d_1 about 1.4 (1.2–1.4)× length of c_1 and 1.6 (1.4–1.6)× length of d_2; d_2 about 0.9 (0.8–0.9)× length of c_1; lengths of setae: c_1 45 (34–45), c_2 258 (205–258), c_p 191 (131–191), c_3 41 (35–41), d_1 62 (42–62), d_2 40 (32–40), e_1 362 (302–362), e_2 186 (165–186), f_2 438 (326–438), h_1 446 (352–446), h_2 491 (438–491), h_3 403 (278–403); distances: c_1–c_1 141 (77–141), c_1–d_1 67 (49–67), d_1–d_1 62 (37–62), d_2–*gla* 54 (35–57), d_1–e_1 85 (57–85), e_1–e_1 151 (91–151). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 0.9 (0.9–1.1)× length of coxal plate II, 51 (39–56); *3a* 31 (17–31); *3b* 1.6 (1.6–2.3)× length of *3a*, 50 (39–50); *g* 23 (17–23), *4a* 78 (48–78). Aedeagus, with one major curve, 22 (21–23) long, narrowing gradually in basal half, distal end straight or slightly reversely curved, internal diameter linear; lateral arms supporting aedeagus turning inwards. Anal slit 92 (61–92) long, distance between anterior rim of anal slit and posterior margin of aedeagus 9 (9–15). Anal suckers about 32 (18–32) in diameter; anal discs 5 (4–5) in diameter, distances between right and left discs 35 (35–37). Pseudanal setae ps_1 about 4.6 (4.4–4.9)× length of ps_2, 235 (195–235) long, ps_2 2.6 (2.4–2.6)× length of ps_3, 51 (36–51) long, ps_3 20 (15–20); ps_2–ps_2 1.1 (0.9–1.1)× distance ps_1–ps_1, ps_1–ps_1 43 (40–44), ps_2–ps_2 47 (43–48).

Legs. **Leg I**. 291 (183–291) long; femur I 57 (45–61), *vF* simple, 67 (40–67) long; genu I 45 (30–45), σ' 57 (49–57), σ" 25 (24–32), Iσ': σ" = 2.3 (1.6–2.3), *cG* 45 (35–45), *mG* 42 (42–55); tibia I 36 (26–40), φ 127 (112–139), *gT* 42 (31–42), *hT* 45 (31–45); tarsus I 110 (78–110) long, 21 (17–25) wide, ω_1 cylindrical, 18 (17–20) long, ε 5 (4–7), ω_2 8 (6–8), ω_3 35 (24–35), distance between *aa* and ω_1 about 16 (12–16), *aa* 20 (18–25) long, *ba* 35 (21–35), *wa* 54 (31–54), *ra* 33 (24–33), *la* 21 (17–24), *d* 50 (26–50), *e* 10 (7–10), *f* 20 (15–21), *s* 8 (7–8), *u* and *v* 8 (7–8), *p* and *q* 9 (9–10), empodium 14 (10–14), claw 19 (14–19). **Leg II**. 250 (182–250) long; femur II 60 (44–62), *vF* 75 (53–75); genu II 45 (32–45), σ 25 (22–25), *cG* 47 (30–47), *mG* 52 (41–52); tibia II 32 (25–35), φ 123 (114–126), *gT* 40 (28–40), *hT* 42 (32–42); tarsus II 105 (74–105) long, 19 (16–23) wide, ω cylindrical, 26 (21–26) long, *ba* 34 (23–31), *wa* 51 (35–56), *ra* 33 (27–41), *la* 30 (21–30), *d* 40 (30–40), *e* 10 (7–10), *f* 20 (12–20), *s* 7 (5–7), *u* and *v* 6 (5–6), *p* and *q* 7 (6–7), empodium 15 (12–15), claw 19 (14–

19). **Leg III**. 267 (188–267) long; femur III 60 (37–60); genu III 40 (30–40), σ 15 (15–25), *nG* 62 (52–62); tibia III 30 (25–32), φ 145 (123–157), *kT* 57 (47–67); tarsus III 120 (88–120) long, 17 (15–18) wide, *w* setiform, 42 (31–43) long, *r* setiform, 34 (23–38) long, *d* 39 (28–39), *e* 10 (7–10), *f* 27 (22–31), *s* 7 (6–7), *u* 6 (5–6), *v* 7 (6–7), *p* and *q* 5 (4–5), empodium 14 (9–14), claw 19 (14–19). **Leg IV**. 295 (215–295) long; femur IV 65 (35–65), *wF* 68 (41–68); genu IV 50 (38–52); tibia IV 40 (30–40), φ 107 (99–107), *kT* 65 (42–65); tarsus IV 131 (95–131) long, 16 (115–18) wide, *w* and *r* situated anteriorad of distal sucker, *w* spiniform, 36 (32–36) long, *r* spiniform, 18 (13–23) long, distances between basal rim of tarsus IV and proximal sucker *d* 20 (15–20), between *d* and *e* 22 (19–22), between *e* and *f* 62 (44–62), ratio (a+b): c = 0.7 (0.7–0.8), *f* 42 (25–42) long, *s* 7 (6–7), *u* 5 (5–6), *v* 7 (6–7), *p* and *q* 4 (3–4), empodium 14 (14–15), claw 18 (13–18).

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: ND, AK, WO, TK, HB, WI, WN / NN, MB, MC, SC, CO, SL. Australia, Ecuador, Netherlands, Philippines, U.K., U.S.A.

BASED ON LITERATURE: Australia (Robertson 1959), Belgium (Bollaerts & Breny 1951), Bulgaria (Angelkova 1982), Canada (Robertson 1959), Denmark (Robertson 1959), Egypt (Zakladnoi 2003), Faroe Islands (Hallas & Solberg 1989), Finland (Leskinen & Klen 1987), France (Reynaud *et al.* 1981), Germany (Robertson 1959), Greece (Papaioannou-Souliotis 1991), India (Mohanasundaram & Parameswaran 1991), Ireland (Cusack *et al*. 1975), Italy (Robertson 1959), Netherlands (Robertson 1959), Indonesia (as New Guinea) (Oudemans 1906), New Zealand (Robertson 1959), Poland (Studzinski & Malachowska 1975), Sweden (Bostrom *et al.* 1997), U.K. (Michael 1903; Hughes 1948; Griffiths 1979), Uruguay (Rimbaud 1983), U.S.A. (Baker *et al.* 1976).

Material examined. Neotype and 736 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: acorns of *Quercus* sp., avocadoes, banana, barley, barn dust, bulked wheat, coconut, combine harvester, cucumber, culms and panicles of wheat, cucumber leaves, *Cymbidium*, *Dahlia*, damaged peas, damaging cucumber leaves, fig leaves, garlic (*Allium sativum* L.), gladioli bulbs, grassland, grass seed, harvester, mallow leaves, mandarin, *Musa sapientum*, nectarine bark, nests of dipper (*Cinclus cinclus aquaticus*), onion, pomelo, ornamentals, rotting coconut, rotting mango, ryegrass seed, shallots, soyabean flour, stored apple, stored food products, stored grain, stored hay, stored pollen, strawberry, tamarillo, tomato chutney, weed, wheat.

ANIMAL OR ANIMAL PRODUCTS: bee frames, bee hive, bee surveillance, bird nest, bird's nest in poplar tree, *Bombus* nests, cheese, cheese shelves, dead *Prionoplus reticularis* Lav., ham, hives of *Apis cerana indica*, *A. mellifera*, *A. dorsata* and *A. florae*, honey, house dust, human, litter in a densely populated urban area, nests of sea birds (*Eudyptula minor albosignata* and *Pachyptila turtur*), nest of *Sturnus vulgaris*, pallet and bag scrapings (dried milk powder), prosciutto in meat works, scrapie-infected sheep, shepherd, wedding cake.

Remarks. *Tyrophagus longior* has long been considered one of the important mite pests on cheese (Robertson 1961). The present definition of *T. longior* (Gervais) is established by Robertson (1959) based on the neotype male with another male on the slide labelled "*Tyrophagus longior* (Gerv., 1844), ♂ dors., ex cheese, Gouda, Netherlands, 26.3.54, P.L.R. Coll. No. 237 (3, 4). Neotype".

Robertson (1959) listed synonyms of *Tyrophagus longior* (Gerv., 1844):

Tyroglyphus longior Gervais, 1844: 262; Fumouze & Robin, 1867: 582; Nalepa, 1884: 226; Canestrini, 1888, 28; 1888, 405; Canestrini & Kramer, 1899: 140; Banks, 1906: 14; Eales, 1918: 1088; André, 1933: 353.
Tyroglyphus dimidiatus; Oudemans, 1924: 269.
Tyroglyphus infestans Berlese, 1884 (unnumbered).
Tyroglyphus dimidiatus forma *longior*; Oudemans, 1924: 269.
Tyroglyphus dimidiatus forma *dimidiatus*; Oudemans, 1924: 269.
Tyrophagus dimidiatus forma *humerosus*; Oudemans, 1924: 269.
Tyroglyphus subgen. *Tyrophagus dimidiatus*; Oudemans, 1924:25.
Tyrophagus dimidiatus var. *humerosus*; Vitzthum, 1929: 75.
Tyrophagus dimidiatus var. *longior*; Vitzthum, 1929: 75.
Tyrophagus dimidiatus var. *infestans*; Vitzthum, 1929: 75.
Tyrophagus dimidiatus; Vitzthum, 1929: 75.
Tyrophagus longior; Hull, 1931: 40; Zakhvatkin, 1941: 109; Baker & Wharton, 1952: 335; Robertson, 1959: 165.
Tyrophagus tenuiclavus Zakhvatkin, 1941: 109; Hughes, 1948: 23; Volgin, 1949: 386; Bollaerts & Breny, 1951; synonymy by Robertson, 1959: 165.
Tyrophagus infestans (Berlese); Nesbitt, 1945: 155.
Coelognathus dimidiatus (Hermann); Turk, 1953: 81.
Coelognathus tenuiclavus (Zakhvatkin); Turk, 1953: 81.

Tyrophagus macfarlanei sp. n.

Fig. 43–47, Plates 1D, 5D, 6D, 10D, 14D, 15D

Diagnosis. **Female**. Eyespots absent; *scx* broadly widened medially where pectinations begin, with 18–20 moderate or short pectinations; d_1 3.7× length of c_1 and 2.2× length of d_2; d_2 1.7× length of c_1; coxal plates I extending beyond posterior apex of prosternal apodeme; posterior margin of coxal plates II strongly concave along basal one third. Spermathecal duct narrowing gradually from copu-

latory opening for a distance about 3.8×distance between sclerites of oviducts and then forming a thin tube leading to base of spermathecal sac over a distance about 1.2× distance between sclerites of oviducts, base of spermathecal sac small and flat. Tarsus I ω_1 and tarsus II ω stout, almost cylindrical; setae *w* and *r* of tarsus IV setiform.

Description. **Female** (Fig. 43–47, Plates 1D, 5D, 6D, 10D, 14D, 15D)

Idiosoma. 321 long, 187 wide. Chelicera 72 long, cheliceral seta *cha* conical with bifurcated tip, 5 long, subcapitular setae *m* 32, palpal supracoxal seta *elcp* slender, 16 long, dorsal palptibial seta 17, lateral palptibial seta 12, dorsal palptarsal seta 11, palptarsal solenidion 3. **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins strongly concave and posterolateral margins slightly concave; 60 long, 73 wide between *ve-ve*. Eyespots absent. Grandjean's organ finger-like (12), its basal lobe with 3 basally spiniform teeth. Supracoxal seta *scx* broadly widened at bases of pectinations, 18–20 moderate or short in number, 34 long. Ratios: *vi*: *ve* = 1.2, *sci–sci*: *sci–sce* = 1.5. Lengths of setae: *vi* 59, *ve* 48, *sci* lost, *sce* 86; distances: *vi–vi* 9, *vi–ve* 30, *sci–sci* 30, *sci–sce* 20. Hysterosomal setae d_1 about 3.7× length of c_1 and 2.2× length of d_2; d_2 1.7× length of c_1; lengths of setae: c_1 27, c_2 153, c_p 107, c_3 30, d_1 101, d_2 46, e_1 268, e_2 >147, f_2 254, h_1 337, h_2 319, h_3 242; distances: c_1–c_1 92, c_1–d_1 30, d_1–d_1 41, d_2–*gla* 39, d_1–e_1 73, e_1–e_1 85. **Venter**. Coxal plates I extending beyond posterior apex of prosternal apodeme; posterior margin of coxal plates II strongly concave along basal one-third. Setae *1a* 1.2× length of coxal plate II, 41, *3a* 27; *3b* 1.3× length of *3a*, 35; *g* 21, *4a* 50. Pseudanal setae ps_1 1.9× as long as ps_2, 196 long, ps_2 4.5× length of ps_3, 104 long, ps_3 23. Adanal setae ad_1 22, ad_2 19, ad_3 20. Copulatory opening 5 in diameter, spermathecal duct narrowing gradually from copulatory opening for a distance about 3.8×distance between sclerites of oviducts, then narrowing abruptly and leading to base of spermathecal sac over a distance about 1.2× distance between sclerites of oviducts, base of spermathecal sac small and flat, distance between sclerites of oviducts 6.

Legs. **Leg I**. 170 long; femur I 40, *vF* simple, 44 long; genu I 31, σ' 30, σ" 30, Iσ': σ" = 1.0, *cG* 25, *mG* 32; tibia I 25, φ 123, *gT* 23, *hT* 27; tarsus I 67 long, 13 wide, ω_1 stout, almost cylindrical, 12 long, ε 3, ω_2 5, ω_3 17, distance between *aa* and ω_1 about 9, *aa* 10 long, *ba* 16, *wa* 32, *ra* 25, *la* 18, *d* 16, *e* 7, *f* 10, *s* 4.5, *u* and *v* 3, *p* and *q* 5.5, empodium 13, claw 10. **Leg II**. 152 long; femur II 39, *vF* 42; genu II 27, σ 14, *cG* 17, *mG* 26; tibia II 22, φ 118, *gT* 23, *hT* 27; tarsus II 62 long, 13 wide, ω stout, nearly cylindrical, 16 long, *ba* 20, *wa* setiform, 27 long, *ra* setiform, 23 long, *la* 20, *d* 15, *e* 7, *f* 10, *s* 4.5, *u* and *v* 3, *p* and *q* 5.5, empodium 13, claw 10. **Leg III**. 157 long; femur III 33; genu III 26, σ 12, *35*; tibia III 24, φ 109, *kT* 30; tarsus III 66 long, 12 wide, *w* 25, *r* 19, *d* 11, *e* 6, *f* 10, *s* 4.5, *u* 3, *v* 4, *p* and *q* 3.5, empodium 12, claw 10. **Leg IV**. 184 long; femur IV 38, *wF* 39; genu IV 30; tibia IV 28, φ 114, *kT* 36; tarsus IV 76 long, 11 wide, *w* setiform, 23 long, *r* setiform, 20 long, *d* 14, *e* 6, *f* 13, *s* 4.5, *u* 3, *v* 4, *p* and *q* 3.5, empodium 13, claw 10.

Male. Unknown.

Distribution. New Zealand.

Material examined. Holotype.

Type material. **Holotype** female: NEW ZEALAND: **Intercepted in Queensland, Australia**: 1/1 female (Q22444), 16 May 2001, collector unknown, carrots, NZAC.

Habitat and host. Carrot.

Etymology. This species is named in honour of Bob Macfarlane, Biosecurity New Zealand, who recognises and appreciates the importance of taxonomy to biosecurity

Remarks. *Tyrophagus macfarlanei* and *T. tropicus* Robertson, 1959 differ from all other species in having long d_2 and slender *elcp*. *Tyrophagus macfarlanei* resembles *T. tropicus* in lacking eyespots, *scx* being broadly widened and densely pectinated, but differs from the latter in seta ad_1 nearly as long as ps_3 (Fig. 46) rather than prominently long (more than 2× length of ps_3, Fig. 151), and the structure of spermathecal duct (Fig. 45, 152).

Tyrophagus neiswanderi Johnston & Bruce

Fig. 48–57, Plates 2A, 5E, 7A, 11A, 14E, 15E, 16D, 20D, 21D, 26A, B, 30D, 31D, 32D

Tyrophagus neiswanderi Johnston & Bruce, 1965: 3; Hughes, 1976: 59; Nakao & Kurosa, 1988: 139.

Tyrophagus africanus Meyer & Rodrigues, 1966: 26; **syn. n.**

Diagnosis. **Female**. Eyespots prominent; *scx* shaft widened at point where pectinations begin, with 8–11 moderate or short pectinations; d_1 about 1.6 (1.5–1.8)× length of c_1 and 1.7 (1.6–1.9)× length of d_2; d_2 about 0.9 (0.9–1.0)× length of c_1; coxal plates I reaching to posterior apex of prosternal apodeme; coxal plates II narrowing sharply along its distal 3/5, then becoming contiguous with apex of apodeme II, with 2/3 posterior margin strongly concave. Spermathecal duct narrowing gradually from copulatory opening to base of spermathecal sac, about 2.6 (2.5–3.2)× distance between sclerites of oviducts, base of spermathecal sac triangular, funnel-shaped. Tarsus I ω_1 and tarsus II ω slender, almost cylindrical; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II

ω as in female; d_1 about 1.5 (1.5–1.9)× length of c_1 and 1.3 (1.3–1.5)× length of d_2; d_2 about 1.1 (1.1–1.2)× length of c_1; aedeagus with one major curve, distal end almost straight, tapering from base to tip, internal diameter linear, lateral arms supporting aedeagus turning outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 1.8.

Description. **Female** (Fig. 48–52, Plates 2A, 5E, 7A, 11A, 14E, 15E)

Idiosoma. 493 (482–535) long, 327 (304–331) wide. Chelicera 107 (105–110) long, cheliceral seta *cha* conical, 6 (6–7) long, subcapitular setae *m* 47 (43–52), palpal supracoxal seta *elcp* 11 (10–12) long, dorsal palptibial seta 23 (20–27), lateral palptibial seta 17 (15–17), dorsal palptarsal seta 11 (11–13), palptarsal solenidion 4 (4–5).

Dorsum. Prodorsal shield nearly pentagonal, its lateral margins slightly concave and posterolateral margins strongly concave; 89 (87–90) long, 102 (101–105) wide between *ve-ve*. Eyespots present, prominent. Grandjean's organ finger-like, its basal lobe with 2 basally confluent and 1 separate spiniform teeth. Supracoxal seta *scx* widened at bases of pectinations, with 8 (8–11) moderate or short pectinations, 31 (30–32) long. Ratios: *vi*: *ve* = 1.5 (1.7–1.8), *sci*: *sce* = 2.1 (2.1–2.3), *sci–sci*: *sci–sce* = 1.5 (1.4–1.5). Lengths of setae: *vi* 87 (87–110), *ve* 57 (51–63), *sci* 223 (221–228), *sce* 108 (101–122); distances: *vi–vi* 15 (14–17), *vi–ve* 55 (43–56), *sci–sci* 45 (40–50), *sci–sce* 30 (29–32). Hysterosomal setae d_1 about 1.6 (1.5–1.8)× length of c_1 and 1.7 (1.6–1.9)× length of d_2; d_2 about 0.9 (0.9–1.0)× length of c_1; lengths of setae: c_1 54 (45–58), c_2 245 (240–251), c_p 185 (183–192), c_3 45 (43–47), d_1 87 (77–90), d_2 51 (43–54), e_1 375 (349–405), e_2 274 (262–284), f_2 365 (308–373), h_1 419 (404–449), h_2 411 (392–423), h_3 318 (300–318); distances: c_1–c_1 116 (115–118), c_1–d_1 69 (69–85), d_1–d_1 48 (48–55), d_2–*gla* 62 (60–65), d_1–e_1 105 (98–121), e_1–e_1 118 (111–128). **Venter**. Coxal plates I reaching to posterior apex of prosternal apodeme; coxal plates II narrowing sharply along its distal 3/5, then becoming contiguous with apex of apodeme II, with 2/3 posterior margin strongly concave. Setae *1a* 1.1 (1.1–1.2)× length of coxal plate II, 65 (56–65) long, *3a* 25 (25–29); *3b* 3.9 (3.3–3.9)× length of *3a*, 97 (90–97) long; *g* 22 (22–24), *4a* 101 (99–107). Pseudanal setae ps_1 1.6 (1.6–2.0) × as long as ps_2, 232 (232–238) long, ps_2 6.6 (5.6–6.6) × length of ps_3, 145 (118–170) long, ps_3 22 (20–26). Adanal setae ad_1 20 (17–23), ad_2 20 (15–22), ad_3 16 (13–18). Copulatory opening 4 (4–5) in diameter, spermathecal duct narrowing gradually from copulatory opening to base of spermathecal sac, about 2.6 (2.5–3.2)× distance between sclerites of oviducts, base of spermathecal sac triangular, funnel-shaped, distance between sclerites of oviducts 23 (18–25).

Legs. **Leg I.** 247 (231–262) long; femur I 64 (63–66), *vF* simple, 54 (53–68) long; genu I 43 (42–44), σ' 43 (42–46), σ" 28 (26–29), Iσ': σ" = 1.5 (1.5–1.6), *cG* 47 (45–50), *mG* 60 (57–62); tibia I 36 (35–38), φ 134 (124–141), *gT* 44 (40–48), *hT* 48 (44–51); tarsus I 98 (95–100) long, 24 (23–25) wide, $ω_1$ slender, almost cylindrical, 20 (19–22) long, ε 4 (4–5), $ω_2$ 7 (6–7), $ω_3$ 30 (27–37), distance between *aa* and $ω_1$ about 14 (13–16), *aa* 30 (28–32) long, *ba* 29 (26–31), *wa* 55 (52–59), *ra* 39 (33–41), *la* 28 (22–30), *d* 36 (29–43), *e* 8 (7–9), *f* 16 (14–19), *s* 7 (6–7), *u* and *v* 5 (4–5), *p* and *q* 7 (6–7), empodium 20 (18–21), claw 16 (14–17). **Leg II**. 232 (227–245) long; femur II 61 (60–64), *vF* 68 (65–70); genu II 45 (44–46), σ 27 (26–29), *cG* 42 (42–48), *mG* 48 (46–50); tibia II 28 (28–33), φ 154 (137–176), *gT* 42 (41–44), *hT* 48 (47–53); tarsus II 91 (89–92) long, 22 (20–25) wide, ω slender, nearly cylindrical, 22 (22–24) long, *ba* 31 (29–32), *wa* 52 (51–54), *ra* 34 (33–43), *la* 25 (23–28), *d* 35 (31–42), *e* 7 (6–9), *f* 15 (14–18), *s* 7 (6–7), *u* and *v* 5 (4–5), *p* and *q* 7 (6–7), empodium 20, claw 16 (14–16). **Leg III**. 237 (231–257) long; femur III 52 (51–53); genu III 40 (39–42), σ 25 (25–26), *nG* 60 (56–64); tibia III 37 (36–38), φ 154 (138–182), *kT* 55 (51–65); tarsus III 100 (97–102) long, 16 (15–16) wide, *w* 53 (50–56), *r* 36 (34–38), *d* 35 (31–40), *e* 7 (6–7), *f* 19 (15–22), *s* 7 (6–7), *u* 4 (4–4.5), *v* 7 (6–7), *p* and *q* 5 (4–5), empodium 18 (15–20), claw 15 (13–16). **Leg IV**. 271 (264–284) long; femur IV 53 (51–56), *wF* 55 (50–61); genu IV 49 (48–50); tibia IV 50 (50–51), φ 133 (126–141), *kT* 55 (50–56); tarsus IV 106 (101–107) long, 16 (15–19) wide, *w* setiform, 47 (40–50) long, *r* setiform, 27 (25–28) long, *d* 30 (25–34), *e* 7 (7–9), *f* 21 (20–24), *s* 7 (6–7), *u* 4 (4–4.5), *v* 7 (6–7), *p* and *q* 5 (4–5), empodium 18 (15–18), claw 14 (13–15).

Male (Fig. 53–57, Plates 16D, 20D, 21D, 26A, B, 30D, 31D, 32D)

Idiosoma. 397 (397–425) long, 242 (242–275) wide. Chelicera 80 (80–85) long, cheliceral seta *cha* conical with a blunt tip, 6 (5–6) long, subcapitular setae *m* 36 (34–36), palpal supracoxal seta *elcp* 11 (11–12) long, dorsal palptibial seta 23 (20–23), lateral palptibial seta 13 (13–15), dorsal palptarsal seta 10 (10–11), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield as in female, 70 (70–81) long, 82 (82–90) wide between *ve-ve*. Eyespots prominent. Grandjean's organ as in female, 13 (12–13) long; supracoxal seta *scx* 23 (23–26) long. Ratios: *vi*: *ve* = 1.8 (1.8–1.9), *sci*: *sce* = 1.6 (1.6–1.7), *sci–sci*: *sci–sce* = 1.5 (1.4–1.5). Lengths of setae: *vi* 85 (85–110), *ve* 48 (48–57), *sci* 178 (172–178), *sce* 108 (99–108); distances: *vi–vi* 11 (11–12), *vi–ve* 35 (35–37), *sci–sci* 32 (32–36), *sci–sce* 21 (21–25). Hysterosomal setae d_1 about 1.5 (1.5–1.9)× length of c_1 and 1.3 (1.3–1.5)× length of d_2; d_2 about 1.1 (1.1–1.2)× length of c_1; lengths of setae: c_1 29 (29–42), c_2 234 (234–250), c_p 148 (148–187), c_3 30 (30–50), d_1 43

(43–79), d_2 32 (32–51), e_1 320 (320–342), e_2 221 (221–251), f_2 240 (240–362), h_1 342 (342–389), h_2 355 (355–387), h_3 333 (270–333); distances: c_1–c_1 92 (92–107), c_1–d_1 45 (45–60), d_1–d_1 44 (44–45), d_2–*gla* 42 (42–47), d_1–e_1 70 (70–79), e_1–e_1 95 (95–107). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 1.1 (1.0–1.1)× length of coxal plate II, 48 (48–50); *3a* 24 (24–26); *3b* 3.4× length of *3a*, 82 (82–90); *g* 21 (21–27), *4a* 88 (88–100). Aedeagus with one major curve, distal end almost straight, 16 (16–20) long, tapering from base to tip, internal diameter linear; lateral arms supporting aedeagus turning outwards. Anal slit 62 (62–70) long, distance between anterior rim of anal slit and posterior margin of aedeagus 19 (15–19). Anal suckers about 21 (21–23) in diameter; anal discs 4 (3–5) in diameter, distances between right and left discs 32 (17–32). Pseudanal setae ps_1 about 2.3 (1.8–2.3)× length of ps_2, 251 (225–251) long, ps_2 6.8 (6.8–6.9)× length of ps_3, 108 (108–125) long, ps_3 16 (16–18); ps_2–ps_2 2.0× distance ps_1–ps_1, ps_1–ps_1 30 (30–32), ps_2–ps_2 59 (59–63).

Legs. **Leg I.** 201 (201–222) long; femur I 51 (51–53), *vF* simple, 47 (47–52) long; genu I 36 (36–37), σ' 46 (45–46), σ" 27 (22–27), Iσ': σ" = 1.7 (1.7–2.0), *cG* 37 (37–46), *mG* 44 (44–50); tibia I 30 (30–33), φ 112 (112–116), *gT* 34 (34–36), *hT* 38 (38–41); tarsus I 77 (77–88) long, 20 (19–20) wide, shape of ω_1 as in female, 17 (16–17) long, ε 4 (4–4.5), ω_2 6 (6–6.5), ω_3 26 (26–28), distance between *aa* and ω_1 about 13 (13–14), *aa* 17 (17–21) long, *ba* 28 (28–32), *wa* 41 (41–50), *ra* 31 (31–35), *la* 24 (22–24), *d* 24 (24–35), *e* 8 (7–8), *f* 15 (13–15), *s* 6 (6–6.5), *u* and *v* 4 (4–5), *p* and *q* 6 (6–7), empodium 14 (14–18), claw 15 (13–16). **Leg II**. 167 (167–189) long; femur II 46 (46–53), *vF* 57 (57–70); genu II 37 (37–42), σ 21 (21–25), *cG* 26 (26–40), *mG* 39 (39–50); tibia II 26 (26–41), φ 127 (125–127), *gT* 31 (31–40), *hT* 36 (36–51); tarsus II 71 (71–82) long, 16 (16–19) wide, ω as in female, 17 (17–18) long, *ba* 25 (20–25), *wa* 37 (37–44), *ra* 31 (31–36), *la* 23 (22–25), *d* 23 (23–35), *e* 7 (6–7), *f* 17 (17–20), *s* 6 (6–6.5), *u* and *v* 4 (4–5), *p* and *q* 6 (6–7), empodium 14 (13–19), claw 16 (13–16). **Leg III**. 174 (174–201) long; femur III 40 (40–42); genu III 32 (32–35), σ 17 (17–25), *nG* 44 (44–52); tibia III 28 (28–33), φ 138 (127–138), *kT* 44 (44–52); tarsus III 77 (77–90) long, 14 (14–15) wide, *w* 34 (34–36), *r* 27 (25–27), *d* 28 (28–29), *e* 7 (6–7), *f* 26 (14–26), *s* 6 (5–6), *u* 4, *v* 6 (5–6), *p* and *q* 4 (3–4), empodium 15 (15–19), claw 15 (12–16). **Leg IV**. 209 (209–225) long; femur IV 42 (42–53), *wF* 43 (43–50); genu IV 36 (36–37); tibia IV 31 (31–37), φ 116 (115–116), *kT* 46 (46–50); tarsus IV 83 (83–100) long, 13 (13–15) wide, *w* and *r* situated at level between suckers and close to distal sucker, *w* setiform, 32 (32–39) long, *r* setiform, 20 (20–21) long, distances between basal rim of tarsus IV and proximal sucker *d* 22 (22–25), between *d* and *e* 20 (20–25), between *e* and *f* 24 (24–28), ratio (a+b): c = 1.8, *f* 26 (17–26) long, *s* 6 (6–6.5), *u* 4 (4–4.5), *v* 6 (6–7), *p* and *q* 3 (3–4), empodium 13 (13–20), claw 14 (13–16).

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: ND, AK, BP, TK, WI / MC. Australia, Germany, Netherlands, South Africa, U.K., U.S.A.

BASED ON LITERATURE: China (Teng *et al*. 1988), Japan (Nakao & Kurosa 1988), Mexico (Estebanes-Gonzalez 1997), New Zealand (Martin & Workman 1985), Poland (Czaikowska *et al.* 1988), South Africa (Meyer & Rodrigues 1966), Switzerland (Fischer 1993), U.K. (Griffiths 1979). U.S.A. (Johnston & Bruce 1965).

Material examined. Two paratypes and 388 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: bud on gooseberry culture, bulbs (Amaryllidaceae) vallarta, bulbs of *Amaryllis hippeastrum*, capsicum (*Capsicum frutescens*) in glasshouse, corn, cucumber, cucumber fruits, cucumber in greenhouse, *Cymbidium* orchid flower buds & leaves, *Cymbidium* pollen caps, diseased onions, *Epiphyllum* sp., flower bulbs, garlic, *Geranium*, grape leaves with galls, *Hibiscus* sp., lemon, miniature cymbidium orchid, *Narcissus* bulbs, onion, orange, orchid flower, orchid house floor, orchid pots, Pepino (*Solanum muricatum*), *Phalaenopsis* orchid flower buds, plant material, *Prunus* leaves, scale culture room, soil and plant material, grape vines, tomato in green house, *Zantedeschia* bulbs.

ANIMAL OR ANIMAL PRODUCTS: respiratory tract of human, short tailed bat.

Remarks. Re-examination of the holotype, allotype, and paratypes of *T. africanus* Meyer & Rodrigues (Acy 65/26 in ARC-PPRI) reveals that *T. africanus* is conspecific with *T. neiswanderi*. According to the Principle of Priority (Article 23) of International Code of Zoological Nomenclature we regard *T. africanus* as a junior synonym of *T. neiswanderi*.

It seems that *T. neiswanderi* is mostly associated with plants and their products. Indeed at its type locality (Ohio, USA), it is found infesting glasshouse cucumbers (Johnston & Bruce, 1965), and Griffiths (pers. com.) observed a number of cases in commercial cucumber crops in the UK where he identified *T. nieswanderi* as the causative agent of serious damage to developing heads. The record of this species on short tailed bat may be explained by a hypothesis that this species uses the bat as a tool for dispersal.

Tyrophagus putrescentiae (Schrank)

Fig. 58–67, Plates 2B, 5F, 7B, 11B, 14F, 15F, 17A, 20E, 22A, 26C, D, 30E, 31E, 33A

Acarus putrescentiae Schrank, 1781: 521.

Tyroglyphus (*Tyrophagus) putrescentiae*; Oudemans, 1924a: 250.

Diagnosis. **Female**. Eyespots present; *scx* widened at bases of pectinations, long and numbering 10–14; d_1 about 2.1 (2.1–2.8)× length of c_1 and 2.4 (2.4–3.3)× length of d_2; d_2 about 0.9 (0.8–0.9)× length of c_1; coxal plates I just beyond apex of prosternal apodeme; coxal plates II with sinuous posterior border, narrowing sharply medially, becoming consitguous with apex of its apodeme. Spermathecal duct narrowing rapidly from copulatory opening for a distance about 0.6 (0.5–1.3)× diameter of distance between sclerites of oviducts and then gradually widening to base of spermathecal sac over a distance about 2.2 (1.9–2.2)× distance between sclerites of oviducts, base of spermathecal sac flat. Distal 2/3 ω_1 obviously widening, tarsus II ω slightly widening at apex; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 2.0 (2.0–2.2)× length of c_1 and 1.9 (1.9–2.2)× length of d_2; d_2 about 1.0 (1.0–1.1)× length of c_1; aedeagus with two obvious curves, S-shaped, distal 1/3 reversely curved, tapering from base to tip, internal diameter linear; lateral arms supporting aedeagus turning outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 1.8.

Description. **Female** (Fig. 58–62, Plates 2B, 5F, 7B, 11B, 14F, 15F)

Idiosoma. 492 (486–492) long, 314 (314–319) wide. Chelicera 94 (92–94) long, cheliceral seta *cha* conical, 6 (5–6) long, subcapitular setae *m* 35 (35–39), palpal supracoxal seta *elcp* 14 (13–14) long, dorsal palptibial seta 25 (23–25), lateral palptibial seta 17 (15–17), dorsal palptarsal seta 12 (11–13), palptarsal solenidion 4 (4–5). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins slightly concave; 83 (81–83) long, 95 (84–95) wide between *ve-ve*. Eyespots present. Grandjean's organ finger-like, 15 (13–15), its basal lobe with 1–2 large and 2 small spiniform teeth. Supracoxal seta *scx* widened at bases of pectinations, with 12 (10–14) long or short pectinations, 31 (31–33) long. Ratios: *vi*: *ve* = 1.6 (1.6–2.0), *sci*: *sce* = 1.8 (1.4–1.8), *sci–sci*: *sci–sce* = 1.2 (1.2–1.4). Lengths of setae: *vi* 117 (98–117), *ve* 60 (60–62), *sci* 185 (185–210), *sce* 137 (116–137); distances: *vi–vi* 15 (13–15), *vi–ve* 40 (39–40), *sci–sci* 42 (36–42), *sci–sce* 33 (29–33). Hysterosomal setae d_1 about 2.1 (2.1–2.8)× length of c_1 and 2.4 (2.4–3.3)× length of d_2; d_2 about 0.9 (0.8–0.9)× length of c_1; lengths of setae: c_1 50 (50–51), c_2 261 (247–261), c_p 177 (177–181), c_3 47 (47–49), d_1 107 (107–141), d_2 45 (43–45), e_1 333 (319–333), e_2 276 (276–286), f_2 337 (337–391), h_1 392 (384–392), h_2 370 (370–373), h_3 314 (314–319); distances: c_1–c_1 117 (117–119), c_1–d_1 76 (75–76), d_1–d_1 51 (50–51), d_2–*gla* 51 (48–51), d_1–e_1 94 (90–94), e_1–e_1 119 (115–119). **Venter**. Coxal plates I extending postero-medially slightly beyond apex of prosternal apodeme; coxal plates II with sinuous posterior border, narrowing sharply medially, becoming consitguous with apex of its apodeme. Setae *1a* 1.1× length of coxal plate II, 58 (51–58), *3a* 33 (31–33); *3b* 2.6 (2.6–2.7)× length of *3a*, 85 (83–85); *g* 30 (29–30), *4a* 108 (97–108). Pseudanal setae ps_1 1.5× as long as ps_2, 252 (250–252) long, ps_2 6.8× length of ps_3, 168 (168–170) long, ps_3 25 (24–25). Adanal setae ad_1 21 (18–21), ad_2 18 (17–18), ad_3 14 (14–17). Copulatory opening 5 in diameter, spermathecal duct narrowing rapidly from copulatory opening for a distance about 0.6 (0.5–1.3)× diameter of distance between sclerites of oviducts and then gradually widening to base of spermathecal sac over a distance about 2.2 (1.9–2.2)× distance between sclerites of oviducts, base of spermathecal sac flat, distance between sclerites of oviducts 16 (16–20).

Legs. **Leg I.** 222 (220–222) long; femur I 56 (56–58), *vF* simple, 54 (54–56) long; genu I 34 (34–41), σ' 57 (52–57), σ" 26 (25–26), Iσ': σ" = 2.2, *cG* 46 (45–46), *mG* 57 (57–60); tibia I 31 (29–31), φ 115 (110–115), *gT* 45 (44–45), *hT* 49 (45–49); tarsus I 89 (89–91) long, 21 (19–21) wide, distal 2/3 ω_1 widening, 21 (20–21) long, ε 5 (4–5), ω_2 7 (7–8), ω_3 23 (23–25), distance between *aa* and ω_1 about 16 (14–16), *aa* 24 (22–24) long, *ba* 28 (27–28), *wa* 50 (48–50), *ra* 28 (28–35), *la* 32 (24–32), *d* 31 (31–36), *e* 8 (7–8), *f* 15 (14–15), *s* 5 (5–6), *u* and *v* 4 (4–4.5), *p* and *q* 7 (7–7.5), empodium 15 (14–15), claw 14 (14–15). **Leg II**. 206 (200–206) long; femur II 50 (49–50), *vF* 60 (60–68); genu II 38 (38–40), σ 22 (18–22), *cG* 35 (35–36), *mG* 53 (50–53); tibia II 28 (28–30), φ 125 (120–125), *gT* 41 (41–43), *hT* 47 (47–49); tarsus II 88 (85–88) long, 19 (17–19) wide, ω slightly widening at apex, 22 (22–23) long, *ba* 28 (26–28), *wa* 44 (42–44), *ra* 31 (31–36), *la* 25 (23–25), *d* 34 (34–40), *e* 7 (6–7), *f* 16 (14–16), *s* 5 (5–6), *u* and *v* 4 (4–4.5), *p* and *q* 6 (6–7), empodium 14, claw 13 (12–13). **Leg III**. 225 (220–225) long; femur III 44 (43–44); genu III 34 (33–34), σ 23 (23–26), *nG* 62 (62–65); tibia III 29 (29–31), φ 139 (128–139), *kT* 59 (59–61); tarsus III 92 (92–95) long, 15 (13–15) wide, *w* setiform, 34 (34–35) long, *r* setiform, 32 (32–35) long, *d* 27 (26–27), *e* 6 (6–7), *f* 26 (24–26), *s* 5 (5–5.5), *u* 4, *v* 5 (5–6), *p* and *q* 3 (3–3.5), empodium 13 (12–13), claw 12 (11–12). **Leg IV**. 259 (259–262) long; femur IV 51 (49–51), *wF* 48 (48–52); genu IV 44 (44–47); tibia IV 35 (33–35), φ 123 (118–123), *kT* 54 (52–54); tarsus IV 106 (104–106) long, 15

(13–15) wide, *w* setiform, 37 (35–37) long, *r* setiform, 28 (27–28) long, *d* 34 (27–34), *e* 5 (5–6), *f* 29 (25–29), *s* 5 (5–6), *u* 4, *v* 5 (5–6), *p* and *q* 3 (3–3.5), empodium 15 (13–15), claw 12 (11–12).

Male (Fig. 63–67, Plates 17A, 20E, 22A, 26C, D, 30E, 31E, 33A)

Idiosoma. 378 (302–446) long, 233 (171–281) wide. Chelicera 75 (73–81) long, cheliceral seta *cha* conical, 4.5 (4–5) long, subcapitular setae *m* 29 (26–29), palpal supracoxal seta *elcp* 12 (8–12) long, dorsal palptibial seta 22 (19–22), lateral palptibial seta 13 (8–14), dorsal palptarsal seta 8 (8–10), palptarsal solenidion 3 (3–4). **Dorsum**. Prodorsal shield as in female, 67 (67–74) long, 77 (68–77) wide between *ve-ve*. Eyespots present. Grandjean's organ finger shaped, basally with 1–4 spiniform teeth, 14 (13–14) long, supracoxal seta *scx* widened in basal 1/3, with 11 (11–12) moderate or short pectinations, 28 (24–28) long. Ratios: *vi*: *ve* = 1.8 (1.8–2.3), *sci*: *sce* = 1.9 (1.7–1.9), *sci–sci*: *sci–sce* = 1.4 (1.2–1.4). Lengths of setae: *vi* 81 (81–104), *ve* 45 (44–46), *sci* 172 (172–190), *sce* 89 (89–105); distances: *vi–vi* 12 (9–12), *vi–ve* 33 (33–35), *sci–sci* 32 (26–32), *sci–sce* 23 (18–27). Hysterosomal setae d_1 about 2.0 (2.0–2.2)× length of c_1 and 1.9 (1.9–2.2)× length of d_2; d_2 about 1.0 (1.0–1.1)× length of c_1; lengths of setae: c_1 32 (30–40), c_2 191 (191–197), c_p 142 (141–151), c_3 35 (34–42), d_1 63 (63–87), d_2 34 (32–40), e_1 328 (301–328), e_2 213 (206–213), f_2 317 (291–317), h_1 325 (325–331), h_2 309 (281–309), h_3 232 (223–232); distances: c_1–c_1 95 (84–120), c_1–d_1 57 (40–63), d_1–d_1 37 (33–54), d_2–*gla* 49 (49–60), d_1–e_1 77 (64–90), e_1–e_1 81 (76–113). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 1.1 (0.8–1.1)× length of coxal plate II, 46 (33–46); *3a* 26 (23–26); *3b* 2.3 (2.3–2.7)× length of *3a*, 61 (52–63); *g* 21 (19–21), *4a* 83 (40–48). Aedeagus with two obvious curves, S-shaped, distal 1/3 reversely curved, tapering from base to tip, internal diameter linear, 18 (16–18) long; lateral arms supporting aedeagus turning outwards. Anal slit 67 (67–70) long, distance between anterior rim of anal slit and posterior margin of aedeagus 16 (16–22). Anal suckers about 19 (18–25) in diameter; anal discs 4 (4–4.5) in diameter, distances between right and left discs 27 (27–35). Pseudanal setae ps_1 about 1.7 (1.7–2.2)× length of ps_2, 181 (178–181) long, ps_2 7.4 (5.7–7.4)× length of ps_3, 104 (81–106) long, ps_3 14 (14–16); ps_2–ps_2 2.0 (1.9–2.1)× distance ps_1–ps_1, ps_1–ps_1 27 (24–29), ps_2–ps_2 55 (50–59).

Legs. **Leg I.** 181 (149–191) long; femur I 48 (40–50), *vF* simple, 43 (40–43) long; genu I 34 (30–38), σ' 41 (30–41), σ" 30 (22–30), Iσ': σ" = 1.4 (1.4–1.7), *cG* 33 (33–37), *mG* 43 (42–46); tibia I 28 (25–31), φ 103 (81–108), *gT* 33 (33–34), *hT* 38 (26–38); tarsus I 70 (65–78) long, 16 (26–25) wide, shape of ω_1 slightly clavate, 17 (15–17) long, ε 5 (4–5), ω_2 6 (6–8), ω_3 18 (18–22), distance between *aa* and ω_1 about 11 (10–11), *aa* 15 (15–17) long, *ba* 27 (25–27), *wa* 41 (41–43), *ra* 30 (24–30), *la* 21 (18–21), *d* 24 (24–37), *e* 6 (6–7), *f* 15 (14–17), *s* 5 (5–5.5), *u* and *v* 4 (4–4.5), *p* and *q* 6 (6–7), empodium 10 (10–15), claw 12 (11–14). **Leg II**. 161 (146–184) long; femur II 43 (36–47), *vF* 51 (51–54); genu II 33 (29–39), σ 20 (16–20), *cG* 32 (32–35), *mG* 41 (40–42); tibia II 25 (25–28), φ 102 (102–115), *gT* 34 (30–34), *hT* 37 (33–37); tarsus II 77 (65–77) long, 14 (14–22) wide, ω nearly cylindrical and slightly widened at apex, 18 (16–19) long, *ba* 20 (20–23), *wa* 39 (34–41), *ra* 30 (30–32), *la* 20 (19–22), *d* 31 (31–33), *e* 7 (6–7), *f* 14 (13–14), *s* 5 (5–5.5), *u* and *v* 4 (4–4.5), *p* and *q* 6 (5–6), empodium 12 (12–16), claw 12 (11–13). **Leg III**. 175 (158–201) long; femur III 34 (30–40); genu III 29 (27–32), σ 20 (8–20), *nG* 51 (43–55); tibia III 26 (26–28), φ 116 (116–119), *kT* 43 (43–48); tarsus III 73 (65–78) long, 11 (11–17) wide, *w* setiform, 34 (26–36) long, *r* setiform, 30 (24–30) long, *d* 25 (25–33), *e* 7 (6–7), *f* 24 (18–24), *s* 5 (5–6), *u* 4 (3–4), *v* 5 (5–6), *p* and *q* 2 (2–2.5), empodium 10 (10–14), claw 12 (10–12). **Leg IV**. 197 (179–214) long; femur IV 38 (38–43), *wF* 37 (37–39); genu IV 34 (32–40); tibia IV 29 (29–31), φ 109 (102–109), *kT* 40 (39–40); tarsus IV 80 (76–90) long, 12 (12–17) wide, *w* and *r* situated at level between suckers and close to distal sucker, *w* setiform, 28 (27–30) long, *r* setiform, 17 (17–20) long, distances between basal rim and proximal sucker *d* 23 (21–27), between *d* and *e* 19 (18–21), between *e* and *f* 24 (23–27), ratio (a+b): c = 1.8 (1.4–2.1), *f* 26 (18–29) long, *s* 5 (5–6), *u* 4 (3–4), *v* 5 (5–6), *p* and *q* 2 (2–3), empodium 10 (10–14), claw 12 (10–12).

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: WN. Australia, China (mainland, Taiwan), Ecuador, Germany, Japan, Netherlands, U.S.A.

BASED ON LITERATURE: Netherlands (Oudemans 1924a). Other previous records are doubtful because the concept of this species has been based on Robertson's revision in which *T. putrescentiae* is a complex of two species.

Material examined. Neotype and 60 other specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: banana, *Citrus aurantium*, garlic, *Gladiolus*, humus, hyacinth, muscari bulb, mushroom, *Narcissus* bulb, orange, orchids, palm seed, *Ranunculus* sp. bulb, tulip bulb.

ANIMAL OR ANIMAL PRODUCTS: burrows & nests of mutton birds (*Puffinus tenuirostris*), dead *Tinca tinca* (fish).

Remarks. The type of *T. putrescentiae* is a neotype male designated by Robertson (1959) in the Oudemans collection (RMNH) labeled "*Tyroglyphus putrescentiae* Schrank

1781, ♂ dors., No. 17, P6984, in humus, Hilversum 22 April 1902, Oudemans".

Examination of the type specimen suggests that Robertson's concept of *T. putrescentiae* (Schrank) is a mixture of two species. Her description is based on the neotype of *T. putrescentiae* whilst her figures are based on the specimens in BMNH labelled "*Tyrophagus putrescentiae* (Schrank), 6♂♂, 11♀♀, ex cheese, Sutton Bonington, Leics., 20/10/50, P.L.R. Coll. No. 160(b)" which is considered a different species here as *T. communis* **sp. n.** (distinguishing characters see remarks in *T. communis*).

Tyrophagus putrescentiae differs from *T. communis* in the 2/3 of posterior margin of coxal plates II being strongly concave and the solenidion ω_1 widened at distal 2/3.

Tyrophagus robertsonae Lynch, 1989

Fig. 68–77, Plates 2C, 5G, 7C, 11C, 14G, 15G, 17B, 20F, 22B, 26E, F, 30F, 31F, 33B

Tyrophagus robertsonae Lynch, 1989: 560.

Diagnosis. **Female**. Eyespots present, faint; *scx* slender, shaft slightly widening where pectinations begin, numbering 6–8 moderate or short; d_1 about 2.8 (2.8–2.9)× length of c_1 and 2.7 (2.7–3.1)× length of d_2; d_2 about 1.0 (0.9–1.0)× length of c_1; coxal plates I reaching to posterior apex of prosternal apodeme; coxal plates II broadly triangular, posterior margin slightly concave and not reaching apex of its apodeme. Spermathecal duct small, narrowing rapidly from copulatory opening for a distance about 0.8 (0.8–1.0)×distance between sclerites of oviducts, then forming a cylindrical tube and slightly expanding at base of spermathecal sac, about 5.0 (4.8–5.7)× distance between sclerites of oviducts, base of spermathecal sac very small. Tarsus I ω_1 strongly clavate; tarsus II ω slightly clavate; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 2.3 (2.2–2.3)× length of c_1 and 2.3 (2.2–2.3)× length of d_2; d_2 about 1.0× length of c_1; aedeagus very small, with one major curve, narrowing gradually from base to tip, its distal end straight or slightly reversely curved, internal diameter linear; lateral arms supporting aedeagus turning inwards or outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 2.4 (2.4–2.9).

Description. **Female** (Fig. 68–72, Plates 2C, 5G, 7C, 11C, 14G, 15G)

Idiosoma. 320 (320–379) long, 183 (183–194) wide. Chelicera 74 (74–78) long, cheliceral seta *cha* conical and distally bifurcate, 4 (4–5) long, subcapitular setae *m* 31 (31–40), palpal supracoxal seta *elcp* 10 (10–11) long, dorsal palptibial seta 20 (20–22), lateral palptibial seta 16 (16–18), dorsal palptarsal seta 11 (11–14), palptarsal solenidion 3 (2–3). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins slightly concave and posteriolateral margins straight or slightly convex; 64 (64–68) long, 74 (74–79) wide between *ve-ve*. Eyespots present, faint. Grandjean's organ finger-like, 15 (15–17) long, its basal lobe with 2–3 spiniform teeth. Supracoxal seta *scx* slender, slightly widened in basal half, with 6–8 moderate or short pectinations, 29 (29–34) long. Ratios: *vi*: *ve* = 1.8, *sci*: *sce* = 1.9, *sci–sci*: *sci–sce* = 1.5 (1.5–1.6). Lengths of setae: *vi* 66 (66–78), *ve* 37 (37–44), *sci* 164 (164–182), *sce* 86 (86–95); distances: *vi–vi* 11(11–13), *vi–ve* 32 (32–34), *sci–sci* 31 (31–37), *sci–sce* 21 (21–24). Hysterosomal setae d_1 about 2.8 (2.8–2.9)× length of c_1 and 2.7 (2.7–3.1)× length of d_2; d_2 about 1.0 (0.9–1.0)× length of c_1; lengths of setae: c_1 26 (26–32), c_2 221 (221–237), c_p 119 (119–123), c_3 26 (26–28), d_1 74 (74–92), d_2 27 (27–30), e_1 351 (351–372), e_2 243 (243–260), f_2 292 (292–234), h_1 372 (372–404), h_2 322 (322–389), h_3 237 (237–267); distances: c_1–c_1 70 (70–78), c_1–d_1 44 (44–48), d_1–d_1 26 (26–30), d_2–*gla* 40 (37–43), d_1–e_1 61 (61–70), e_1–e_1 60 (60–68). **Venter**. Coxal plates I reaching to posterior apex of prosternal apodeme; coxal plates II broadly triangular, posterior margin slightly concave and not reaching apex of its apodeme. Setae *1a* 1.0× length of coxal plate II, 39 (39–40), *3a* 22 (22–23); *3b* 2.3 (2.3–2.6)× length of *3a*, 51 (51–59) long; *g* 18 (18–20), *4a* 57 (57–64). Pseudanal setae ps_1 1.9 (1.7–1.9)× as long as ps_2, 167 (167–181) long, ps_2 4.5 (4.5–4.9)× length of ps_3, 90 (90–108) long, ps_3 20 (20–22). Adanal setae ad_1 27 (27–29), ad_2 20 (19–20), ad_3 14 (14–16). Copulatory opening 4 (4–6) in diameter, spermathecal duct short, narrowing rapidly from copulatory opening for a distance about 0.8 (0.8–1.0)× diameter of copulatory opening, then forming a cylindrical tube and slightly expanding at base of spermathecal sac, about 5.0 (4.8–5.7)× distance between sclerites of oviducts, base of spermathecal sac very small, distance between sclerites of oviducts 5 (4–8).

Legs. **Leg I.** 165 (165–182) long; femur I 40 (40–43), *vF* simple, 36 (36–40) long; genu I 30 (30–31), σ' 19 (19–20), σ" 15 (15–18), Iσ': σ" = 1.3 (1.1–1.3), *cG* 30 (30–33), *mG* 39 (39–42); tibia I 23 (23–26), φ 102 (102–111), *gT* 36 (36–40), *hT* 40 (38–44); tarsus I 66 (66–75) long, 20 (19–22) wide, ω_1 strongly clavate, 15 (15–17) long, ε 5 (4–5), ω_2 6 (6–8), ω_3 23 (23–28), distance between *aa* and ω_1 about 10 (10–13), *aa* 20 (20–28) long, *ba* 28 (27–30), *wa* 40 (40–45), *ra* 28 (28–31), *la* 20 (20–23), *d* 29 (29–33), *e* 5 (5–7), *f* 14 (14–17), *s* 5 (5–5.5), *u* and *v* 5 (5–5.5), *p* and *q* 6 (6–7), empodium 13 (13–15), claw 13 (13–15). **Leg II**. 155 (155–161) long; femur II 40 (40–43), *vF* 46 (46–50); genu II 31 (31–34), σ 17 (17–19), *cG* 27 (27–30), *mG* 40 (40–44); tibia II 21 (21–23), φ 100 (100–105), *gT* 28 (28–31), *hT* 32 (32–34); tarsus II 62 (62–68) long, 20

(18–20) wide, ω clavate, 16 (16–17) long, *ba* 22 (22–23), *wa* 36 (36–38), *ra* 27 (27–28), *la* 17 (17–20), *d* 28 (28–31), *e* 6 (6–7), *f* 16 (16–19), *s* 5 (5–5.5), *u* and *v* 5 (5–5.5), *p* and *q* 6 (6–7), empodium 13 (13–14), claw 12 (12–15). **Leg III**. 158 (158–162) long; femur III 33 (33–35); genu III 24 (24–26), σ 12 (12–14), *nG* 39 (39–41); tibia III 22 (22–24), φ 118 (118–121), *kT* 42 (42–46); tarsus III 66 (66–70) long, 15 (15–17) wide, *w* setiform, 29 (29–33) long, *r* setiform, 27 (27–29) long, *d* 26 (26–30), *e* 5 (5–6), *f* 20 (20–21), *s* 6 (5–6), *u* 4 (4–5), *v* 6 (6–7), *p* and *q* 3 (3–3.5), empodium 13(13–15), claw 12 (12–14). **Leg IV**. 182 (182–191) long; femur IV 35 (35–38), *wF* 36 (36–40); genu IV 33 (33–36); tibia IV 24 (24–27), φ 96 (96–101), *kT* 36 (36–40); tarsus IV 76 (76–80) long, 17 (17–18) wide, *w* setiform, 30 (30–33) long, *r* setiform, 24 (24–26) long, *d* 26 (26–28), *e* 5 (5–6), *f* 23 (19–23), *s* 5 (5–6), *u* 4 (4–4.5), *v* 5 (5–6), *p* and *q* 3 (3–3.5), empodium 13 (13–15), claw 12 (12–13).

Male (Fig. 73–77, Plates 17B, 20F, 22B, 26E, F, 30F, 31F, 33B)

Idiosoma. 267 (267–286) long, 166 (166–182) wide. Chelicera 55 (55–57) long, cheliceral seta *cha* conical, 3.5 (3–3.5) long, subcapitular setae *m* 22 (22–26), palpal supracoxal seta *elcp* 7 (7–9) long dorsal palptibial seta 16 (16–18), lateral palptibial seta 10 (10–12), dorsal palptarsal seta 8 (8–10), palptarsal solenidion 2 (2–3). **Dorsum**. Prodorsal shield as in female, 50 (50–54) long, 57 (57–61) wide between *ve*-*ve*. Eyespots present. Grandjean's organ as in female, 12 (10–12) long, supracoxal seta with 5–6 pectinations, 21 (21–24) long. Ratios: *vi*: *ve* = 1.8 (1.8–1.9), *sci*: *sce* = 1.8 (1.6–1.8), *sci–sci*: *sci–sce* = 1.4 (1.3–1.4). Lengths of setae: *vi* 53 (53–62), *ve* 30 (30–33), *sci* 119 (119–125), *sce* 68 (68–76); distances: *vi–vi* 9 (9–10), *vi–ve* 24 (24–26), *sci–sci* 23 (23–26), *sci–sce* 17 (17–20). Hysterosomal setae d_1 about 2.3 (2.2–2.3)× length of c_1 and 2.3 (2.2–2.3)× length of d_2; d_2 about 1.0× length of c_1; lengths of setae: c_1 19 (19–23), c_2 168 (168–177), c_p 105 (105–119), c_3 20 (20–22), d_1 43 (43–51), d_2 19 (19–23), e_1 202 (202–221), e_2 167 (167–170), f_2 231 (231–254), h_1 271 (271–277), h_2 258 (258–271), h_3 180 (180–188); distances: c_1–c_1 63 (63–66), c_1–d_1 38 (38–40), d_1–d_1 24 (24–27), d_2–*gla* 37 (37–39), d_1–e_1 42 (42–48), e_1–e_1 58 (58–60). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 0.8 (0.8–0.9)× length of coxal plate II, 23 (23–26) long; *3a* 13 (13–14); *3b* 2.2 (2.2–2.5)× length of *3a*, 28 (28–35) long; *g* 15 (13–15), *4a* 26 (26–30). Aedeagus very small, 12 (12–13) long, with one major curve, narrowing gradually from base to tip, its distal end straight or slightly reversely curved, internal diameter linear; lateral arms supporting aedeagus turning inwards but maybe outwards in some specimens. Anal slit 48 (48–51) long, distance between anterior rim of anal slit and posterior margin of aedeagus 12 (10–12). Anal suckers about 16 (11–16) in diameter; anal discs 3 (3–4) in diameter, distances between right and left discs 19 (19–21). Pseudanal setae ps_1 about 2.3 (2.0–2.3)× length of ps_2, 115 (115–122) long, ps_2 4.5 (4.5–4.7)× length of ps_3, 50 (50–61) long, ps_3 11 (11–13); ps_2–ps_2 2.1 (2.0–2.1)× distance ps_1–ps_1, ps_1–ps_1 17 (16–17), ps_2–ps_2 35 (35–37).

Legs. **Leg I.** 128 (128–137) long; femur I 33 (33–36), *vF* simple, 29 (29–32) long; genu I 24 (24–27), σ' 20 (20–24), σ" 23 (23–24), Iσ': σ" = 0.9 (0.9–1.0), *cG* 24 (24–27), *mG* 27 (27–30); tibia I 19 (19–21), φ 84 (84–97), *gT* 16 (16–20), *hT* 16 (16–22); tarsus I 52 (52–55) long, 16 (16–18) wide, $ω_1$ strongly clavate, 13 (13–14) long, ε 4 (3–4), $ω_2$ 5 (5–6), $ω_3$ 16 (16–18), distance between *aa* and $ω_1$ about 8 (8–10), *aa* 16 (16–18) long, *ba* 16 (16–19), *wa* 24 (24–26), *ra* 21 (21–24), *la* 16 (16–18), *d* 23 (23–26), *e* 6 (5–6), *f* 12 (12–14), *s* 4 (4–4.5), *u* and *v* 4 (4–4.5), *p* and *q* 6 (6–7), empodium 11 (11–13), claw 11 (11–12). **Leg II**. 124 (124–133) long; femur II 31 (31–33), *vF* 37 (37–41); genu II 24 (24–25), σ 14 (14–16), *cG* 17 (17–19), *mG* 21 (21–26); tibia II 17 (17–20), φ 79 (79–85), *gT* 14 (14–16), *hT* 18 (18–20); tarsus II 50 (50–56) long, 16 (16–17) wide, ω clavate, 14 (14–15) long, *ba* 17 (17–19), *wa* 27 (27–29), *ra* 17 (17–20), *la* 12 (12–16), *d* 19 (19–21), *e* 6 (5–6), *f* 8 (8–10), *s* 4 (4–4.5), *u* and *v* 4 (4–5), *p* and *q* 6 (6–7), empodium 11 (11–13), claw 11 (11–13). **Leg III**. 129 (129–135) long; femur III 25 (25–28); genu III 20 (20–22), σ 8 (8–10), *nG* 29 (29–32); tibia III 18 (18–20), φ 95 (95–102), *kT* 21 (21–25); tarsus III 50 (50–55) long, 12 (12–14) wide, *w* setiform, 19 (19–22) long, *r* setiform, 18 (17–18) long, *d* 17 (17–19), *e* 5 (5–5.5), *f* 15 (15–17), *s* 5 (5–5.5), *u* 4 (3–4), *v* 5 (5–6), *p* and *q* 2 (2–2.5), empodium 11 (11–13), claw 10 (10–12). **Leg IV**. 143 (143–158) long; femur IV 25 (25–29), *wF* 27 (27–30); genu IV 25 (25–28); tibia IV 20 (20–23), φ 80 (80–89), *kT* 20 (20–24); tarsus IV 59 (59–66) long, 13 (13–16) wide, *w* and *r* situated at level between suckers, *w* setiform, 26 (26–28) long, *r* setiform, 19 (19–22) long, distances between basal rim of tarsus IV and proximal sucker *d* 20 (20–25), between *d* and *e* 13 (13–18), between *e* and *f* 14 (14–15), ratio (a+b): c = 2.4 (2.4–2.9), *f* 17 (17–19) long, *s* 5 (5–5.5), *u* 4 (3–4), *v* 5 (5–5.5), *p* and *q* 3 (2–3), empodium 11 (11–13), claw 11 (10–11).

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: MC. Thailand.
BASED ON LITERATURE: U.S.A. (Lynch 1989).

Material examined. Holotype, 11 paratypes and 34 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. Soil, lab culture, mangosteen, onions.

Remarks. *Tyrophagus robertsonae* is similar to *T. javensis*

(Oudemans, 1916) in having a short cylindrical spermathecal duct and a small base to the spermathecal sac in female (Fig. 70, 122) and a small aedeagus in male (Fig. 75, 126). It differs from the latter in the *scx* being tapering (Fig. 70) rather than widened at bases of pectinations (Fig. 121) and seta *r* of tarsus IV being setiform (Fig. 72, 77) rather than spiniform (Fig. 123, 128). Thus, morphologically, these two species are very close.

Tyrophagus savasi Lynch, 1989

Fig. 78–87, Plates 2D, 5H, 7D, 11D, 14H, 15H, 17C, 20G, 22C, 27A, B, 30G, 31G, 33C

Tyrophagus savasi Lynch, 1989: 548.

Diagnosis. **Female**. Eyespots present; *scx* widened in basal 2/3, with 8–12 long or short pectinations; d_1 about 2.4 (2.2–2.5)× length of c_1 and 2.8 (2.7–2.9)× length of d_2; d_2 about 0.9 (0.8–0.9)× length of c_1; coxal plates I reaching to posterior apex of prosternal apodeme; coxal plates II triangular, not extending to apex of apodeme II, with posterior margin nearly straight. Spermathecal duct narrowing rapidly from copulatory opening for a distance about 0.8 (0.5–0.8)×distance between sclerites of oviducts, then forming a cylindrical tube and narrowing at base of spermathecal sac, about 1.7 (1.6–1.8)× distance between sclerites of oviducts, base of spermathecal sac bending forwards, funnel-shaped. Tarsus I ω_1 moderate, mostly cylindrical; tarsus II ω nearly cylindrical; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 3.1 (3.1–3.2)× length of c_1 and 2.6 (2.6–2.7)× length of d_2; d_2 about 1.2 (1.2–1.3)× length of c_1; aedeagus with one major curve, narrowing gradually in basal half, its distal end straight or slightly reversely curved, internal diameter linear, lateral arms supporting aedeagus turning outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 1.8.

Description. **Female** (Fig. 78–82, Plates 2D, 5H, 7D, 11D, 14H, 15H)

Idiosoma. 459 (448–509) long, 292 (256–292) wide. Chelicera 108 (101–108) long, cheliceral seta *cha* conical, 8 (7–8) long, subcapitular setae *m* 45 (45–51), palpal supracoxal seta *elcp* 14 (12–14) long, dorsal palptibial seta 32 (28–32), lateral palptibial seta 24 (22–24), dorsal palptarsal seta 19 (19–21), palptarsal solenidion 5 (5–5.5). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins slightly concave and with a small medial lobe; 102 (98–102) long, 107 (102–107) wide between *ve-ve*. Eyespots present. Grandjean's organ finger-like, 19 (17–19) long, its basal lobe with 3–4 spiniform teeth. Supracoxal seta *scx* widened in basal 2/3, with 8–12 long pectinations, 41 (37–41) long. Ratios: *vi*: *ve* = 2.5 (2.1–2.5), *sci*: *sce* = 1.7 (1.6–1.7), *sci–sci*: *sci–sce* = 1.3 (1.2–1.4). Lengths of setae: *vi* 119 (93–119), *ve* 47 (43–54), *sci* 219 (184–224), *sce* 132 (111–142); distances: *vi–vi* 15 (13–15), *vi–ve* 46 (44–47), *sci–sci* 47 (44–47), *sci–sce* 35 (34–35). Hysterosomal setae d_1 about 2.4 (2.2–2.5)× length of c_1 and 2.8 (2.7–2.9)× length of d_2; d_2 about 0.9 (0.8–0.9)× length of c_1; lengths of setae: c_1 56 (45–59), c_2 252 (224–257), c_p 202 (197–212), c_3 53 (48–55), d_1 133 (113–133), d_2 48 (39–49), e_1 362 (347–371), e_2 248 (239–251), f_2 424 (399–441), h_1 438 (405–444), h_2 436 (408–437), h_3 306 (267–312); distances: c_1–c_1 122 (114–124), c_1–d_1 64 (61–66), d_1–d_1 45 (42–47), d_2–*gla* 61 (57–66), d_1–e_1 100 (89–105), e_1–e_1 111 (99–114). **Venter**. Coxal plates I reaching to posterior apex of prosternal apodeme; coxal plates II triangular, not extending posteriorly beyond apex of apodeme II, with posterior margin nearly straight. Setae *1a* 1.1× length of coxal plate II, 69 (69–71), *3a* 33 (28–33); *3b* 2.9 (2.8–2.9)× length of *3a*, 96 (88–101) long; *g* 31 (29–33), *4a* 125 (111–127). Pseudanal setae ps_1 1.6 (1.4–1.6)× as long as ps_2, 293 (279–302) long, ps_2 5.6 (5.6–6.4)× length of ps_3, 178 (164–212) long, ps_3 32 (29–33). Adanal setae ad_1 20 (19–22), ad_2 23 (19–23), ad_3 19 (16–21). Copulatory opening 12 (9–12) in diameter, spermathecal duct narrowing rapidly from copulatory opening for a distance about 0.8 (0.5–0.6)× between sclerites of oviducts, then forming a cylindrical tube and narrowing at base of spermathecal sac, about 1.7 (1.6–1.8)× distance between sclerites of oviducts, base of spermathecal sac bending forwards, funnel-shaped, distance between sclerites of oviducts 27 (25–28).

Legs. **Leg I.** 252 (244–256) long; femur I 59 (56–61), *vF* simple, 56 (54–61) long; genu I 44 (42–45), σ' 51 (48–52), σ" 38 (37–39), Iσ': σ" = 1.3 (1.2–1.3), *cG* 53 (49–55), *mG* 57 (50–57); tibia I 35 (33–36), φ 142 (132–155), *gT* 45 (39–47), *hT* 51 (49–54); tarsus I 97 (84–101) long, 25 (22–25) wide, ω_1 moderate, mostly cylindrical, 16 (15–17) long, ε 5 (4–5), ω_2 8 (7–9), ω_3 28 (27–31), distance between *aa* and ω_1 about 15 (12–15), *aa* 28 (26–29) long, *ba* 29 (27–29), *wa* 46 (44–51), *ra* 41 (40–42), *la* 29 (27–31), *d* 57 (48–59), *e* 8 (7–8), *f* 23 (20–27), *s* 7 (6.5–7), *u* and *v* 6 (5.5–6), *p* and *q* 8 (7–8), empodium 17 (15–17), claw 16 (14–17). **Leg II**. 239 (222–241) long; femur II 59 (52–61), *vF* 70 (67–71); genu II 45 (43–46), σ 30 (28–33), *cG* 43 (42–45), *mG* 58 (55–61); tibia II 32 (31–33), φ 149 (121–154), *gT* 37 (34–39), *hT* 51 (50–55); tarsus II 85 (79–88) long, 22 (20–22) wide, ω moderate, mostly cylindrical, 20 (19–21) long, *ba* 29 (25–30), *wa* 43 (39–45), *ra* 37 (36–38), *la* 25 (24–26), *d* 50 (39–51), *e* 8 (7–8), *f* 24 (23–29), *s* 6 (6–6.5), *u* and *v* 6 (5.5–6), *p* and *q* 7 (7–8), empodium 13, claw 15 (14–17). **Leg III**. 242 (222–244) long; femur III 51 (49–53); genu III 41 (37–41), σ 18 (17–22), *nG* 66 (59–68); tibia III 34 (33–36), φ 167 (154–

172), *kT* 65 (58–68); tarsus III 95 (94–101) long, 18 (17–20) wide, *w* setiform, 40 (39–44) long, *r* setiform, 37 (34–39) long, *d* 41 (39–42), *e* 7 (6–7), *f* 37 (34–41), *s* 6 (6–7), *u* 5 (5–6), *v* 7 (6–7), *p* and *q* 4 (3–4), empodium 14 (13–16), claw 13 (13–15). **Leg IV**. 279 (266–281) long; femur IV 61 (58–63), *wF* 53 (52–60); genu IV 46 (45–46); tibia IV 41 (37–44), φ 116 (98–121), *kT* 61 (56–64); tarsus IV 110 (97–112) long, 19 (17–20) wide, *w* setiform, 46 (42–47) long, *r* setiform, 42 (38–42) long, *d* 53 (51–53), *e* 7 (6–7), *f* 32 (31–34), *s* 6 (6–7), *u* 5 (4.5–5), *v* 6 (6–7), *p* and *q* 3.5 (3–4), empodium 13, claw 13 (13–15).

Male (Fig. 83–87, Plates 17C, 20G, 22C, 27A, B, 30G, 31G, 33C)

Idiosoma. 402 (385–437) long, 247 (204–247) wide. Chelicera 95 (89–96) long, cheliceral seta *cha* conical, 6 (5–6) long, subcapitular setae *m* 43 (41–50), palpal supracoxal seta *elcp* 12 (12–13) long dorsal palptibial seta 26 (23–27), lateral palptibial seta 17 (16–20), dorsal palptarsal seta 15 (15–18), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield as in female, 75 (69–77) long, 97 (95–101) wide between *ve-ve*. Eyespots present. Grandjean's organ as in female, 14 (12–14) long, supracoxal seta with 8–12 pectinations, 27 (23–29) long. Ratios: *vi*: *ve* = 1.7 (1.6–1.9), *sci*: *sce* = 1.9 (1.7–2.2), *sci–sci*: *sci–sce* = 1.0 (1.0–1.1). Lengths of setae: *vi* 95 (89–105), *ve* 57 (54–61), *sci* 205 (189–214), *sce* 108 (99–115); distances: *vi–vi* 16 (14–16), *vi–ve* 41 (38–42), *sci–sci* 35 (34–37), *sci–sce* 35 (32–36). Hysterosomal setae d_1 about 3.1 (3.1–3.2)× length of c_1 and 2.6 (2.6–2.7)× length of d_2; d_2 about 1.2 (1.2–1.3)× length of c_1; lengths of setae: c_1 35 (33–36), c_2 218 (198–234), c_p 171 (164–185), c_3 45 (43–50), d_1 110 (104–121), d_2 43 (39–46), e_1 333 (308–346), e_2 217 (210–237), f_2 365 (337–374), h_1 373 (332–381), h_2 400 (384–410), h_3 290 (278–304); distances: c_1–c_1 92 (90–101), c_1–d_1 40 (39–43), d_1–d_1 35 (34–37), d_2–*gla* 65 (59–66), d_1–e_1 82 (78–82), e_1–e_1 102 (97–109). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 1.2 (1.1–1.2)× length of coxal plate II, 54 (50–58) long; *3a* 26 (25–27); *3b* 3.2 (3.2–3.5)× length of *3a*, 82 (81–96) long; *g* 26 (24–26), *4a* 97 (96–102). Aedeagus with one major curve, narrowing gradually in basal half, its distal end straight or slightly reversely curved, internal diameter linear, 26 (25–26) long; lateral arms supporting aedeagus turning outwards. Anal slit 75 (73–76) long, distance between anterior rim of anal slit and posterior margin of aedeagus 20 (18–22). Anal suckers about 31 (26–32) in diameter; anal discs 5 (4–6) in diameter, distances between right and left discs 40 (38–41). Pseudanal setae ps_1 about 1.5 (1.4–1.5)× length of ps_2, 221 (219–228) long, ps_2 9.5 (8.7–9.5)× length of ps_3, 143 (130–151) long, ps_3 15 (14–16); ps_2–ps_2 1.8 (1.7–1.8)× distance ps_1–ps_1, ps_1–ps_1 30 (30–33), ps_2–ps_2 55 (54–57).

Legs. **Leg I.** 203 (197–210) long; femur I 52 (49–53), *vF* simple, 49 (47–55) long; genu I 40 (39–41), σ' 35(35–38), σ" 31 (30–31), Iσ': σ" = 1.1 (1.1–1.2), *cG* 37 (35–39), *mG* 53 (50–53); tibia I 30 (30–31), φ 114 (102–116), *gT* 34 (33–38), *hT* 46 (43–46); tarsus I 76 (74–80) long, 23 (22–24) wide, ω_1 nearly cylindrical, 16 (15–16) long, ε 3 (3–4), ω_2 8 (6–8), ω_3 25 (22–27), distance between *aa* and ω_1 about 12 (10–13), *aa* 25 (25–27) long, *ba* 30 (28–32), *wa* 45 (43–46), *ra* 33 (33–35), *la* 25 (24–26), *d* 49 (45–49), *e* 7 (7–8), *f* 19 (17–21), *s* 6 (6–6.5), *u* and *v* 5 (5–5.5), *p* and *q* 8 (7–8), empodium 15 (14–16), claw 13 (12–14). **Leg II**. 195 (189–200) long; femur II 50 (48–53), *vF* 59 (54–61); genu II 40 (38–42), σ 26 (25–28), *cG* 36 (36–38), *mG* 45 (44–47); tibia II 30 (29–30), φ 120 (102–121), *gT* 40 (37–40), *hT* 35 (33–36); tarsus II 75 (75–80) long, 22 (20–22) wide, ω cylindrical, 17 (16–18) long, *ba* 26 (26–27), *wa* 45 (44–47), *ra* 37 (37–38), *la* 22 (20–23), *d* 46 (45–46), *e* 7 (6–7), *f* 20 (19–22), *s* 6 (6–6.5), *u* and *v* 5 (5–6), *p* and *q* 8 (7–8), empodium 14 (13–16), claw 16 (14–17). **Leg III**. 212 (204–220) long; femur III 40 (38–45); genu III 35 (33–37), σ 20 (19–22), *nG* 55 (52–57); tibia III 30 (29–33), φ 121 (108–122), *kT* 52 (50–53); tarsus III 80 (78–87) long, 16 (16–17) wide, *w* setiform, 36 (36–41) long, *r* 35 (34–39) long, *d* 43 (40–44), *e* 6 (6–6.5), *f* 29 (24–29), *s* 6 (6–6.5), *u* 4 (4–4.5), *v* 6 (5.5–6), *p* and *q* 3 (3–4), empodium 13 (13–15), claw 13 (13–15). **Leg IV**. 231 (228–233) long; femur IV 49 (45–49), *wF* 44 (43–50); genu IV 40 (39–42); tibia IV 35 (34–37), φ 107 (101–109), *kT* 48 (43–48); tarsus IV 85 (84–89) long, 17 (16–17) wide, *w* and *r* situated slightly anterior to or at level of distal sucker, *w* setiform, 42 (41–44) long, *r* setiform, 25 (25–27) long, distances between basal rim of tarsus IV and proximal sucker *d* 24 (23–25), between *d* and *e* 23 (22–23), between *e* and *f* 26 (25–27), ratio (a+b): c = 1.8, *f* 36 (33–37) long, *s* 6 (6–6.5), *u* 4 (4–5), *v* 6 (6–6.5), *p* and *q* 3 (3–4), empodium 13 (12–13), claw 12 (11–13).

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: TK, WN / DN. U.K.

BASED ON LITERATURE: U.K. (Lynch 1989).

Material examined. Holotype, 8 paratypes, and 26 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: *Coprosma lucida*, *Narcissus* bulbs.

ANIMAL OR ANIMAL PRODUCTS: honeybee, cheese.

Remarks. *Tyrophagus savasi* is very similar to *T. neiswanderi* Johnston & Bruce in structure of spermathecal duct and *scx* (Fig. 50, 80), base of spermathecal sac being funnel-shaped in female. It differs from the latter in ω_1 of tarsus I and ω of tarsus II being stout (Fig. 86) rather than slender (Fig. 51) and aedeagus of male being long (Fig. 85) rather than short (Fig. 55).

Tyrophagus similis Volgin, 1949

Fig. 88–98, Plates 3A, 5I, 8A, 12A, 14I, 15I, 17D, 20H, 22D, 27C, 30H, 31H, 33D

Tyrophagus similis Volgin, 1949: 387; Samšiòák, 1962: 274; Hughes, 1976: 64; Fain, 1977: 561; Nakao & Kurosa, 1988: 136.

Tyrophagus oudemansi Robertson, 1959: 167; synonymy by Samšiòák, 1962: 274.

Tyrophagus dimidiatus (Hermann, 1804); Hughes, 1961: 45.

Diagnosis. **Female**. Eyespots absent; *scx* slender, tapering from base to tip, with 12–16 short pectinations; setae c_1, d_1 and d_2 micro-setae, obviously very much shorter than others; d_1 about 1.0 (1.0–1.2)× length of c_1 and 1.4 (1.1–1.4)× length of d_2, d_2 about 0.8 (0.8–1.2)× length of c_1; coxal plates I not reaching to posterior apex of prosternal apodeme; coxal plates II not extending posteriorly beyond apex of apodeme II, with posterior margin sinuous and distal 1/3 becoming concave and narrow. Spermathecal duct broad, widening gradually from copulatory opening to base of spermathecal sac, about 1.4 (1.4–1.6)× distance between sclerites of oviducts, base of spermathecal sac broadly round, bending backwards. Tarsus I ω_1 stout and obviously widened at apex, tarsus II ω strong and widened at apex; setae *w* and *r* of tarsus IV spiniform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 1.0 (1.0–1.3)× length of c_1 and 1.1 (0.6–1.2)× length of d_2; d_2 about 0.9 (0.9–1.2)× length of c_1; aedeagus with one major curve, narrowing gradually in basal half and almost cylindrical in distal half, distal end truncated, internal diameter tapering rapidly from distal end to midlength; lateral arms supporting aedeagus turning inwards; setae *w* and *r* of tarsus IV spiniform, situated anteriorad of or close to distal sucker, ratio (a+b): c = 0.8 (0.8–1.1).

Description. **Female** (Fig. 88–92, Plates 3A, 5I, 8A, 12A, 14I, 15I)

Idiosoma. 522 (522–577) long, 324 (324–397) wide. Chelicera 105 (105–116) long, cheliceral seta *cha* conical, 8 (8–9) long, subcapitular setae *m* 42 (42–45), palpal supracoxal seta *elcp* 11 (11–13) long, dorsal palptibial seta 24 (24–28), lateral palptibial seta 18 (18–23), dorsal palptarsal seta 13 (13–19), palptarsal solenidion 6 (5–6). **Dorsum**. Prodorsal shield obviously punctate, nearly rectangular in shape, lateral margin slightly concave, posterior margin broadly round; 83 (83–97) long, 101 (101–118) wide between *ve-ve*. Eyespots absent. Grandjean's organ finger-like, 25 (25–26) long, its basal lobe with 3 obvious spiniform teeth. Supracoxal seta *scx* slender, tapering from base to tip, with 12–16 short pectinations, 48 (43–53) long. Ratios: *vi*: *ve* = 1.6 (1.6–1.8), *sci*: *sce* = 1.9 (1.6–1.9), *sci–sci*: *sci–sce* = 1.7 (1.4–1.7). Lengths of setae: *vi* 91 (91–111), *ve* 58 (58–63), *sci* 218 (218–225), *sce* 112 (112–138); distances: *vi–vi* 13 (13–17), *vi–ve* 42 (42–52), *sci–sci* 42 (42–50), *sci–sce* 25 (25–36). Hysterosomal setae c_1, c_3, d_1 and d_2 minute, obviously shorter than others; d_1 about 1.0 (1.0–1.2)× length of c_1 and 1.4 (1.1–1.4)× length of d_2; d_2 about 0.8 (0.8–1.2)× length of c_1; lengths of setae: c_1 29 (25–30), c_2 199 (199–202), c_p 145 (145–151), c_3 33 (33–38), d_1 30 (30–37), d_2 22 (22–36), e_1 279 (255–279), e_2 205 (183–205), f_2 383 (328–383), h_1 366 (276–366), h_2 394 (365–394), h_3 271 (266–271); distances: c_1–c_1 142 (142–153), c_1–d_1 72 (71–72), d_1–d_1 79 (79–92), d_2–*gla* 60 (33–63), d_1–e_1 79 (79–93), e_1–e_1 159 (159–174). **Venter**. Coxal plates I not reaching to posterior apex of prosternal apodeme; coxal plates II not extending posteriorly beyond apex of apodeme II, with posterior margin sinuous and distal 1/3 becoming concave and narrow. Setae *1a* 0.6 (0.6–0.7)× length of coxal plate II, 35 (35–41) long, *3a* 22 (22–30); *3b* 1.7 (1.5–1.7)× length of *3a*, 37 (37–44) long; *g* 20 (20–25), *4a* 51 (50–51). Pseudanal setae ps_1 3.3 (2.0–3.3)× as long as ps_2, 173 (173–246) long, ps_2 2.2 (2.2–4.5)× length of ps_3, 53 (53–121) long, ps_3 24 (24–27). Adanal setae ad_1 17 (17–23), ad_2 18 (18–20), ad_3 18 (18–20). Copulatory opening 14 (13–14) in diameter, spermathecal duct broad, widening gradually from copulatory opening to base of spermathecal sac, about 1.4 (1.4–1.6)× distance between sclerites of oviducts, base of spermathecal sac broadly round, bending backwards, distance between sclerites of oviducts 37 (37–43).

Legs. **Leg I.** 235 (235–248) long; femur I 64 (64–70), *vF* simple, 50 (50–53) long; genu I 41 (41–42), σ' 67 (57–72), σ" 38 (30–38), Iσ': σ" = 1.8 (1.8–2.0), *cG* 36 (36–50), *mG* 50 (50–61); tibia I 33 (33–35), φ 131 (131–139), *gT* 34 (34–40), *hT* 38 (38–47); tarsus I 98 (98–101) long, 31 (29–31) wide, ω_1 stout and obviously widened at apex, 20 (20–23) long, ε 5 (2–5), ω_2 11 (11–13), ω_3 34 (33–34), distance between *aa* and ω_1 about 14 (11–14), *aa* 28 (28–30) long, *ba* 35 (34–35), *wa* 62 (60–62), *ra* 45 (44–45), *la* 30 (29–30), *d* 42 (42–43), *e* 10 (10–11), *f* 17 (17–19), *s* 8 (8–10), *u* and *v* 8 (8–12), *p* and *q* 10 (10–12), empodium 20 (19–22), claw 19 (19–21). **Leg II**. 219 (219–233) long; femur II 60 (60–63), *vF* 65 (65–71); genu II 34 (34–38), σ 30 (28–30), *cG* 30 (30–43), *mG* 45 (45–59); tibia II 34 (34–36), φ 138 (138–147), *gT* 26 (26–34), *hT* 36 (36–43); tarsus II 90 (90–96) long, 28 (23–28) wide, ω strong and widened at apex, 23 (23–26) long, *ba* 33 (33–34), *wa* 53 (53–65), *ra* 42 (42–48), *la* 23 (23–28), *d* 37 (37–43), *e* 10 (10–11), *f* 18 (18–24), *s* 9 (8–9), *u* and *v* 9 (8–9), *p* and *q* 10 (7–10), empodium 19 (18–19), claw 18 (18–20). **Leg III**. 207 (207–233) long; femur III 43 (43–50); genu III 34 (34–40), σ 23 (23–24), *nG* 52 (52–58); tibia III 32 (32–34), φ 138 (136–138), *kT* 44 (44–50); tarsus III 97 (97–

109) long, 21 (20–21) wide, *w* spiniform, 37 (37–43) long, *r* setiform, 36 (36–40) long, *d* 28 (28–29), *e* 8 (8–9), *f* 27 (26–27), *s* 8 (7–8), *u* and *v* 7 (7–8), *p* and *q* 5 (5–5.5), empodium 17 (17–19), claw 16 (16–21). **Leg IV**. 238 (238–278) long; femur IV 50 (50–57), *wF* 44 (44–53); genu IV 45 (45–53); tibia IV 35 (35–41), φ 109 (109–112), *kT* 42 (42–53); tarsus IV 113 (113–127) long, 22 (18–22) wide, *w* spiniform, 36 (36–48) long, *r* spiniform, 24 (24–31) long, *d* 34 (34–36), *e* 9 (9–10), *f* 35 (33–35), *s* 7.5 (7.5–8), *u* 7.5, *v* 8, *p* and *q* 4 (4–4.5), empodium 17 (17–18), claw 17 (17–20).

Male (Fig. 93–97, Plates 17D, 20H, 22D, 27C, 30H, 31H, 33D)

Idiosoma. 526 (502–526) long, 372 (341–372) wide. Chelicera 112 (96–112) long, cheliceral seta *cha* conical, 10 (9–10) long, subcapitular setae *m* 46 (39–46), palpal supracoxal seta *elcp* 11 (11–12) long, dorsal palptibial seta 24 (24–25), lateral palptibial seta 18 (17–18), dorsal palptarsal seta 13 (13–16), palptarsal solenidion 5 (5–6). **Dorsum**. Prodorsal shield laterally concave and posteriorly convex, 92 (84–92) long, 113 (105–113) wide between *ve-ve*. Eyespots absent. Grandjean's organ as in female, 19 (17–19) long; supracoxal seta slender as in female, with 12–18 short pectinations, 47 (40–47) long. Ratios: *vi*: *ve* = 1.7 (1.7–1.9), *sci*: *sce* = 1.8 (1.7–1.8), *sci–sci*: *sci–sce* = 1.5 (1.5–1.8). Lengths of setae: *vi* 108 (86–108), *ve* 63 (46–63), *sci* 245 (193–245), *sce* 135 (113–135); distances: *vi–vi* 18 (14–18), *vi–ve* 48 (43–48), *sci–sci* 45 (43–45), *sci–sce* 30 (25–30). Hysterosomal setae d_1 about 1.0 (1.0–1.3)× length of c_1 and 1.1 (0.6–1.2)× length of d_2; d_2 about 0.9 (0.9–1.2)× length of c_1; lengths of setae: c_1 30 (18–30), c_2 241 (208–241), c_p 178 (130–178), c_3 35 (30–35), d_1 30 (20–30), d_2 27 (19–27), e_1 208 (208–233), e_2 232 (141–232), f_2 411 (293–411), h_1 383 (213–383), h_2 435 (321–435), h_3 323 (198–323); distances: c_1–c_1 151 (125–151), c_1–d_1 67 (67–71), d_1–d_1 75 (75–87), d_2–*gla* 53 (51–53), d_1–e_1 83 (68–83), e_1–e_1 167 (155–167). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 0.5 (0.5–1.6)× length of coxal plate II, 31 (31–32) long; *3a* 22 (20–22); *3b* 1.7 (1.7–1.8)× length of *3a*, 37 (34–37) long; *g* 22 (19–22), *4a* 53 (45–53). Aedeagus with one major curve, 23 long, narrowing gradually in basal half and almost cylindrical in distal half, distal end truncated, internal diameter tapering rapidly from distal end to midlength; lateral arms supporting aedeagus turning inwards. Anal slit 92 (75–92) long, distance between anterior rim of anal slit and posterior margin of aedeagus 11 (11–17). Anal suckers about 27 (27–32) in diameter; anal discs 5 (5–6) in diameter, distances between right and left discs 36 (33–36). Pseudanal setae ps_1 about 4.7 (3.5–4.7)× length of ps_2, 198 (133–198) long, ps_2 2.3 (2.3–2.4)× length of ps_3, 42 (31–42) long, ps_3 18 (16–18); ps_2–ps_2 0.7 (0.7–1.0)× distance ps_1–ps_1, ps_1–ps_1 35 (34–47), ps_2–ps_2 26 (26–38).

Legs. **Leg I.** 255 (243–255) long; femur I 75 (61–75), *vF* simple, 52 (40–52) long; genu I 50 (38–50), σ' 75 (46–75), σ" 43 (25–43), Iσ': σ" = 1.7 (1.7–2.0), *cG* 44 (38–44), *mG* 63 (47–63); tibia I 35 (29–35), φ 145 (113–145), *gT* 38 (27–38), *hT* 46 (34–46); tarsus I 107 (87–107) long, 31 (22–31) wide, ω_1 stout and clavate, 21 (16–21) long, ε 5 (3–5), ω_2 7.5 (7.5–9), ω_3 33 (28–33), distance between *aa* and ω_1 about 16 (10–16), *aa* 32 (23–32) long, *ba* 37 (29–37), *wa* 62 (48–62), *ra* 43 (39–43), *la* 32 (30–32), *d* 45 (40–45), *e* 12 (11–12), *f* 21 (17–21), *s* 8 (7–8), *u* and *v* 7 (7–8), *p* and *q* 9 (8–9), empodium 16 (15–17), claw 21 (18–21). **Leg II**. 242 (207–242) long; femur II 63 (58–63), *vF* 72 (58–72); genu II 48 (36–48), σ 33 (24–33), *cG* 43 (33–43), *mG* 54 (40–54); tibia II 35 (28–35), φ 164 (128–164), *gT* 30 (23–30), *hT* 45 (33–45); tarsus II 102 (82–102) long, 30 (21–30) wide, ω strong and clavate, 21 (17–21) long, *ba* 35 (30–35), *wa* 71 (46–71), *ra* 47 (35–47), *la* 25 (25–28), *d* 43 (36–43), *e* 10 (9–10), *f* 22 (17–22), *s* 9 (7–9), *u* and *v* 8 (8–10), *p* and *q* 9 (8–9), empodium 15 (15–17), claw 22 (18–22). **Leg III**. 245 (231–245) long; femur III 50 (47–50); genu III 39 (38–39), σ 27 (20–27), *nG* 61 (46–61); tibia III 33 (30–33), φ 115 (115–116), *kT* 50 (38–50); tarsus III 154 (98–154) long, 24 (15–24) wide, *w* spiniform, 42 (33–42) long, *r* setiform, 31 (30–31) long, *d* 35 (29–35), *e* 8 (7–8), *f* 41 (23–41), *s* 8 (7–8), *u* 7 (7–7.5), *v* 8 (8–8.5), *p* and *q* 5 (5–5.5), empodium 15, claw 17 (15–17). **Leg IV**. 293 (253–293) long; femur IV 63 (51–63), *wF* 45 (32–45); genu IV 50 (45–50); tibia IV 42 (33–42), φ 129 (108–129), *kT* 43 (33–43); tarsus IV 125 (108–125) long, 25 (16–25) wide, *w* and *r* situated anteriorad of or close to distal sucker, *w* spiniform, 40 (29–40) long, *r* spiniform, 22 (22–23) long, distances between basal rim of tarsus IV and proximal sucker *d* 25 (24–25), between *d* and *e* 20 (20–22), between *e* and *f* 56 (44–56), ratio (a+b): c = 0.8 (0.8–1.1), *f* 33 (27–33) long, *s* 9 (7–9), *u* and *v* 8 (7–9), *p* and *q* 4 (4–5), empodium 15, claw 17 (15–17).

EGG (Fig. 98). Elongate-oval in shape; shell of newly formed egg smooth, with patches of tubercles in partially developed egg; fully developed egg ornamented with banded tubercles.

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: AK, TK, HB, WA, WN / NN, MB, MC, DN. Australia, Netherlands, South Africa, U.K.

BASED ON LITERATURE: Australia (Robertson 1959; Halliday 1998), Belgium (Hughes 1976), China (Li 1999), Germany (Robertson 1959), Faroe Is (Hallas & Solberg 1989), France (Giustina 1981), Iceland (Hughes 1976), Iran (Hajiqanbar *et al*. 2002), Italy (Laffi 1980), Japan (Nakao & Kurosa 1988), Mexico (Estebanes-

Gonzalez & Rodriguez-Navarro 1991), Netherlands (Hughes 1976), New Zealand (Robertson 1959, Ramsay & Paterson 1977), Romania (Cindea 1978), Sweden (Bostrom *et al*. 1997), U.K. (Robertson 1959), U.S.A. (Walter *et al*. 1986), Yemen (Al-Safadi 1987).

Material examined. 345 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: acorns (*Quercus* sp.), agricultural soil, barn dust, bean plumules, cucumber, dahlia, garlic, Kiwifruit, *Lilium* bulbs, maize, melon, melon seed-beds, moss, mushrooms, *Narcissus* bulbs, orchid, pasture, pumpkin, rotten straws of rice, sandy soil in pots of Rama ryegrass, seeds and debris from tent, spinach, spinach buds, stored hay, sugarbeet fields, tea-tree scrub.

ANIMAL OR ANIMAL PRODUCTS: bat debris, black backed gull colony nests and debris, dead *Rhopoea* larva [grub], larva of *Zenarge turneri*, nematode culture, nematode (*Heterodera avenae*), nests of sea birds, nest of *Sturnus vulgaris*, Norway rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans*), rabbit (*Oryctolagus cuniculus*), white heron *Egretta alba modesta*.

Remarks. Other synonyms of *Tyrophagus similis* Volgin, 1949 listed by Robertson (1959) are:

Tyroglyphus dimidiatus forma *infestans* (Berlese, 1884); Oudemans, 1924: 269.
Tyrophagus infestans Berlese, 1884; Oudemans, 1926: 144.
Tyroglyphus dimidiatus Hermann (*longior* Gervais); Jary & Stapley, 1937: 119; van den Bruel, 1940: 87.
Tyrophagus dimidiatus var. *dimidiatus* (Hermann, 1804); Nesbitt, 1945: 155.
Tyrophagus dimidiatus (Hermann, 1804); Baker & Wharton, 1952: 335.
Tyrophagus humerosus (Oudemans, 1923); Zakhvatkin, 1941: 106; Sorokin, 1952: 545.

Tyrophagus vanheurni Oudemans

Fig. 99–108, Plates 3B, 5J, 8B, 12B, 14J, 15J, 18A, 20I, 23A, 27D, 30I, 31I, 34A

Tyrophagus vanheurni Oudemans, 1924c: 326.
Tyrophagus palmarum Oudemans; Robertson, 1959: 169 (misidentification).
Tyrophagus longior (Gervais, 1844); Robertson, 1946: 198 (misidentification).

Diagnosis. **Female**. Eyespots absent; *scx* thin, tapering from base to tip, with 14 (10–16) short pectinations; d_1 about 2.6 (2.5–2.7)× length of c_1 and 2.4 (2.4–3.1)× length of d_2, d_2 about 0.9 (0.8–1.1)× length of c_1; coxal plates I reaching to posterior apex of prosternal apodeme; coxal plates II not extending posteriorly beyond apex of apodeme II, with posterior margin strongly sinuous. Spermathecal duct cylindrical tube, widening slightly as it reaches base of spermathecal sac, about 3.6 (3.2–5.2)× distance between sclerites of oviducts, base of spermathecal sac bending slightly backwards. Tarsus I ω_1 and tarsus II ω 'banana'-shaped, i.e. medially widened and tapering at base and apex; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 2.7 (2.6–3.1)× length of c_1 and 3.4 (2.9–3.9)× length of d_2; d_2 about 0.8 (0.8–0.9)× length of c_1; aedeagus with one curve, distal end straight, tapering from base to tip, internal diameter linear, slightly broad near apex, lateral arms supporting aedeagus turning inwards; setae *w* and *r* of tarsus IV setiform, situated anteriorad of distal sucker; ratio (a+b): c = 1.2 (1.1–1.4).

Description. **Female** (Fig. 99–102, Plates 3B, 5J, 8B, 12B, 14J, 15J)

Idiosoma. 466 (402–516) long, 297 (246–348) wide. Chelicera 97 (85–98) long, cheliceral seta *cha* conical, 6 (6–7) long, subcapitular setae *m* 41 (34–42), palpal supracoxal seta *elcp* 12 (12–13) long, dorsal palptibial seta 24 (23–25), lateral palptibial seta 18 (14–19), dorsal palptarsal seta 12 (11–13), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins concave, 76 (71–76) long, 101 (87–102) wide between *ve-ve*. Eyespots absent. Grandjean's organ finger-like, 18 (15–18) long, with 1–2 proximal and 1 basal spiniform teeth. Supracoxal seta *scx* slender, tapering from base to tip, with 14 (10–16) short pestinations, 37 (32–38) long. Ratios: *vi*: *ve* = 1.8 (1.8–1.9), *sci*: *sce* = 1.5 (1.4–1.6), *sci–sci*: *sci–sce* = 1.5 (1.2–1.7). Lengths of setae: *vi* 87 (87–111), *ve* 51 (38–51), *sci* 206 (168–224), *sce* 137 (118–148); distances: *vi–vi* 15 (11–15), *vi–ve* 47 (38–48), *sci–sci* 43 (33–44), *sci–sce* 29 (26–30). Hysterosomal setae d_1 about 2.6 (2.5–2.7)× length of c_1 and 2.4 (2.4–3.1)× length of d_2, d_2 about 0.9 (0.8–1.1)× length of c_1; lengths of setae: c_1 36 (30–51), c_2 224 (174–238), c_p 185 (138–189), c_3 41 (29–41), d_1 94 (83–132), d_2 40 (26–45), e_1 341 (275–353), e_2 235 (185–254), f_2 304 (276–399), h_1 337 (298–363), h_2 319 (286–366), h_3 301 (246–322); distances: c_1–c_1 108 (86–127), c_1–d_1 43 (41–55), d_1–d_1 36 (35–55), d_2–*gla* 65 (50–78), d_1–e_1 119 (86–133), e_1–e_1 112 (84–125). **Venter**. Coxal plates I reaching to posterior apex of prosternal apodeme; coxal plates II not extending beyond apex of apodeme II, with posterior margin strongly sinuous. Setae *1a* 0.8 (0.8–0.9)× length of coxal plate II, 39 (37–45) long, *3a* 18 (18–27); *3b* 1.6 (1.6–2.5)× length of *3a*, 43 (43–49); *g* 18 (18–21), *4a* 79 (69–83). Pseudanal setae ps_1 1.4 (1.4–1.7)× as long as ps_2, 221 (205–234) long, ps_2 6.7 (5.7–6.7)× length of ps_3, 167 (126–167) long, ps_3 25 (22–25). Adanal setae ad_1 15 (14–17), ad_2 17 (15–17), ad_3 15 (12–16). Copulatory opening 11 (10–15) in diameter, spermathecal duct a cylindrical tube, slighly

widening slightly toward base of spermathecal sac, about 3.6 (3.2–5.2)× distance between sclerites of oviducts, base of spermathecal sac bending slightly backwards, distance between sclerites of oviducts 12 (12–18).

Legs. **Leg I.** 209 (183–209) long; femur I 56 (47–56), *vF* simple, 57 (44–60) long; genu I 32 (31–33), σ' 45 (38–48), σ" 21 (18–24), Iσ': σ" = 2.2 (2.1–2.4), *cG* 36 (31–39), *mG* 38 (38–51); tibia I 29 (27–30), φ 137 (101–137), *gT* 29 (29–32), *hT* 34 (31–34); tarsus I 79 (71–82) long, 26 (18–26) wide, ω_1 shrink at base and apex, 19 (16–20) long, ε 5 (4–5), ω_2 6 (4–6), ω_3 35 (23–30), distance between *aa* and ω_1 about 11 (11–13), *aa* 24 (17–24) long, *ba* 21 (20–24), *wa* 36 (35–41), *ra* 28 (28–30), *la* 21(17–21), *d* 33 (27–37), *e* 7 (6–7), *f* 16 (16–21), *s* 6 (5–6), *u* and *v* 6 (5–6), *p* and *q* 7 (6–7), empodium 13 (11–13), claw 16 (13–17). **Leg II**. 195 (177–198) long; femur II 54 (48–56), *vF* 71 (53–73); genu II 33 (32–33), σ 18 (16–22), *cG* 34 (25–38), *mG* 49 (36–43); tibia II 29 (25–30), φ 143 (127–143), *gT* 28 (25–30), *hT* 34 (25–36); tarsus II 79 (70–80) long, 22 (17–23) wide, ω slightly shrink at base and apex, 21 (17–22) long, *ba* 25 (20–24), *wa* 37 (32–44), *ra* 35 (27–36), *la* 23 (21–23), *d* 37 (32–37), *e* 7 (6–7), *f* 17 (15–17), *s* 6 (5–6), *u* and *v* 6 (5–6), *p* and *q* 7 (6–7), empodium 13 (12–13), claw 18 (15–18). **Leg III**. 220 (175–222) long; femur III 43 (40–44); genu III 34 (31–36), σ 13 (14–16), *nG* 65 (53–66); tibia III 30 (25–30), φ 151 (127–156), *kT* 46 (43–62); tarsus III 90 (78–90) long, 19 (15–19) wide, *w* setiform, 35 (31–37) long, *r* setiform, 24 (21–24) long, *d* 31 (20–31), *e* 7 (6–7), *f* 25 (21–32), *s* 6 (5–7), *u* 5 (5–6), *v* 6 (6–7), *p* and *q* 3 (3–3.5), empodium 15 (11–15), claw 13 (12–13). **Leg IV**. 227 (206–242) long; femur IV 47 (34–48), *wF* 46 (35–48); genu IV 41 (35–41); tibia IV 37 (30–33), φ 115 (101–122), *kT* 43 (35–52); tarsus IV 88 (85–101) long, 15 (14–19) wide, *w* setiform, 33 (29–50) long, *r* setiform, 15 (15–22) long, *d* 42 (32–44), *e* 6 (6–7), *f* 29 (23–33), *s* 6 (5–7), *u* 5 (5–6), *v* 6 (6–7), *p* and *q* 3 (3–3.5), empodium 12 (9–12), claw 14 (12–15).

Male (Fig. 103–108, Plates 18A, 20I, 23A, 27D, 30I, 31I, 34A)

Idiosoma. 342 (332–406) long, 234 (208–253) wide. Chelicera 80 (70–85) long, cheliceral seta *cha* conical, 6 (5–6) long, subcapitular setae *m* 31 (29–33), palpal supracoxal seta *elcp* 11 (11–12) long, dorsal palptibial seta 24 (18–26), lateral palptibial seta 18 (11–18), dorsal palptarsal seta 16 (11–17), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield as in female, 63 (59–70) long, 82 (74–86) wide between *ve*-*ve*. Eyespots absent. Grandjean's organ as in female, 15 (14–16) long; supracoxal seta *scx* slender, tapering from base to tip, with 12 (10–12) pectinations. Ratios: *vi*: *ve* = 2.2 (2.2–2.5), *sci*: *sce* = 1.7 (1.5–1.7), *sci*–*sci*: *sci*–*sce* = 1.2 (1.1–1.2). Lengths of setae: *vi* 78 (78–90), *ve* 35 (35–46), *sci* 173 (152–191), *sce* 101 (101–107); distances: *vi*–*vi* 10 (8–10), *vi*–*ve* 36 (32–38), *sci*–*sci* 29 (25–30), *sci*–*sce* 24 (21–25). Hysterosomal setae d_1 about 2.7 (2.6–3.1)× length of c_1 and 3.4 (2.9–3.9)× length of d_2; d_2 about 0.8 (0.8–0.9)× length of c_1; lengths of setae: c_1 29 (26–35), c_2 189 (162–226), c_p 143 (135–152), c_3 27 (26–34), d_1 78 (68–110), d_2 23 (23–28), e_1 278 (222–278), e_2 190 (129–224), f_2 299 (226–299), h_1 287 (247–288), h_2 331 (275–331), h_3 266 (169–266); distances: c_1–c_1 88 (79–90), c_1–d_1 36 (36–55), d_1–d_1 37 (35–37), d_2–*gla* 35 (27–40), d_1–e_1 78 (70–103), e_1–e_1 93 (76–95). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 0.8 (0.8–0.9)× length of coxal plate II, 31 (30–37); *3a* 18 (14–18); *3b* 2.3 (2.3–2.7)× length of *3a*, 42 (36–42); *g* 13 (13–15), *4a* 57 (57–76). Aedeagus with one curve, distal end straight, tapering from base to tip which is truncated, 16 (14–17) long, internal diameter linear, slightly broad near apex; lateral arms supporting aedeagus turning inwards. Anal slit 58 (59–63) long, distance between anterior rim of anal slit and posterior margin of aedeagus 8 (4–8). Anal suckers about 25 (19–30) in diameter; anal discs 4 in diameter, distances between right and left discs 37 (23–37). Pseudanal setae ps_1 about 5.8 (2.2–6.3)× length of ps_2, 193 (164–193) long, ps_2 2.4 (2.1–4.1)× length of ps_3, 33 (27–57) long, ps_3 14 (13–17); ps_2–ps_2 1.0 (1.0–1.1)× distance ps_1–ps_1, ps_1–ps_1 32 (30–32), ps_2–ps_2 31 (29–31).

Legs. **Leg I.** 168 (156–183) long; femur I 39 (39–45), *vF* simple, 43 (42–46) long; genu I 27 (27–33), σ' 36 (28–40), σ" 17 (13–18), Iσ': σ" = 2.1 (2.1–2.7), *cG* 30 (30–33), *mG* 40 (34–45); tibia I 23 (23–30), φ 102 (102–106), *gT* 27 (21–35), *hT* 28 (23–34); tarsus I 63 (60–68) long, 20 (15–21) wide, shape of ω_1 as in female, 15 (15–16) long, ε 3, ω_2 4, ω_3 23 (22–25), distance between *aa* and ω_1 about 8 (8–10), *aa* 8 (8–10) long, *ba* 19 (14–20), *wa* 35 (31–40), *ra* 22 (22–25), *la* 17 (17–20), *d* 27 (26–31), *e* 7, *f* 15 (14–16), *s* 5 (5–5.5), *u* and *v* 5 (5–5.5), *p* and *q* 6 (5–6), empodium 10 (10–11), claw 10 (10–15). **Leg II**. 160 (142–181) long; femur II 39 (39–43), *vF* 59 (53–63); genu II 28 (28–32), σ 15 (13–17), *cG* 31 (29–32), *mG* 41 (34–41); tibia II 21 (21–25), φ 118 (107–129), *gT* 19 (19–25), *hT* 26 (23–30); tarsus II 62 (57–70) long, 18 (16–20) wide, ω as in female, 15 (15–17) long, *ba* 21 (18–23), *wa* 31 (30–35), *ra* 25 (20–28), *la* 14 (14–18), *d* 22 (22–29), *e* 7 (6–7), *f* 13 (12–17), *s* 5 (5–5.5), *u* and *v* 5 (5–5.5), *p* and *q* 6 (6–7), empodium 10, claw 13 (12–15). **Leg III**. 178 (163–186) long; femur III 35 (35–38); genu III 26 (26–33), σ 18 (12–20), *nG* 50 (45–51); tibia III 23 (22–26), φ 119 (116–128), *kT* 36 (36–45); tarsus III 76 (70–83) long, 15 (12–15) wide, *w* setiform, 27 (23–28) long, *r* setiform, 21 (20–25) long, *d* 25 (20–26), *e* 7 (6–7), *f* 24 (18–24), *s* 5 (5–5.5), *u* 4 (4–5), *v* 6 (5–6), *p* and *q* 3 (3–3.5), empodium 10 (10–11), claw 12 (11–14). **Leg IV**. 185 (178–201) long; femur IV 37 (36–42), *wF* 33 (29–39); genu IV 30 (30–32); tibia

IV 26 (25–31), φ 91 (89–113), *kT* 33 (26–36); tarsus IV 75 (73–82) long, 15 (14–15) wide, *w* and *r* situated anteriorad of distal sucker, *w* setiform, 30 (22–32) long, *r* setiform, 22 (13–22) long, distances between basal rim of tarsus IV and proximal sucker *d* 16 (14–17), between *d* and *e* 16 (15–18), between *e* and *f* 27 (25–30), ratio (a+b): c = 1.2 (1.1–1.4), *f* 33 (21–33) long, *s* 5 (5–6), *u* 4 (4–5), *v* 6 (5–6), *p* and *q* 3 (3–4), empodium 11 (10–11), claw 12 (11–13).

Distribution. BASED ON MATERIAL EXAMINED: New Zealand: KE / ND, AK, CL, WO, BP, TO, TK, HB, WI, WN / MC, SI / AU. Australia, Netherlands, Tuvalu, U.K.

BASED ON LITERATURE: Netherlands (Oudemans 1924c).

Material examined. Lectotype and 203 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: coconut, *Capsicum frutescens* in glasshouse, injured living *Macadamia* husk, pollen from beehive.

ANIMAL OR ANIMAL PRODUCTS: cheese, dead fruit flies, dead house-fly, dead *Rattus exulans*, dead *Rattus norvegicus*, debris in collection of *Culex antipodeus*, honeybee, *Mus musculus*, *Orthodera ministralis* ootheca on male scale insect, *Rattus exulans*, *Rattus norvegicus*, *Rattus rattus*, short-tailed bat, sphecids stick-trap, Welsh cheddar cheese in store.

Remarks. This species is similar to *T. palmarum* Oudemans in lacking eyespots, having slender *scx*, spermathecal duct cylindrical in female, lateral arms supporting aedeagus turning inwards in male, and position of setae *w* and *r* on tarsus IV (male), but differs from the latter in having ω_1 of tarsus I 'banana'-shaped rather than clavate and aedeagus short rather than long.

Tyrophagus vanheurni has been considered an invalid name since 1959. In her remarkable revision Robertson (1959) concluded that *T. vanheurni* had no status because "Oudemans' specimens are a mixture of *palmarum* and *putrescentiae*". She designated a lectotype male so that it could be listed as a synonym of *T. putrescentiae*. We examined two slides from Oudemans collection in RMNH labelled "*Tyrophagus vanheurni* Oudemans 1924, ♀ dors., vent., ♂ dors., vent., No. 6, P6993, in cocosnoot, Twello, 10.3.1924, Jhr. W.C. van Heurn, J.G. Betrem donavit" (as lectotype) and "*Tyroglyphus vanheurni* Oudems. 1924, &, No. 4, P6991, in een cocosnoot, Twello, Maart 1924, Jhr. W.C. van Heurn", repectively, and found both were in very poor condition. After remounting the second slide (No. 4, P6991) 27 females were separated and re-mounted individually on 27 slides which made it possible to carry out a detailed study of these specimens, which we have done. We consider that the specimens on the two slides are conspecific and represent a taxon distinct from *T. putrescentiae* or *T. palmarum*.

Re-examination of Robertson's specimens including both sexes (P.L.R. Var. Ser. III, Nos. 83, 84, P.L.R. Var. Ser. III, Nos. 7, 8) in ANIC indicates that she misidentified *T. vanheurni* as *T. palmarum*.

AUSTRALASIAN AND OCEANIAN SPECIES *NOT PRESENT* IN NEW ZEALAND

This *Fauna of New Zealand* contribution provides mainly an account of New Zealand species of *Tyrophagus*. However, most New Zealand species are shared with Australia and this project was originally initiated as a taxonomic revision of Australasian species to help identification of mites intercepted on imported/exported products between countries. For this purpose, we also provide an account of other Australasian and Oceanian species that are likely to be intercepted at the border in New Zealand but **are not present in New Zealand**.

Tyrophagus australasiae (Oudemans)

Fig. 109–118, Plates 18B, 20J, 23B, 27E, F, 30J, 31J, 34B

Tyroglyphus australasiae Oudemans, 1916: 267.
Tyrophagus australasiae (Oudemans); Robertson, 1959: 161.
Tyrophagus putrescentiae (Oudemans); Samšiòák, 1962: 268.
Tyrophagus javensis (Oudemans); Robertson, 1959: 164 (misidentification); Samšiòák, 1962: 272; Fain, 1993: 99.

Diagnosis. **Male** (Lectotype) (Slide No.8, P6921). Eyespots present; *scx* slightly widened where bases of pectinations begin, with 8–9 medium or short pectinations; d_1 about 3.4 (2.7–3.4)× length of c_1 and 2.6 (2.5–2.6)× length of d_2; d_2 about 1.3 (1.1–1.3)× length of c_1; coxal plates I extending slightly beyond apex of prosternal apodeme; coxal plates II triangular, extending posteriorly beyond apex of apodeme II, with posterior margin almost straight; aedeagus with two obvious curves, S-shaped, distal 1/3 reversely curved, tapering from base to tip, internal diameter linear, lateral arms supporting aedeagus turning outwards; ω_1 of tarsus I slightly clavate, tarsus II ω nearly cylindrical; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 2.5.

Description. **Male** (P6921; Fig. 109–113, Plates 18B, 20J, 23B, 27E, 30J, 31J, 34B)

Idiosoma. 430 (359–430) long, 277 (228–277) wide. Che-

licera 82 (68–82) long, cheliceral seta *cha* conical and distally pointed, 5 long, subcapitular setae *m* 32 (27–32); palpal supracoxal seta *elcp* 10 (8–10) long, dorsal palptibial seta 21 (20–21), lateral palptibial seta 13 (11–13), dorsal palptarsal seta 12 (10–12), palptarsal solenidion 3 (3–4). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins strongly concave and posterolateral margins slightly concave; 70 (62–70) long, 75 (66–75) wide between *ve-ve*. Eyespots present. Grandjean's organ finger-like, smooth, its basal lobe with 2–3 spiniform teeth. Supracoxal seta *scx* slender, slightly widened at bases of pectinations, with 8–9 long or short pectinations, 37 (29–37) long. Ratios: *vi*: *ve* = 1.6 (1.6–2.0), *sci*: *sce* = 2.0 (1.9–2.0), *sci–sci*: *sci–sce* = 1.3 (0.9–1.3). Lengths of setae: *vi* 87 (77–87), *ve* 53 (39–53), *sci* 180 (151–180), *sce* 92 (81–92); distances: *vi–vi* 13 (11–13), *vi–ve* 32 (27–32), *sci–sci* 25 (21–25), *sci–sce* 20 (20–23). Hysterosomal setae d_1 about 3.4 (2.7–3.4)× length of c_1 and 2.6 (2.5–2.6)× length of d_2; d_2 about 1.3 (1.1–1.3)× length of c_1; lengths of setae: c_1 32 (28–32), c_2 200 (172–200), c_p 167 (138–167), c_3 42 (36–42), d_1 108 (76–108), d_2 42 (31–42), e_1 292 (263–292), e_2 205 (171–205), f_2 285 (263–285), h_1 298 (278–298), h_2 295 (279–295), h_3 250 (235–250); distances: c_1–c_1 92 (80–92), c_1–d_1 52 (43–52), d_1–d_1 42 (38–42), d_2–*gla* 55 (38–55), d_1–e_1 62 (62–71), e_1–e_1 292 (263–292). **Venter**. Coxal plates I extending postero-medially beyond posterior apex of prosternal apodeme; coxal plates II broad, extending posteriorly beyond apex of apodeme II, with posterior margin almost straight. Setae *1a* 1.1 (1.0–1.1)× length of coxal plate II, 51 (43–51); *3a* 19 (19–21); *3b* 4.4 (2.9–4.4)× length of *3a*, 83 (61–83); *g* 20 (18–20), *4a* 80 (76–80). Aedeagus from ventral view similar to *T. communis* **sp**. **n**.; lateral arms supporting aedeagus turning outwards. Anal slit 65 (61–65) long, distance between anterior rim of anal slit and posterior margin of aedeagus 20 (20–21). Anal suckers about 23 (20–23) in diameter; anal discs 4 in diameter, distance between right and left discs 31 (31–32). Pseudanal setae ps_1 about 1.8× length of ps_2, 196 (188–196) long, ps_2 7.3 (7.3–7.8)× length of ps_3, 110 (102–110) long, ps_3 15 (13–15); ps_2–ps_2 2.0 (2.0–2.2)× distance ps_1–ps_1, ps_1–ps_1 32 (25–32), ps_2–ps_2 65 (56–65).

Legs. **Leg I.** 195 (174–195) long; femur I 50 (43–50), *vF* simple, 43 (41–43) long; genu I 34 (33–34), σ' 35 (33–35), σ" 23 (17–23), Iσ': σ" = 1.5 (1.5–1.9), *cG* 39 (28–39), *mG* 40 (35–40); tibia I 30 (27–30), φ 103 (94–103), *gT* 27 (27–30), *hT* 32 (30–32); tarsus I 78 (70–78) long, 17 (16–17) wide, ω_1 slightly clavate, 14 long, ε 5 (4–5), ω_2 7 (6–7), ω_3 20 (16–20), distance between *aa* and ω_1 about 14(11–14), *aa* 20 (18–20) long, *ba* 23 (20–23), *wa* 42 (35–42), *ra* 30 (26–30), *la* 20, *d* 39 (32–39), *e* 7 (6–7), *f* 13 (10–13), *s* 5 (4–5), *u* and *v* 5 (4–5), *p* and *q* 7 (6–7), empodium 14 (12–14), claw 13 (12–13). **Leg II**. 190 (171–190) long; femur II 48 (40–48), *vF* 59 (49–59); genu II 37 (30–37), σ 16 (13–16), *cG* 31 (30–31), *mG* 41 (32–41); tibia II 26, φ 93 (86–93), *gT* 30 (26–30), *hT* 35 (30–35); tarsus II 75 (66–75) long, 15 (14–15) wide, ω nearly cylindrical, 16 (15–16) long, *ba* 21 (18–21), *wa* 41 (35–41), *ra* 32 (27–32), *la* 22 (20–22), *d* 34 (29–34), *e* 7 (6–7), *f* 16 (14–16), *s* 5 (4–5), *u* and *v* 5 (4–5), *p* and *q* 7 (6–7), empodium 14 (12–14), claw 12 (11–12). **Leg III**. 207 (196–207) long; femur III 42 (37–42); genu III 33 (28–33), σ 17 (14–17), *nG* 52 (41–52); tibia III 28 (26–28), φ 102 (92–102), *kT* 43 (41–43); tarsus III 86 (73–86) long, 14 (13–14) wide, *w* setiform, 34 (31–34), *r* setiform, 29 (26–29), *d* 32 (30–32), *e* 6, *f* 27 (23–27), *s* 5 (4–5), *u* 4 (4–4.5), *v* 5 (5–5.5), *p* and *q* 2, empodium 14 (12–14), claw 12 (11–12). **Leg IV**. 222 (202–222) long; femur IV 45 (41–45), *wF* 46 (33–46); genu IV 36 (34–36); tibia IV 33 (30–33), φ 95 (89–95), *kT* 36 (35–36); tarsus IV 81 (77–81) long, 13 (12–13) wide, *w* and *r* situated at level between suckers, *w* setiform, 32 (31–32) long, *r* setiform, 12 (11–12) long, distances between basal rim of tarsus IV and proximal sucker *d* 28 (26–28), between *d* and *e* 21 (17–21), between *e* and *f* 20 (18–20), ratio (a+b): c = 2.5, *f* 28 (22–28) long, *s* 4 (4–5), *u* 4, *v* 5 (5–5.5), *p* and *q* 2, empodium 13 (12–13), claw 12 (11–12).

Male (P6610; Fig. 114–118, Plate 27F)

Idiosoma. 257 long, 147 wide. Chelicera 57 long, cheliceral seta *cha* conical and distally pointed, 3 long, subcapitular setae *m* 22; palpal supracoxal seta *elcp* 9 long, dorsal palptibial seta 14, lateral palptibial seta 8, dorsal palptarsal seta 7, palptarsal solenidion 3. **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins strongly concave and posterolateral margins slightly concave; 49 long, 57 wide between *ve-ve*. Eyespots present. Grandjean's organ finger-like, smooth, its basal lobe with 2–3 spiniform teeth. Supracoxal seta *scx* moderately widened at bases of pectinations, with 8–10 long or short pectinations, 23 long. Ratios: *vi*: *ve* = 1.5, *sci*: *sce* = 2.0, *sci–sci*: *sci–sce* = 1.4. Lengths of setae: *vi* 51, *ve* 33, *sci* 106, *sce* 52; distances: *vi–vi* 8, *vi–ve* 24, *sci–sci* 23, *sci–sce* 17. Hysterosomal setae d_1 about 1.6× length of c_1 and 2.0× length of d_2; d_2 about 0.8× length of c_1; lengths of setae: c_1 65, c_2 103, c_p 94, c_3 26, d_1 42, d_2 21, e_1 194, e_2 132, f_2 222, h_1 247, h_2 212, h_3 184; distances: c_1–c_1 65, c_1–d_1 34, d_1–d_1 22, d_2–*gla* 34, d_1–e_1 53, e_1–e_1 52. **Venter**. Coxal plates I extending postero-medially beyond posterior apex of prosternal apodeme; coxal plates II broadly triangular, extending posteriorly beyond apex of apodeme II, with posterior margin very slightly concave. Setae *1a* 0.9× length of coxal plate II, 27; *3a* 16; *3b* 2.6× length of *3a*, 41 long; *g* 15, *4a* 42. Aedeagus tapering from base to tip, with two obvious curves, S-shaped, distal 1/3 reversely

curved, internal diameter linear, 16 long; lateral arms supporting aedeagus turning outwards. Anal slit 44 long, distance between anterior rim of anal slit and posterior margin of aedeagus 13. Anal suckers about 14 in diameter; anal discs 3 in diameter, distance between right and left discs 20. Pseudanal setae ps_1 about 1.9× length of ps_2, 119 long, ps_2 5.6× length of ps_3, 62 long, ps_3 11; ps_2–ps_2 2.4× distance ps_1–ps_1, ps_1–ps_1 15, ps_2–ps_2 36.

Legs. **Leg I.** 141 long; femur I 35, *vF* simple, 32 long; genu I 27, σ' 28, σ" 16, Iσ': σ" = 1.8, *cG* 28, *mG* 36; tibia I 22, φ 82, *gT* 23, *hT* 34; tarsus I 56 long, 14 wide, ω_1 obviously clavate, 13 long, ε 3, ω_2 5, ω_3 11, distance between *aa* and ω_1 about 8, *aa* 14 long, *ba* 21, *wa* 27, *ra* 16, *la* 13, *d* 17, *e* 5, *f* 8, *s* 5, *u* and *v* 3, *p* and *q* 5, empodium 13, claw 11. **Leg II**. 128 long; femur II 33, *vF* 29; genu II 24, σ 11, *cG* 26, *mG* 32; tibia II 20, φ 77, *gT* 21, *hT* 26; tarsus II 50 long, 11 wide, ω slightly clavate, 14 long, *ba* 12, *wa* 25, *ra* 19, *la* 16, *d* 15, *e* 5, *f* 8, *s* 4, *u* and *v* 3, *p* and *q* 4, empodium 10, claw 10. **Leg III**. 124 long; femur III 25; genu III 23, σ 110, *nG* 33; tibia III 18, φ 93, *kT* 32; tarsus III 56 long, 11 wide, *w* setiform, 20, *r* setiform, 12, *d* 16, *e* 5, *f* 13, *s* 4.5, *u* 3, *v* 4.5, *p* and *q* 1, empodium 11, claw 10. **Leg IV**. 160 long; femur IV 31, *wF* 27; genu IV 24; tibia IV 23, φ 91, *kT* 26; tarsus IV 63 long, 10 wide, *w* and *r* situated at level between suckers, *w* setiform, 24 long, *r* setiform, 12 long, distances between basal rim of tarsus IV and proximal sucker *d* 19, between *d* and *e* 17, between *e* and *f* 16, ratio (a+b): c = 2.3, *f* 16 long, *s* 4, *u* 3, *v* 3.5, *p* and *q* 2, empodium 10, claw 9.

Distribution. BASED ON MATERIAL EXAMINED: Indonesia.
BASED ON LITERATURE: Indonesia (Oudemans 1916).

Material examined. Lectotype and 4 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. ANIMAL OR ANIMAL PRODUCTS: eggs of ant (*Plagiolepis longipes* Jerd.), crowned pigeon (*Goura* sp.).

Remarks. The lectotype male of *Tyrophagus australasiae* (No. 8, P6921) is similar to *T. communis* **sp**. **n**. in eyespots, ω_1 of tarsus I and ω of tarsus II, lateral arms supporting aedeagus, position of suckers of tarsus IV, and coxal plates II, but differs from the latter in shaft of supracoxal setae being slender and with less (8) pectinations (Fig. 111) rather than obviously widened at bases of pectinations and with more (13–16) pectinations (Fig. 3). Further distinguishing characters are unavailable because aedeagus of the lectotype male of this species is folded dorsoventrally and female is unknown.

Males on slide No. 6, P6610 were misidentified as *T. javensis* (Oudemans) by Robertson (1959) and Samšiòák (1962) (discussed below in *T. javensis*) probably because the slide has the same collection data with the female of *T. javensis*. These males are very similar to those of *T. communis* **sp**. **n**. in almost every aspect, such as eyespots, shape of *scx* and aedeagus, position of setae and suckers on tarsus IV, except the shape of solenidion ω_1 on tarsus I (Fig. 117). Due to the complexity of the genus we tentatively retain these males in *T. australiae* until females are discovered.

Tyrophagus javensis (Oudemans)

Fig. 119–128, Plates 3C, 5K, 8C, 12C, 14K, 15K, 18C, 20K, 23C, 28A, B, 30K, 31K, 34C
Tyroglyphus javensis Oudemans, 1916: 267.

Diagnosis. **Female**. Eyespots absent; *scx* slightly or moderately widening where bases of pectinations begin, pectinations 6–8, moderate or short; d_1 about 5.3 (2.5–5.3)× length of c_1 and 4.3 (2.3–4.3)× length of d_2; d_2 about 1.0 (1.0–1.2)× length of c_1; coxal plates I extending postero-medially beyond apex of prosternal apodeme, posterior margin sinuous; coxal plates II triangular, extending posteriorly beyond apex of apodeme II, with 2/3 of posterior margin strongly concave. Spermathecal duct narrowing rapidly from copulatory opening for a distance about 2.7 (2.7–3.1)×distance between sclerites of oviducts and then extending to base of spermathecal sac, more than 4.0 (3.7–4.3)× distance between sclerites of oviducts, base of spermathecal sac very small, bending forwards. Tarsus I ω_1 slender, obviously widened at apex, tarsus II ω slender, slightly widened at apex; seta *w* of tarsus IV setiform, *r* of tarsus IV spiniform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 2.4 (2.4–2.7)× length of c_1 and 2.7 (2.7–2.9)× length of d_2; d_2 about 0.9 (0.9–1.0)× length of c_1; aedeagus very small, with one major curve, distal end short, reversely curved, tapering from base to tip, internal diameter linear, lateral arms supporting aedeagus turning outwards; seta *w* of tarsus IV setiform, *r* of tarsus IV spiniform; ratio (a+b): c = 2.8.

Description. **Female** (Fig. 119–123, Plates 3C, 5K, 8C, 12C, 14K, 15K)
Idiosoma. 492 (438–504) long, 301 (288–305) wide. Chelicera 81 (78–82) long, cheliceral seta *cha* conical, 5 (4–5) long, subcapitular setae *m* 37 (36–39), palpal supracoxal seta *elcp* 10 (10–11) long, dorsal palptibial seta 21 (19–23), lateral palptibial seta 14 (13–14), dorsal palptarsal seta 13 (11–13), palptarsal solenidion 3 (3–4). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins strongly concave and posterolateral margins wavy with an obvious medial lobe; 80 (77–80) long, 91 (85–91) wide between *ve-ve*. Eyespots absent. Grandjean's organ fin-

ger-like (13–14 long), its basal lobe with 3–4 spiniform teeth. Supracoxal seta *scx* slightly or moderately widened at bases of pectinations, with 6–9 moderate or short pectinations, 33 (30–33) long. Ratios: *vi*: *ve* = 2.3 (2.2–2.3), *sci*: *sce* = 1.8 (1.8–2.0), *sci–sci*: *sci–sce* = 1.4 (1.3–1.4). Lengths of setae: *vi* 91 (91–93), *ve* 40 (40–42), *sci* 205 (199–205), *sce* 113 (98–113); distances: *vi–vi* 14 (11–14), *vi–ve* 40 (38–42), *sci–sci* 38 (35–38), *sci–sce* 28 (27–29). Hysterosomal setae d_1 about 5.3 (2.5–5.3)× length of c_1 and 4.3 (2.3–4.3)× length of d_2; d_2 about 1.0 (1.0–1.2)× length of c_1; lengths of setae: c_1 21 (20–21), c_2 108 (83–108), c_p (158–201), c_3 48 (25–48), d_1 113 (51–113), d_2 22 (22–26), e_1 353 (315–353), e_2 208 (186–208), f_2 313 (271–313), h_1 335 (311–335), h_2 338 (296–338), h_3 268 (193–268); distances: c_1–c_1 105 (83–108), c_1–d_1 60 (60–63), d_1–d_1 35 (30–35), d_2–*gla* 70 (70–71), d_1–e_1 108 (90–108), e_1–e_1 102 (101–102). **Venter**. Coxal plates I extending postero-medially beyond apex of prosternal apodeme, posterior margin sinuous; coxal plates II triangular, extending posteriorly beyond apex of apodeme II, with 2/3 of posterior margin strongly concave. Setae *1a* 1.2 (1.1–1.2)× length of coxal plate II, 51 (47–51), *3a* 18 (18–27); *3b* 3.8 (3.2–3.8)× length of *3a*, 69 (69–87) long; *g* 22 (21–22), *4a* 76 (76–89). Pseudanal setae ps_1 1.5 (1.5–2.7)× as long as ps_2, 221 (193–268) long, ps_2 6.2 (2.8–6.2)× length of ps_3, 143 (53–143) long, ps_3 19 (19–23). Adanal setae ad_1 11 (10–11), ad_2 13 (12–13), ad_3 11 (11–12). Copulatory opening 5.3 in diameter, spermathecal duct narrowing rapidly from copulatory opening for a distance about 2.7 (2.7–3.1)× diameter of copulatory opening and then extending to base of spermathecal sac, more than 4.0 (3.7–4.3)× distance between sclerites of oviducts, base of spermathecal sac very small, bending forwards, distance between sclerites of oviducts 5.0 (4.5–5.0).

Legs. **Leg I.** 221 (161–221) long; femur I 54 (45–50), *vF* simple, 50 (50–52) long; genu I 37 (32–40), σ' 31 (30–31), σ" 23 (23–30), Iσ': σ" = 1.3 (1.0–1.3), *cG* 36 (34–36), *mG* 54 (54–57); tibia I 31 (25–31), φ 113 (91–113), *gT* 37 (37–38), *hT* 49 (44–49); tarsus I 88 (67–88) long, 18 (18–21) wide, ω_1 slender, obviously widened at apex, 18 (17–18) long, ε 4, ω_2 6 (5–6), ω_3 27 (19–27), distance between *aa* and ω_1 about 12 (12–14), *aa* 24 (23–24) long, *ba* 25 (25–27), *wa* 36 (36–43), *ra* 24 (24–25), *la* 19 (19–25), *d* 35 (33–35), *e* 6 (6–7), *f* 14 (13–14), *s* 6 (5–6), *u* and *v* 4 (4–5), *p* and *q* 7 (7–7.5), empodium 16 (13–16), claw 13 (13–14). **Leg II**. 210 (150–210) long; femur II 52 (45–52), *vF* 59 (57–59); genu II 38 (38–39), σ 29 (23–29), *cG* 33 (31–33), *mG* 44 (44–51); tibia II 28 (27–28), φ 117 (113–117), *gT* 35 (35–41), *hT* 38 (37–38); tarsus II 82 (78–82) long, 17 (17–21) wide, ω slender, slightly widened at apex, 24 (22–24) long, *ba* 24 (24–29), *wa* 33 (33–47), *ra* 29 (29–35), *la* 21 (21–24), *d* 34 (34–36), *e* 6 (5–6), *f* 15 (13–15), *s* 5 (5–6), *u* and *v* 5 (4–5), *p* and *q* 7 (7–7.5), empodium 15 (12–15), claw 12 (12–13). **Leg III**. 212 (152–212) long; femur III 46 (39–46); genu III 36 (34–36), σ 16 (16–17), *nG* 54 (52–54); tibia III 31 (28–31), φ 136 (132–136), *kT* 50 (50–52); tarsus III 84 (84–86) long, 16 (15–16) wide, *w* setiform, 35 (35–37) long, *r* setiform, 28 (28–31) long, *d* 37 (32–37), *e* 6 (5–6), *f* 16 (16–20), *s* 5 (5–6), *u* 4 (4–4.5), *v* 6 (5.5–6), *p* and *q* 3 (3–3.5), empodium 13 (12–13), claw 12 (12–13). **Leg IV**. 242 (178–242) long; femur IV 49 (46–49), *wF* 49 (48–49); genu IV 41 (38–41); tibia IV 35 (32–35), φ 92 (92–118), *kT* 46 (43–46); tarsus IV 94 (89–98) long, 16 (15–16) wide, *w* setiform, 34 (34–37) long, *r* spiniform, 16 (16–18) long, *d* 35 (35–38), *e* 6 (5–6), *f* 16 (13–16), *s* 5 (5–6), *u* 5 (4–5), *v* 6, *p* and *q* 3, empodium 15 (13–15), claw 12 (12–13).

Male (Fig. 124–128, Plates 18C, 20K, 23C, 28A, B, 30K, 31K, 34C)

Idiosoma. 252 (233–252) long, 153 (136–153) wide. Chelicera 50 (50–52) long, cheliceral seta *cha* conical, 3.5 (3.5–4) long, subcapitular setae *m* 21 (21–24), palpal supracoxal seta *elcp* 6 (6–7) long, dorsal palptibial seta 12 (12–15), lateral palptibial seta 8 (8–10), dorsal palptarsal seta 7 (7–10), palptarsal solenidion 2 (2–3). **Dorsum**. Prodorsal shield as in female, 47 (47–48) long, 53 (53–56) wide between *ve-ve*. Eyespots absent. Grandjean's organ and supracoxal seta as in female, *scx* 17 (17–19) long. Ratios: *vi*: *ve* = 1.5 (1.5–1.6), *sci*: *sce* = 2.3 (2.1–2.3), *sci–sci*: *sci–sce* = 1.3 (1.1–1.3). Lengths of setae: *vi* 48 (48–52), *ve* 31 (31–32), *sci* 135 (124–135), *sce* 60 (57–60); distances: *vi–vi* 8 (8–9), *vi–ve* 23 (23–25), *sci–sci* 21 (18–21), *sci–sce* 16 (16–19). Hysterosomal setae d_1 about 2.4 (2.4–2.7)× length of c_1 and 2.7 (2.7–2.9)× length of d_2; d_2 about 0.9 (0.9–1.0)× length of c_1; lengths of setae: c_1 18 (18–19), c_2 143 (126–143), c_p 108 (108–116), c_3 22 (22–24), d_1 43 (43–52), d_2 16 (16–18), e_1 235 (235–244), e_2 167 (167–181), f_2 259 (247–259), h_1 266 (255–266), h_2 259 (259–264), h_3 162 (162–174); distances: c_1–c_1 56 (56–58), c_1–d_1 33 (33–34), d_1–d_1 18 (18–21), d_2–*gla* 31 (31–34), d_1–e_1 50 (49–50), e_1–e_1 51 (47–51). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 0.7 (0.7–0.8)× length of coxal plate II, 22 (22–26) long; *3a* 14 (12–14); *3b* 1.8 (1.8–2.0)× length of *3a*, 25 (25–27); *g* 9 (9–10), *4a* 31 (31–33). Aedeagus very small, 12 (12–13) long, with one major curve, distal end short, reversely curved, tapering from base to tip, internal diameter linear; lateral arms supporting aedeagus turning outwards. Anal slit 42 (39–42) long, distance between anterior rim of anal slit and posterior margin of aedeagus 13 (11–13). Anal suckers about 14 (12–14) in diameter; anal discs 3 (2.5–3) in diameter, distances between right and left discs 18 (18–20). Pseudanal setae ps_1 about 2.0 (2.0–2.2)× length of ps_2, 134 (128–134) long, ps_2 6.7 (5.9–6.7)× length of ps_3,

67 (59–67) long, ps_3 10; ps_2–ps_2 2.2 (2.1–2.2)× distance ps_1–ps_1, ps_1–ps_1 17 (16–17), ps_2–ps_2 37 (37–39).

Legs. **Leg I.** 121 (117–121) long; femur I 30 (28–30), *vF* simple, 28 (28–30) long; genu I 22 (21–22), σ' 23 (23–24), σ" 23 (23–24), Iσ': σ" = 1.0, *cG* 17 (17–20), *mG* 24 (22–24); tibia I 18 (18–19), φ 77 (77–81), *gT* 23 (23–24), *hT* 22 (21–22); tarsus I 50 (48–50) long, 16 (15–16) wide, ω_1 obviously clavate, 14 (14–14.5) long, ε 3, ω_2 4 (4–5), ω_3 16 (16–17), distance between *aa* and ω_1 about 12 (10–12), *aa* 18 (16–18) long, *ba* 16 (16–18), *wa* 30 (29–30), *ra* 16 (16–18), *la* 16 (14–16), *d* 20 (19–20), *e* 6 (6–7), *f* 11 (9–11), *s* 4 (4–4.5), *u* and *v* 3 (3–3.5), *p* and *q* 5 (5–6), empodium 11 (11–13), claw 9 (9–10). **Leg II**. 120 (118–120) long; femur II 30 (28–30), *vF* 36 (33–36); genu II 20 (20–21), σ 14 (13–14), *cG* 20 (20–23), *mG* 26 (25–26); tibia II 18 (17–18), φ 80 (80–85), *gT* 23 (21–23), *hT* 20 (19–20); tarsus II 47 (47–49) long, 13 (13–15) wide, ω slender and clavate, 14 (14–15) long, *ba* 16 (15–16), *wa* 30 (29–30), *ra* 16 (16–18), *la* 14 (13–14), *d* 22 (20–22), *e* 5 (5–6), *f* 11 (10–11), *s* 4, *u* and *v* 3 (3–3.5), *p* and *q* 3 (2–3), empodium 10 (10–11), claw 8 (8–10). **Leg III**. 117 (117–118) long; femur III 25 (25–27); genu III 20 (20–22), σ 8 (8–9), *nG* 32 (32–34); tibia III 19 (18–19), φ 99 (99–102), *kT* 26 (26–30); tarsus III 53 (53–55) long, 12 (12–13) wide, *w* setiform, 22 (22–24) long, *r* setiform, 16 (16–17), *d* 16 (16–19), *e* 3 (3–4), *f* 20 (20–23), *s* 4 (4–4.5), *u* 3, 3 (3–4), *p* and *q* 3 (2–3), empodium 10, claw 8 (8–9). **Leg IV**. 142 (137–142) long; femur IV 30 (30–31), *wF* 28 (28–31); genu IV 24 (23–24); tibia IV 20 (20–21), φ 78 (78–82), *kT* 27 (27–30); tarsus IV 57 (57–59) long, 11 (11–13) wide, *w* and *r* situated at level between suckers, *w* setiform, 16 (16–18) long, *r* spiniform, 10 (10–11) long, distances between basal rim of tarsus IV and proximal sucker *d* 17 (16–17), between *d* and *e* 16 (16–17), between *e* and *f* 12 (12–13), ratio (a+b): c = 2.8, *f* 14 long, *s* 4 (4–4.5), *u* 3, *v* 4 (4–4.5), *p* and *q* 1.5 (1.5–2), empodium 10 (9–10), claw 8 (8–9).

Distribution. BASED ON MATERIAL EXAMINED: Australia, Ecuador, Indonesia, Panama, Philippines, Singapore, Thailand.
BASED ON LITERATURE: Indonesia (Oudemans 1916).

Material examined. Lectotype and 92 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: banana, bark scrapings, pineapple, water melon.

ANIMAL OR ANIMAL PRODUCTS: workers of ant (*Plagiolepis longipes* Jerd.).

Remarks. Lectotype female and subsequently discovered females of this species are very similar to those of *T. robertsonae* Lynch in spermathecal ducts which are of short length with a small sclerotised base to the spermathecal sac (Fig. 70, 122), ω_1 on tarsus I and ω on tarsus II being clavate (Fig. 71, 122), but this species differs from the latter in *scx* which is expanded where the bases of pectionations begin (Fig. 121) rather than tapering from base to tip (Fig. 70), seta *r* on tarsus IV being spiniform (Fig. 123) rather than setiform (Fig. 72) and lacking eyespots (Fig. 121) rather than having a pair of faint eyespots (Fig. 70). Subsequently discovered males of *T. javensis* are also similar to those of *T. robertsonae* Lynch in having small aedeagus (Fig. 75, 126) and ω_1 on tarsus I and ω on tarsus II being clavate (Fig. 76, 127), but differ from the latter in shape of *scx* (Fig. 126) and *r* (Fig. 128), and lacking eyespots (Fig. 126) as in female. It is obvious that *T. javensis* (Oudemans) is distinct from males (one of them was designated as lectotype of *T. javensis* by Robertson, 1959) on slide labelled "*Tyroglyphus australasiae* Oudemans, ♂ dors., vent., lat., No. 6, P6610, Op eieren van *Plagiolepis longipes* (mier), Salatiga, Maart 1915, P.V.D. Goof" in having small aedeagus and seta *r* on tarsus IV being spiniform. Therefore, Robertson's concept of *T. javensis* should be abolished and we have rectified this problem in accordance with the rules of the International Code for Zoological Nomenclature.

Tyrophagus pacificus sp. n.

Fig. 129–138, Plates 3D, 5L, 8D, 12D, 14L, 15L, 18D, 20L, 23D, 28C, D, 30L, 31L, 34D

Diagnosis. **Female**. Eyespots present but not prominent; *scx* moderately or broadly widening where pectinations begin, with 6–10 long pectinations; d_1 about 2.9 (2.8–2.9)× length of c_1 and 3.1 (2.4–3.1)× length of d_2; d_2 about 0.9 (0.9–1.2)× length of c_1; coxal plates I just reaching posterior apex of prosternal apodeme; coxal plates II broadly trangular, extending beyond apex of apodeme II, its posterior margin virtually straight. Spermathecal duct narrowing rapidly from copulatory opening for a distance about 2.9 (2.7–2.9)×distance between sclerites of oviducts and then extending to base of spermathecal sac over a distance about 3.4 (2.7–3.4)× distance between sclerites of oviducts, base of spermathecal sac flat. Tarsus I ω_1 obviously widened at apex, tarsus II ω slightly widened at apex; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates I and II, solenidia I ω_1 and II ω as in female; d_1 about 3.0 (2.5–3.0)× length of c_1 and 2.8 (2.8–3.1)× length of d_2; d_1 about 1.1 (0.9–1.1)× length of c_1; aedeagus very long, with two obvious curves, S-shaped, distal half reversely curved, tapering from base to tip, internal diameter linear, lateral arms supporting aedeagus turning outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 3.4 (3.4–3.5).

Description. **Female** (Fig. 129–133, Plates 3D, 5L, 8D, 12D, 14L, 15L)

Idiosoma. 402 (342–402) long, 269 (235–369) wide. Chelicera 85 (80–85) long, cheliceral seta *cha* conical and with a blunt tip, 5 (5–5.5) long, subcapitular setae *m* 35 (29–35); palpal supracoxal seta *elcp* 10 (10–11) long, dorsal palptibial seta 22 (22–25), lateral palptibial seta 16 (16–19), dorsal palptarsal seta 12 (110–12), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral and posterolateral margins slightly concave; 76 (70–76) long, 86 (74–86) wide between *ve-ve*. Eyespots present but not obvious. Grandjean's organ finger-like, 12 (12–13) long, its basal lobe with 2 basally confluent and 1 separate spiniform teeth. Supracoxal seta *scx* widened at bases of pectinations, with 8 (6–10) long or short pectinations, 35 (33–35) long. Ratios: *vi*: *ve* = 1.6, *sci*: *sce* = 2.1 (1.8–2.1), *sci–sci*: *sci–sce* = 1.5 (1.3–1.5). Lengths of setae: *vi* 76 (73–76), *ve* 47 (45–47), *sci* 197 (155–197), *sce* 91 (85–91); distances: *vi–vi* 13 (13–14), *vi–ve* 37 (28–37), *sci–sci* 37 (30–37), *sci–sce* 24 (23–24). Hysterosomal setae d_1 about 2.9 (2.8–2.9)× length of c_1 and 3.1 (2.4–3.1)× length of d_2; d_2 about 0.9 (0.9–1.2)× length of c_1; lengths of setae: c_1 38 (30–38), c_2 142 (142–177), c_p 160 (123–160), c_3 41 (33–41), d_1 110 (85–110), d_2 36 (35–36), e_1 312 (252–312), e_2 215 (140–215), f_2 292 (281–292), h_1 356 (285–356), h_2 367 (291–367), h_3 252 (229–252); distances: c_1–c_1 101 (85–101), c_1–d_1 57 (47–57), d_1–d_1 49 (43–49), d_2–*gla* 56 (47–56), d_1–e_1 67 (65–67), e_1–e_1 101 (87–101). **Venter**. Coxal plates I just reaching distal extremity of prosternal apodeme; coxal plates II broadly triangular, extending beyond apex of apodeme II, its posterior margin virtually straight. Setae *1a* 1.2 (1.2–1.3)× length of coxal plate II, 53 (46–53), *3a* 31 (25–31); *3b* 2.4 (2.3–2.4)× length of *3a*, 73 (58–73); *g* 25 (20–25), *4a* 74 (64–74). Pseudanal setae ps_1 1.6 (1.4–1.8)× as long as ps_2, 195 (172–195) long, ps_2 3.8 (3.8–5.2)× length of ps_3, 124 (98–124) long, ps_3 33 (19–33). Adanal setae ad_1 26 (24–26), ad_2 18 (12–18), ad_3 (12–16). Copulatory opening 5 in diameter, spermathecal duct narrowing rapidly from copulatory opening for a distance about 2.9 (2.7–2.9)×distance between sclerites of oviducts and then extending to base of spermathecal sac over a distance about 3.4 (2.7–3.4)× distance between sclerites of oviducts, base of spermathecal sac flat, distance between sclerites of oviducts 9 (9–14).

Legs. **Leg I.** 205 (202–205) long; femur I 51 (50–51), *vF* simple, 47 (47–54) long; genu I 36 (32–36), σ' 41 (38–41), σ" 18 (18–20), Iσ': σ" = 2.3 (1.9–2.3), *cG* 36 (35–36), *mG* 41 (38–41); tibia I 30 (29–30), φ 106 (84–106), *gT* 38 (37–38), *hT* 33 (32–33); tarsus I 82 (82–84) long, 20 (19–20) wide, ω_1 obviously widened at apex, 16 (16–17) long, ε 4 (4–5), ω_2 4 (4–5), ω_3 20 (20–21), distance between *aa* and ω_1 about 15 (13–15), *aa* 17 (15–17) long, *ba* 29 (26–29), *wa* 42 (42–44), *ra* 28 (25–28), *la* 18 (18–22), *d* 27 (27–32), *e* 5 (5–6), *f* 10 (10–13), *s* 6 (5–6), *u* and *v* 4 (4–5), *p* and *q* 6 (6–7), empodium 13 (12–13), claw 12 (12–14). **Leg II**. 191 (191–198) long; femur II 49 (44–49), *vF* 58 (58–62); genu II 35 (35–37), σ 18 (18–19), *cG* 35 (34–35), *mG* 40 (40–43); tibia II 29 (29–30), φ 107 (107–109), *gT* 34 (34–37), *hT* 36 (36–38); tarsus II 81 (79–81) long, 18 (18–19) wide, ω slightly widened at apex, 23 (22–23) long, *ba* 19 (19–21), *wa* 42 (32–42), *ra* 35 (25–35), *la* 17 (17–19), *d* 22 (22–24), *e* 5 (5–6), *f* 9 (9–12), *s* 6 (5–6), *u* and *v* 4 (4–5), *p* and *q* 6 (6–7), empodium 13 (12–13), claw 11 (11–13). **Leg III**. 212 (212–220) long; femur III 40 (40–42); genu III 34 (34–36), σ 17 (16–17), *nG* 51 (51–53); tibia III 28 (26–28), φ 122 (122–126), *kT* 51 (51–53); tarsus III 88 (88–90) long, 13 (13–14) wide, *w* 32 (32–34), *r* 26 (26–27), *d* 26 (26–29), *e* 4 (4–5), *f* 19 (16–19), *s* 5 (5–6), *u* 4, *v* 6 (6–6.5), *p* and *q* 3 (3–3.5), empodium 12 (12–13), claw 11 (11–13). **Leg IV**. 234 (232–234) long; femur IV 47 (47–49), *wF* 47 (47–49); genu IV 44 (38–44); tibia IV 35 (34–35), φ 101 (101–105), *kT* 40 (37–40); tarsus IV 96 (96–101) long, 15 (14–15) wide, *w* setiform, 34 (32–34) long, *r* setiform, 22 (18–22) long, *d* 26 (19–26), *e* 4 (4–5), *f* 19 (16–19), *s* 5 (5–6), *u* 4, *v* 6 (6–7), *p* and *q* 3 (3–3.5), empodium 13 (12–13), claw 11 (11–13).

Male (Fig. 134–138, Plates 18D, 20L, 23D, 28C, D, 30L, 31L, 34D)

Idiosoma. 325 (325–330) long, 190 (182–190) wide. Chelicera 70 (70–75) long, cheliceral seta *cha* conical, 4 (4–4.5) long, subcapitular setae *m* 26 (24–26), palpal supracoxal seta *elcp* 9 (9–10) long, dorsal palptibial seta 18 (18–22), lateral palptibial seta 13 (13–16), dorsal palptarsal seta 7 (7–9), palptarsal solenidion 3 (3–3.5). **Dorsum**. Prodorsal shield as in female, 63 (61–63) long, 72 (67–72) wide between *ve-ve*. Eyespots present but not prominent. Grandjean's organ as in female, 12 (10–12) long, supracoxal seta *scx* 25 (25–27) long. Ratios: *vi*: *ve* = 1.6 *sci*: *sce* = 2.1 (2.1–2.2), *sci–sci*: *sci–sce* = 1.5 (1.3–1.5). Lengths of setae: *vi* 57, *ve* 38 (38–45), *sci* 163 (160–163), *sce* 78 (74–78); distances: *vi–vi* 11 (11–12), *vi–ve* 28 (28–30), *sci–sci* 32 (30–32), *sci–sce* 22 (22–23). Hysterosomal setae d_1 about 3.0 (2.5–3.0)× length of c_1 and 2.8 (2.8–3.1)× length of d_2; d_1 about 1.1 (0.9–1.1)× length of c_1; lengths of setae: c_1 28 (28–30), c_2 164 (160–164), c_p 119 (110–119), c_3 33 (33–34), d_1 83 (75–83), d_2 30 (27–30), e_1 268 (268–308), e_2 176 (163–176), f_2 238 (238–246), h_1 258 (258–264), h_2 265 (265–274), h_3 208 (208–222); distances: c_1–c_1 67 (67–68), c_1–d_1 50 (47–50), d_1–d_1 41 (41–43), d_2–*gla* 32 (32–34), d_1–e_1 57 (57–60), e_1–e_1 72 (70–72). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 1.0 (1.0–1.1)× length of coxal plate II,

37 (37–39); *3a* 22 (20–22); *3b* 2.6 (2.6–3.2)× length of *3a*, 57 (57–63); *g* 22 (20–22), *4a* 61 (57–60). Aedeagus with two obvious curves, S-shaped, distal half reversely curved, tapering from base to tip, 25 long, internal diameter linear, lateral arms supporting aedeagus turning outwards. Anal slit 53 (53–56) long, distance between anterior rim of anal slit and posterior margin of aedeagus 24 (18–24). Anal suckers about 17 (14–21) in diameter; anal discs 4 (3–4) in diameter, distances between right and left discs 31 (31–33). Pseudanal setae ps_1 about 1.8 (1.8–1.9)× length of ps_2, 136 (127–136) long, ps_2 5.4 (5.3–5.4)× length of ps_3, 75 (69–75) long, ps_3 14 (13–14); ps_2–ps_2 2.5 (2.3–2.5)× distance ps_1–ps_1, ps_1–ps_1 17 (17–19), ps_2–ps_2 42 (42–44).

Legs. **Leg I.** 166 (160–166) long; femur I 41 (41–42), *vF* simple, 45 (41–45) long; genu I 30 (28–30), σ' 34 (34–35), σ" 18 (18–19), Iσ': σ" = 1.9 (1.8–1.9), *cG* 28 (26–28), *mG* 35 (33–35); tibia I 25 (24–25), φ 92 (81–92), *gT* 29 (28–29), *hT* 29 (27–29); tarsus I 65 (63–65) long, 17 (16–17) wide, shape of ω_1 as in female, 14 (14–15) long, ε 4 (3.5–4), ω_2 5 (4–5), ω_3 15 (15–16), distance between *aa* and ω_1 about 12 (11–12), *aa* 15 (15–17) long, *ba* 18 (16–18), *wa* 34 (32–34), *ra* 24 (21–24), *la* 17 (16–17), *d* 28 (25–28), *e* 6 (4–6), *f* 12 (12–13), *s* 5 (5–6), *u* and *v* 4 (4–5), *p* and *q* 6 (6–7), empodium 12 (12–14), claw 13 (11–13). **Leg II**. 160 (157–160) long; femur II 42 (40–42), *vF* 45 (45–47); genu II 30 (29–30), σ 13 (13–15), *cG* 24 (24–28), *mG* 28 (28–31); tibia II 23 (22–23), φ 103 (99–103), *gT* 22 (22–23), *hT* 26 (24–26); tarsus II 65 (64–65) long, 14 (14–16) wide, ω as in female, 16 (16–17) long, *ba* 17 (15–17), *wa* 37 (35–37), *ra* 15 (15–23), *la* 24 (15–24), *d* 23 (23–24), *e* 5 (5–6), *f* 11 (11–12), *s* 5 (5–6), *u* and *v* 4 (4–5), *p* and *q* 5 (5–6), empodium 11 (11–13), claw 11 (10–12). **Leg III**. 151 (151–157) long; femur III 35 (34–35); genu III 28 (26–28), σ 13 (12–13), *nG* 29 (29–40); tibia III 24 (22–24), φ 113 (108–113), *kT* 27 (27–39); tarsus III 68 (68–70) long, 14 (13–14) wide, *w* setiform, 28 (26–28) long, *r* setiform, 15 (15–20) long, *d* 23 (20–23), *e* 5 (5–6), *f* 14 (14–20), *s* 5 (4.5–5), *u* 3.5 (3.5–4), *v* 5 (5–6), *p* and *q* 3 (3–3.5), empodium 12 (10–12), claw 11 (10–12). **Leg IV**. 182 (178–182) long; femur IV 39 (37–39), *wF* 37 (35–37); genu IV 33 (33–34); tibia IV 29 (27–29), φ 92 (92–96), *kT* 26 (24–26); tarsus IV 76 (73–76) long, 13 (12–13) wide, *w* and *r* situated at level between suckers, *w* setiform, 26 (25–26) long, *r* setiform, 14 (14–15) long, distances between basal rim of tarsus IV and proximal sucker *d* 30 (29–30), between *d* and *e* 18 (17–18), between *e* and *f* 14 (13–14), ratio (a+b): c = 3.4 (3.4–3.5), *f* 14 (14–15) long, *s* 5 (5–5.5), *u* 4, *v* 6 (6–6.5), *p* and *q* 3 (3–3.5), empodium 13 (12–13), claw 11 (11–12).

Distribution. BASED ON MATERIAL EXAMINED: Cook Is, Fiji, Niue, Samoa, Tonga.

Material examined. Holotype, 66 paratypes and 5 non-type specimen — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: banana, *Cerbera mallam* seeds, coconut, guava.

Etymology. The species name *pacificus* refers to the distribution of this species in the South Pacific region.

Remarks. This new species, *T. pacificus*, is similar to *T. curvipeni*s Fain & Fauvel in having a pair of eyespots on prodorsal shield, coxal plate II being broadly triangular and male having a S-shaped aedeagus, but differs from the latter in supracoxal seta *scx* being widened at bases of pectinations (Fig. 131) rather than slender and tapering from bases to tips (Fig. 25); ω_1 on tarsus I being stout (Fig. 132) rather than slender (Fig. 26); aedeagus in male being longer (Fig. 136) than that of *T. curvipeni*s (Fig. 30).

Tyrophagus perniciosus Zakhvatkin

Fig. 139–148, Plates 4A, 5M, 9A, 13A, 14M, 15M, 19A, 20M, 24A, 28E, F, 30M, 31M, 35A

Tyrophagus perniciosus Zakhvatkin, 1941: 104; Hughes, 1976: 62; Nakao & Kurosa, 1988: 138.

Diagnosis. **Female**. Eyespots absent; *scx* strong tapering from base to tip or slightly widened in basal 2/3, with 16–22 moderate or short pectinations; d_1 about 2.9 (2.4–3.2)× length of c_1 and 2.7 (2.7–3.8)× length of d_2; d_2 about 0.9× length of c_1; coxal plates I not reaching apex of prosternal apodeme; coxal plates II triangular, not extending posteriorly beyond apex of apodeme II, with 2/3 of posterior margin slightly concave. Spermathecal duct broad, widening gradually from midway to base of spermathecal sac, base of spermathecal sac broadly round, bending backwards. Tarsus I ω_1 stout, obviously clavate, tarsus II ω stout, slightly clavate; setae *w* and *r* of tarsus IV spiniform.

Male. Eyespots, coxal plates, solenidia I ω_1 and II ω as in female; d_1 about 4.0 (3.2–4.0)× length of c_1 and 3.4 (2.9–3.4)× length of d_2; d_2 about 1.2 (1.1–1.2)× length of c_1; aedeagus with one major curve, narrowing gradually in basal 1/4 and almost straight in distal 3/4, distal end nearly truncated, internal diameter of distal 3/4 broad, lateral arms supporting aedeagus turning inwards; setae *w* and *r* of tarsus IV spiniform; ratio (a+b): c = 1.9 (1.4–1.9).

Description. **Female** (Fig. 139–143, Plates 4A, 5M, 9A, 13A, 14M, 15M)

Idiosoma. 572 (438–574) long, 387 (239–387) wide. Chelicera 106 (87–106) long, cheliceral seta *cha* conical and apcally truncated, 7 (7–10) long; subcapitular setae *m* 41 (41–43); palpal supracoxal seta *elcp* 16 (16–17) long, dorsal palptibial seta 27 (25–27), lateral palptibial seta 19

(19–21), dorsal palptarsal seta 19 (17–19), palptarsal solenidion 4 (4–4.5). **Dorsum**. Prodorsal shield nearly rectangular, its lateral margins slightly concave and posterior margins broadly round; 91 (87–91) long, 116 (109–120) wide between *ve-ve*. Eyespots absent. Grandjean's organ finger-like (16–21 long), its basal lobe with 3–5 spiniform teeth. Supracoxal seta *scx* tapering from base to tip or slightly widened in basal 2/3, with 16–22 moderate or short pectinations, 42 (38–42) long. Ratios: *vi*: *ve* = 1.9 (1.7–2.0), *sci*: *sce* = 1.6 (1.5–1.6), *sci–sci*: *sci–sce* = 1.8 (1.3–1.8). Lengths of setae: *vi* 98 (97–98), *ve* 62 (51–62), *sci* 185 (185–205), *sce* 116 (116–135); distances: *vi–vi* 16 (15–16), *vi–ve* 51 (49–51), *sci–sci* 51 (40–51), *sci–sce* 29 (29–31). Hysterosomal setae d_1 about 2.9 (2.4–3.2)× length of c_1 and 2.7 (2.7–3.8)× length of d_2; d_2 about 0.9× length of c_1; lengths of setae: c_1 47 (41–51), c_2 206 (202–208), c_p 141 (131–145), c_3 43 (31–44), d_1 138 (124–138), d_2 51 (35–51), e_1 261 (257–299), e_2 224 (204–227), f_2 278 (278–331), h_1 311 (311–352), h_2 333 (311–354), h_3 253 (238–331); distances: c_1–c_1 152 (129–153), c_1–d_1 62 (43–62), d_1–d_1 91 (65–92), d_2–*gla* 69 (50–69), d_1–e_1 119 (86–119), e_1–e_1 167 (167–169). **Venter**. Coxal plates I terminating well before apex of prosternal apodeme; coxal plates II triangular, not reaching apex of its apodeme, with an almost straight posterior margin. Setae *1a* 0.7 (0.7–0.8)× length of coxal plate II, 40 (40–43) long, *3a* 27 (23–34); *3b* 1.7 (1.3–1.8)× length of *3a*, 47 (42–47); *g* 22 (22–24), *4a* 43 (43–47). Pseudanal setae ps_1 1.5 (1.4–1.9)× as long as ps_2, 224 (216–224) long, ps_2 4.6 (4.6–5.8)× length of ps_3, 152 (114–162) long, ps_3 33 (25–33). Adanal setae ad_1 36 (31–36), ad_2 29 (24–30), ad_3 26 (16–26). Copulatory opening 16 (16–18) in diameter, spermathecal duct broad, widening gradually from midway to base of spermathecal sac, base of spermathecal sac broadly round, bending backwards, distance between sclerites of oviducts 45 (41–49).

Legs. **Leg I.** 247 (213–247) long; femur I 63 (62–65), *vF* simple, 51 (51–52) long; genu I 43 (43–46), σ' 60 (55–60), σ" 31 (27–31), Iσ': σ" = 2.0, *cG* 49 (44–49), *mG* 53 (47–53); tibia I 32 (32–34), φ 121 (121–143), *gT* 24 (24–27), *hT* 38 (33–38); tarsus I 88 (83–90) long, 28 (23–29) wide, $ω_1$ stout, obviously clavate, 19 (17–19) long, ε 5 (3–5), $ω_2$ 8 (8–9), $ω_3$ 34 (33–38), distance between *aa* and $ω_1$ about 12 (8–12), *aa* 27 (27–28) long, *ba* 28 (27–31), *wa* 43 (43–55), *ra* 28 (28–35), *la* 24 (23–27), *d* 41 (38–41), *e* 10 (10–13), *f* 19 (19–21), *s* 9 (8–9), *u* and *v* 7 (7–8), *p* and *q* 9 (9–10), empodium 24 (23–24), claw 21 (21–24). **Leg II**. 216 (214–220) long; femur II 61 (57–62), *vF* 70 (62–70); genu II 38 (38–43), σ 25 (22–25), *cG* 40 (40–41), *mG* 54 (47–54); tibia II 31 (30–31), φ 131 (107–145), *gT* 26 (25–30), *hT* 41 (38–39); tarsus II 88 (77–87) long, 24 (21–24) wide, ω stout, slightly clavate, 20 (20–21) long, *ba* 29 (28–33), *wa* 47 (47–49), *ra* 44 (42–44), *la* 24 (19–24), *d* 28 (28–30), *e* 11 (11–12), *f* 18 (20–22), *s* 8 (8–9), *u* and *v* 8 (7–8), *p* and *q* 9 (9–10), empodium 22 (17–22), claw 24 (23–25). **Leg III**. 242 (207–242) long; femur III 47 (43–50); genu III 37 (33–39), σ 22 (22–23), *nG* 63 (50–63); tibia III 34 (30–34), φ 134 (129–146), *kT* 49 (40–52); tarsus III 97 (93–97) long, 19 (16–19) wide, *w* setiform, 37 (37–43) long, *r* setiform, 35 (35–37) long, *d* 29 (26–35), *e* 10 (10–11), *f* 21 (21–27), *s* 8 (7–8), *u* 7 (6–7), *v* 8 (7–8), *p* and *q* 4 (4–4.5), empodium 19 (15–21), claw 19 (17–22). **Leg IV**. 277 (242–277) long; femur IV 59 (51–59), *wF* 41 (35–41); genu IV 46 (45–46); tibia IV 37 (36–38), φ 118 (118–128), *kT* 37 (23–37); tarsus IV 112 (108–112) long, 19 (17–20) wide, *w* spiniform, 37 (37–44) long, *r* spiniform, 24 (22–24) long, *d* 31 (27–34), *e* 8 (8–11), *f* 25 (23–26), *s* 7 (7–8), *u* 7 (6–7), *v* 8 (7–8), *p* and *q* 4 (4–4.5), empodium 22 (15–23), claw 17 (17–19).

Male (Fig. 144–148, Plates 19A, 20M, 24A, 28E, F, 30M, 31M, 35A)

Idiosoma. 419 (362–419) long, 296 (236–296) wide. Chelicera 92 (74–92) long, cheliceral seta *cha* conical and distally truncated, 7 (5–7) long, subcapitular setae *m* 36 (29–36); palpal supracoxal seta *elcp* 13 (10–13) long, dorsal palptibial seta 22 (19–22), lateral palptibial seta 16 (13–16), dorsal palptarsal seta 13 (11–13), palptarsal solenidion 3 (3–4). **Dorsum**. Prodorsal shield as in female, 74 (61–74) long, 95 (73–95) wide between *ve-ve*. Eyespots absent. Grandjean's organ as in female, 17 (14–17) long; supracoxal seta *scx* slightly widened in basal 2/3, with 10–18 moderate or short pectinations, 33 (29–33) long. Ratios: *vi*: *ve* = 2.0 (1.8–2.0), *sci*: *sce* = 1.8 (1.8–1.9), *sci–sci*: *sci–sce* = 1.5. Lengths of setae: *vi* 85 (65–85), *ve* 42 (36–42), *sci* 169 (131–169), *sce* 94 (70–94); distances: *vi–vi* 15 (11–15), *vi–ve* 41 (31–41), *sci–sci* 37 (30–37), *sci–sce* 24 (20–24). Hysterosomal setae d_1 about 4.0 (3.2–4.0)× length of c_1 and 3.4 (2.9–3.4)× length of d_2; d_2 about 1.2 (1.1–1.2)× length of c_1; lengths of setae: c_1 26 (21–26), c_2 183 (142–183), c_p 116 (83–116), c_3 32 (21–32), d_1 104 (67–104), d_2 31 (23–31), e_1 253 (218–253), e_2 201 (147–201), f_2 286 (278–286), h_1 321 (295–321), h_2 314 (299–314), h_3 258 (208–258); distances: c_1–c_1 127 (113–127), c_1–d_1 52 (44–52), d_1–d_1 62 (58–62), d_2–*gla* 36 (36–42), d_1–e_1 79 (71–79), e_1–e_1 124 (110–124). **Venter**. Shape of coxal plates I and II as in female. Setae *1a* 0.7 (0.5–0.7)× length of coxal plate II, 33 (22–33); *3a* 22 (13–22); *3b* 1.8 (1.8–2.1)× length of *3a*, 39 (27–39); *g* 20 (12–20), *4a* 41 (29–41). Aedeagus with one major curve, narrowing gradually in basal 1/4 and almost straight in distal 3/4, distal end nearly truncated, 26 (24–26) long, internal diameter of distal 3/4 broad; lateral arms supporting aedeagus turning inwards. Anal slit 74 (59–74) long, distance between anterior rim of anal slit and posterior mar-

gin of aedeagus 11 (5–11). Anal suckers about 27 (23–27) in diameter; anal discs 4 in diameter, distance between right and left discs 40 (27–40). Pseudanal setae ps_1 about 4.7 (4.7–5.0)× length of ps_2, 191 (145–191) long, ps_2 3.4 (2.4–3.4)× length of ps_3, 41 (29–41) long, ps_3 12 (12–13); ps_2–ps_2 1.3 (1.3–1.4)× distance ps_1–ps_1, ps_1–ps_1 40 (28–40), ps_2–ps_2 51 (40–51).

Legs. **Leg I.** 201 (167–201) long; femur I 56 (45–56), *vF* simple, 46 (37–46) long; genu I 40 (31–40), σ' 51 (43–51), σ" 26 (22–26), Iσ': σ" = 2.0, *cG* 31 (25–31), *mG* 39 (31–39); tibia I 30 (26–30), φ 106 (99–106), *gT* 21 (16–21), *hT* 25 (22–25); tarsus I 80 (65–80) long, 23 (18–23) wide, ω_1 stout and clavate, 14 (10–14) long, ε 4 (3–4), ω_2 7 (5–7), ω_3 31 (25–31), distance between *aa* and ω_1 about 8 (8–9), *aa* 23 (12–23) long, *ba* 24 (21–24), *wa* 41 (34–41), *ra* 27 (26–27), *la* 18 (16–18), *d* 31 (21–31), *e* 8 (6–8), *f* 14, (13–14), *s* 7 (6–7), *u* and *v* 7 (6–7), *p* and *q* 8 (8–9), empodium 19 (15–19), claw 15 (13–15). **Leg II**. 189 (153–189) long; femur II 53 (41–53), *vF* 44 (37–44); genu II 40 (30–40), σ 23 (14–23), *cG* 33 (22–33), *mG* 35 (25–35); tibia II 30 (27–30), φ 118 (99–118), *gT* 16 (13–16), *hT* 24 (18–24); tarsus II 75 (60–75) long, 20 (15–20) wide, ω stout, slightly clavate, 17 (13–17) long, *ba* 22 (16–22), *wa* 43 (34–43), *ra* 34 (24–34), *la* 23 (15–23), *d* 29 (21–29), *e* 7 (6–7), *f* 18 (13–18), *s* 7 (6–7), *u* and *v* 7 (6–7), *p* and *q* 8 (8–9), empodium 15 (15–16), claw 15 (14–15). **Leg III**. 204 (163–204) long; femur III 43 (35–43); genu III 35 (27–35), σ 21 (21–22), *nG* 47 (29–47); tibia III 27 (21–27), φ 124 (103–124), *kT* 23 (21–23); tarsus III 80 (67–80) long, 15 (12–15) wide, *w* setiform, 31 (21–31), *r* setiform, 29 (20–29), *d* 28 (20–28), *e* 6 (6–7), *f* 23 (19–23), *s* 7 (6–7), *u* 6 (5–6), *v* 7 (6–7), *p* and *q* 3 (3–4), empodium 14, claw 15 (13–15). **Leg IV**. 222 (184–222) long; femur IV 59 (39–59), *wF* 30 (26–30); genu IV 40 (33–40); tibia IV 33 (27–33), φ 106 (106–110), *kT* 23 (19–23); tarsus IV 88 (74–88) long, 16 (11–16) wide, *w* and *r* situated at level between suckers, *w* spiniform, 28 (20–28) long, *r* spiniform, 13 (10–13) long, distances between basal rim of tarsus IV and proximal sucker *d* 23 (16–23), between *d* and *e* 22 (17–22), between *e* and *f* 24 (23–24), ratio (a+b): c = 1.9 (1.4–1.9), *f* 23 (17–23) long, *s* 7 (6–7), *u* 6 (5–6), *v* 7 (6–7), *p* and *q* 4, empodium 15, claw 14 (12–14).

Distribution. BASED ON MATERIAL EXAMINED: Australia.
BASED ON LITERATURE: Australia (Hughes 1976), Bulgaria (Hughes 1976), U.K. (Hughes 1976), Germany (Kazhdaya 1996), Japan (Nakao & Kurosa 1988), Kazakhstan (Sadieva 1984), Netherlands (Jonge 1988), Russia (Zahkvatkin 1941), Turkey (Cobanoglu & Bayram 1998), U.S.A. (USDA 1981).

Material examined. 24 non-type specimens — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: cauliflower seedlings, melon, mushrooms (*Morchella conica* and *M. esculenta*), oil-producing seed and probably many other plants stored in granaries and warehouses, pumpkin, soil and dead plant residues, spinach, tomato (seed & newly germinating plants), various grain products (cereals, etc.).

Feeding on the mycelium of *Sporidesmium mucosum* var. *pluriseptatum* on cucumber.

ANIMAL OR ANIMAL PRODUCTS: bird cage, budgerigar cage, human (causing acariasis), nests of house-martins (*Delichon urbica*) and starlings (*Sturnus vulgaris*).

Remarks. This species can be distinguished from other species in the genus by its robust nature: the female reproductive tract being composed of a broad spermatheca with the sclerite supporting the spermathecal sac being of a very wide diameter so that sclerites of oviducts are broadly spaced; the aedeagus in male being stout with distal 3/4 of its internal diameter broad and terminating in a distinct truncated tip, and ω_1 a stout club.

The specimens associated with the Polynesian rat on the Tokelau Islands (Ramsay 1977) are not *T. perniciosus* but likely to be *T. vanheurani* Oudemans. The mite species associated with soft wax scale and Chinese wax scale (Lo 1995) were also misidentified as *T. perniciosus*.

Tyrophagus tropicus Robertson

Fig. 149–158, Plates 4B, 5N, 9B, 13B, 14N, 15N, 19B, 20N, 24B, 29A, B, 30N, 31N, 35B

Tyrophagus tropicus Robertson, 1959: 173; Wildies, 2000, 149.

Diagnosis. **Female**. Eyespots absent but marginal area of shield faintly punctate; *scx* broadly widened at bases of pectinations, with 16–22 moderate or short pectinations; setae d_1 about 2.2 (1.2–2.7)× length of c_1 and 1.2 (0.7–1.5)× length of d_2; d_2 about 1.9 (1.2–1.9)× length of c_1; coxal plates I and II obscure. Adanal setae ad_1 very long, 4.8 (2.7–4.8) × length of ad_3 and ps_3; ad_2 may also extended. Spermathecal duct narrowing gradually from copulatory opening for a distance nearly 1.3× distance between sclerites of oviducts and then forming a thin tube leading to base of spermathecal sac over a distance about 2.0× distance between sclerites of oviducts, base of spermathecal sac large and flat. Tarsus I ω_1 stout, slightly clavate, tarsus II ω stout, obviously clavate; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates, solenidia I ω_1 and II ω as in female; d_1 about 2.2 (1.2–2.7)× length of c_1 and 1.2 (0.7–1.5)× length of d_2; d_2 about 1.9 (1.2–1.9)× length of c_1;

aedeagus very short, with one major curve, its internal diameter of distal 1/3 spindle-form and of basal 2/3 linear, lateral arms supporting aedeagus turning outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 1.8 (1.5–1.8).

Description. **Female** (Fig. 149–153, Plates 4B, 5N, 9B, 13B, 14N, 15N)

Idiosoma. 443 (373–773) long, 281 (227–281) wide. Chelicera 84 (52–84) long, cheliceral seta *cha* conical, 5 long, subcapitular setae *m* 32 (29–32), palpal supracoxal seta *elcp* slender, 18 (15–18) long, dorsal palptibial seta 20 (19–21), lateral palptibial seta 14 (11–14), dorsal palptarsal seta 12 (10–12), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral edeges almost straight and posteriolateral edeges nearly straight, 73 (57–73) long, 85 (73–85) wide between *ve-ve*. Eyespots absent but marginal area of shield faintly punctate. Grandjean's organ finger-like (12 long), its basal lobe with 3 spiniform teeth. Supracoxal seta *scx* broadly widened at bases of pectinations, with 16–22 moderate or short pectinations, 34 (31–34) long. Ratios: *vi*: *ve* = 1.6 (1.3–1.6), *sci*: *sce* = 1.3 (1.2–1.3), *sci–sci*: *sci–sce* = 1.5 (1.5–1.9). Lengths of setae: *vi* 85 (60–85), *ve* 52 (42–58), *sci* 131 (74–131), *sce* 103 (57–103); distances: *vi–vi* 15 (9–15), *vi–ve* 40 (33–40), *sci–sci* 40 (37–47), *sci–sce* 27 (21–33). Hysterosomal setae d_1 about 2.2 (1.2–2.7)× length of c_1 and 1.2 (0.7–1.5)× length of d_2; d_2 about 1.9 (1.2–1.9)× length of c_1; lengths of setae: c_1 43 (33–43), c_2 168 (55–138), c_p 155 (57–155), c_3 48 (37–48), d_1 93 (41–93), d_2 80 (59–80), e_1 238 (63–238), e_2 206 (112–206), f_2 348 (303–348), h_1 288 (67–333), h_2 345 (304–345), h_3 275 (205–275); distances: c_1–c_1 107 (89–107), c_1–d_1 45 (37–48), d_1–d_1 67 (58–67), d_2–*gla* 67 (51–67), d_1–e_1 97 (84–97), e_1–e_1 117 (97–117). **Venter**. Coxal plates I and II obscure (not detectable). Setae *1a* 1.1 (1.0–1.2)× length of coxal plate II, 51 (40–51), *3a* 25 (20–25); *3b* 2.0 (2.0–2.1)× length of *3a*, 51 (42–51); *g* 19 (19–23), *4a* 73 (69–78). Pseudanal setae, ps_1 1.5 (1.3–1.5)× as long as ps_2, 233 (188–233) long, ps_2 very long, about 6.1 (5.3–6.1)× length of ps_3, 158 (122–162) long, ps_3 26 (21–32). Adanal setae ad_1 very long, 105 (57–105), ad_2 long, 61 (23–61), ad_3 22 (21–22). Copulatory opening with a circular shield supporting sclerotised pad, 11 (10–11) in diameter, spermathecal duct narrowing gradually from copulatory opening for a distance nearly 1.3× distance between sclerites of oviducts and then forming a thin tube leading to base of spermathecal sac over a distance about 2.0× distance between sclerites of oviducts, base of spermathecal sac a large, flat circle, distance between sclerites of oviducts 12.5.

Legs. **Leg I.** 183 (158–183) long; femur I 47 (42–47), *vF* simple, 49 (44–50) long; genu I 35 (28–35), σ' 31 (22–31), σ" 21 (16–26), Iσ': σ" = 1.5 (1.3–1.7), *cG* 23 (23–30), *mG* 41 (32–41); tibia I 32 (24–32), φ 88 (87–98), *gT* 24 (20–24), *hT* 23 (20–23); tarsus I 75 (59–75) long, 17 (16–18) wide, ω_1 stout, slightly clavate, 15 (13–19) long, ε 4 (3–5), ω_2 5 (4–5), ω_3 18 (18–20), distance between *aa* and ω_1 about 10 (8–10), *aa* 13 (10–13) long, *ba* 18 (17–18), *wa* 29 (29–33), *ra* 27 (23–28), *la* 20 (15–20), *d* 29 (29–32), *e* 8 (7–8), *f* 14 (12–14) , *s* 5, *u* and *v* 5 (4–5), *p* and *q* 6 (5–6), empodium 11 (8–11), claw 14 (12–14). **Leg II**. 171 (145–171) long; femur II 47 (40–47), *vF* 63 (51–63); genu II 32 (28–32), σ 16 (11–16), *cG* 26 (23–26), *mG* 31 (29–33); tibia II 27 (22–27), φ 102 (89–102), *gT* 20 (16–20), *hT* 18 (18–23); tarsus II 69 (57–69) long, 17 (14–17) wide, ω stout, obviously clavate,18 (17–21) long, *ba* 21 (17–21), *wa* 36 (25–36), *ra* 21 (20–27), *la* 16 (14–16), *d* 29 (20–29), *e* 7 (6–7), *f* 17 (12–17), *s* 5, *u* and *v* 4, *p* and *q* 5 (5–6), empodium 11 (8–11), claw 12 (10–12). **Leg III**. 187 (157–187) long; femur III 40 (32–40); genu III 31 (26–31), σ 10 (7–10), *nG* 39 (32–39); tibia III 31 (23–31), φ 89 (72–89), *kT* 40 (24–40); tarsus III 82 (64–82) long, 15 (11–15) wide, *w* setiform, 29 (24–29) long, *r* setiform, 30 (21–30) long, *d* 23 (19–23), *e* 7 (6–7), *f* 23 (16–23), *s* 6 (5–6), *u* 4.5, *v* 4.5, *p* and *q* 4 (3–4), empodium 11 (8–11), claw 13 (9–13). **Leg IV**. 225 (193–225) long; femur IV 45 (40–45), *wF* 55 (43–55); genu IV 37 (32–37); tibia IV 35 (27–35), φ 82 (65–82), *kT* 31 (18–31); tarsus IV 90 (79–90) long, 14 (11–14) wide, *w* setiform, 33 (21–33) long, *r* setiform, 25 (24–26) long, *d* 29 (19–29), *e* 7 (6–7), *f* 25 (15–25), *s* 6, *u* 5, *v* 5.5, *p* and *q* 4 (3–4), empodium 10 (7–10), claw 13 (9–13).

Male (Fig. 154–158, Plates 19B, 20N, 24B, 29A, B, 30N, 31N, 35B)

Idiosoma. 367 (307–367) long, 243 (187–243) wide. Chelicera 67 (61–67) long, cheliceral seta *cha* conical, 4 (4–5) long, subcapitular setae *m* 27 (24–29), palpal supracoxal seta *elcp* slender, 13 (13–14) long, dorsal palptibial seta 18 (17–18), lateral palptibial seta 12 (10–12), dorsal palptarsal seta 11 (10–11), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield 55 (55–58) long, 67 (58–67) wide between *ve-ve*. Eyespots absent but marginal area of shield faintly punctate as in female; Grandjean's organ finger-like (8–13 long), its basal lobe with 3–4 spiniform teeth; *scx* as in female, 26 (24–27) long. Ratios: *vi*: *ve* = 1.5 (1.3–1.5), *sci*: *sce* = 1.4 (1.4–1.5), *sci–sci*: *sci–sce* = 1.5. Lengths of setae: *vi* 66 (55–66), *ve* 43 (37–43), *sci* 123 (91–125), *sce* 87 (65–87); distances: *vi–vi* 10 (9–10), *vi–ve* 33 (26–33), *sci–sci* 25 (32–36), *sci–sce* 26 (20–33). Hysterosomal setae d_1 about 2.6 (1.8–2.6)× length of c_1 and 1.2 (0.9–1.2)× length of d_2; d_2 about 2.2 (1.9–2.4)× length of c_1; lengths of setae: c_1 27 (22–33), c_2 128 (100–143), c_p 130 (101–130), c_3 43 (30–43), d_1 70 (42–70), d_2 60 (43–67), e_1 188 (153–192), e_2 151 (111–155), f_2 235 (228–245), h_1 196 (185–232), h_2 266 (250–289), h_3 151

(135–187); distances: c_1–c_1 90 (72–90), c_1–d_1 44 (32–44), d_1–d_1 60 (50–60), d_2–*gla* 57 (42–57), d_1–e_1 102 (70–102), e_1–e_1 100 (82–100). **Venter**. Shape of coxal plates I and II obscure, not discernable. Setae *1a* 1.0 (0.8–1.0)× length of coxal plate II, 35 (27–35); *3a* 17 (14–19); *3b* 2.1 (1.8–2.4)× length of *3a*, 36 (33–37) long; *g* 21 (12–21), *4a* 54 (40–54). Aedeagus very short (13–15 long), with one major curve, nearly cylindrical in basal half and narrowing gradually in distal half, distal end slightly expanded and truncate, its internal diameter of distal 1/3 spindle-form and of basal 2/3 linear, lateral arms supporting aedeagus turning outwards. Anal slit 60 (52–60) long, distance between anterior rim of anal slit and posterior margin of aedeagus 25 (17–25). Anal suckers about 23 (20–23) in diameter; anal discs 5 in diameter, distances between right and left discs 25 (25–27). Pseudanal setae ps_1 about 2.2 (1.5–2.3)× length of ps_2, 111 (88–113) long, ps_2 4.2 (3.0–5.9)× length of ps_3, 50 (44–60) long, ps_3 12 (9–15); ps_2–ps_2 1.8 (1.7–1.9)× distance ps_1–ps_1, ps_1–ps_1 27 (25–28), ps_2–ps_2 48 (46–50).

Legs. **Leg I.** 140 (133–143) long; femur I 35 (35–37), *vF* simple, 42 (35–42) long; genu I 27 (25–27), σ' 26 (21–26), σ" 17 (12–17), Iσ': σ" = 1.5 (1.5–2.3), *cG* 28 (24–28), *mG* 33 (27–33); tibia I 25 (20–25), φ 78 (67–78), *gT* 19 (15–19), *hT* 15 (14–19); tarsus I 57 (53–57) long, 15 (14–15) wide, shape of ω_1 stout, slightly tapering at apex, 14 (13–14) long, ε 3 (3–3.5), ω_2 4 (3.5–4.5), ω_3 17 (16–17), distance between *aa* and ω_1 about 7 (6–7), *aa* 12 (11–12) long, *ba* 12 (11–14), *wa* 27 (27–35), *ra* 23 (19–25), *la* 12 (12–16), *d* 18 (17–19), *e* 7 (6–7), *f* 11 (11–12), *s* 5 (5–5.5), *u* and *v* 3 (3–3.5), *p* and *q* 4 (4–5), empodium 8 (7–8), claw 12 (11–12). **Leg II**. 132 (132–141) long; femur II 35 (32–37), *vF* 49 (44–49); genu II 25 (24–25), σ 13 (9–13), *cG* 22 (15–22), *mG* 24 (16–24); tibia II 21 (19–21), φ 91 (77–91), *gT* 11 (11–13), *hT* 12 (12–16); tarsus II 51 (50–56) long, 14 (14–15) wide, ω obviously clavate, 15 (15–16) long, *ba* 17 (13–17), *wa* 29 (27–32), *ra* 27 (25–27), *la* 16 (13–16), *d* 20 (15–20), *e* 6, *f* 13 (11–13), *s* 5 (5–5.5), *u* and *v* 4 (3–4), *p* and *q* 4 (4–5), empodium 8 (8–9), claw 11 (10–11). **Leg III**. 150 (137–152) long; femur III 30 (30–31); genu III 25 (23–25), σ 7 (6–7), *nG* 34 (23–34); tibia III 22 (22–23), φ 73 (64–72), *kT* 26 (22–26); tarsus III 61 (58–65) long, 14 (11–14) wide, *w* setiform, 25 (23–27) long, *r* setiform, 20 (19–23) long, *d* 20 (19–20), *e* 6, *f* 17 (15–18), *s* 5 (5–6), *u* 4, *v* 4 (4–4.5), *p* and *q* 4 (3–4), empodium 8 (8–9), claw 11 (9–11). **Leg IV**. 165 (157–170) long; femur IV 35 (35–37), *wF* 29 (27–29); genu IV 31 (27–31); tibia IV 29 (25–29), φ 71 (25–29), *kT* 21 (17–22); tarsus IV 61 (57–64) long, 13 (11–13) wide, *w* and *r* situated at level between suckers, *w* setiform, 21 (18–23) long, *r* setiform, 14 (11–14) long, distances between basal rim of tarsus IV and proximal sucker *d* 14 (11–14), between *d* and *e* 17 (14–19), between *e* and *f* 17 (16–20), ratio (a+b): c = 1.8 (1.5–1.8), *f* 19 (17–19) long, *s* 6 (5–6), *u* 4 (4–4.5), *v* 5 (4–5), *p* and *q* 3 (3–4), empodium 8 (8–9), claw 11 (10–11).

Distribution. BASED ON MATERIAL EXAMINED: Africa, China (Hong Kong), Malaysia, Nigeria, Samoa, West Africa.
BASED ON LITERATURE: China (east) (Wang 1985), Germany (Wildies 2000), India (Putatunda & Abrol 2003), Nigeria (Robertson 1959).

Material examined. Holotype, 3 paratypes, and 16 non-type specimen — see Appendix 1 for details of specimens examined.

Habitat and host. PLANT OR PLANT PRODUCTS: bananas, cocoa (*Theobroma cacao*) beans, dried fruit, dried lychee, palm kernel dust.

Remarks. This species is readily recognized amongst species of the genus with its idiosomal setae d_2 being about twice length of c_1. Females of the species are distinctive with the adanal setae ad_1 being very long, about twice length of ad_2. Aedeagus of male is similar to that of *T. vanheurni* Oudemans in having one major curve and being short, but can be differentiated from the latter by lateral arms supporting aedeagus turning outwards (Fig. 156) rather than inwards (Fig. 106).

Dorsal idiosomal setae *vi*, *sci*, *sce*, c_2, c_p, e_1, e_2 and h_1 of some specimens from Hong Kong and Malaysia are stout and reduced in length.

Tyrophagus womersleyi sp. n.

Fig. 159–163, Plates 4C, 5O, 9C, 13C, 14O, 15O

Diagnosis. **Female**. Eyespots present; *scx* slightly to moderately widened at bases of pectinations, with 8–9 moderate or short pectinations; d_1 3.9× length of c_1 and 3.0× length of d_2; d_2 1.3× length of c_1; coxal plates I and II large, both extending just beyond posterior apex of their respective apodemes; coxal plates II with posterior margin convex. Spermathecal duct narrowing rapidly from copulatory opening for a distance nearly 1.5× distance between sclerites of oviducts and then forming a thin tube leading to base of spermathecal sac over a distance about 3.2× distance between sclerites of oviducts, base of spermathecal sac large and flat. Tarsus I ω_1 obviously widened at apex, and tarsus II ω stout, almost cylindrical; setae *r* of tarsus IV spiniform.

Description. **Female** (Fig. 159–163, Plates 4C, 5O, 9C, 13C, 14O, 15O)
Idiosoma. 348 long, 208 wide. Chelicera 73 long, cheliceral seta *cha* conical with bifurcated tip, 4.5 long, subcapitular setae *m* 24, palpal supracoxal seta *elcp* smooth and slen-

der, 10 long, dorsal palptibial seta 27, lateral palptibial seta 13, dorsal palptarsal seta 14, palptarsal solenidion 3. **Dorsum**. Prodorsal shield nearly pentagonal, its lateral margins strongly concave and posterolateral margins slightly concave; 66 long, 69 wide between *ve-ve*. Eyespots present, faint. Grandjean's organ finger-like (12), its basal lobe with 2 basally spiniform teeth. Supracoxal seta *scx* slightly or moderately widened in basal half, with 8–9 moderate or short pectinations, 33 long. Ratios: *vi*: *ve* = 1.5, *sci–sci*: *sci–sce* = 1.5. Lengths of setae: *vi* 68, *ve* 44, *sci* 152, *sce* 73; distances: *vi–vi* 10, *vi–ve* 30, *sci–sci* 30, *sci–sce* 20. Hysterosomal setae d_1 about 3.9× length of c_1 and 3.0× length of d_2; d_2 1.3× length of c_1; lengths of setae: c_1 24, c_2 177, c_p 163, c_3 28, d_1 93, d_2 31, e_1 303, e_2 231, f_2 318, h_1 310, h_2 338, h_3 309; distances: c_1–c_1 76, c_1–d_1 54, d_1–d_1 26, d_2–*gla* 34, d_1–e_1 59, e_1–e_1 80. **Venter**. Coxal plates I and II well developed extending just beyond apex of their respective apodemes; coxal plates II with posterior margin convex. Setae *1a* 0.7× length of coxal plate II, 30, *3a* 17; *3b* 2.8× length of *3a*, 35; *g* 13, *4a* 59. Pseudanal setae ps_1 2.7× as long as ps_2, 205 long, ps_2 5.5× length of ps_3, 77 long, ps_3 14. Adanal setae ad_1 12, ad_2 10, ad_3 11. Copulatory opening 8.5 in diameter, Spermathecal duct narrowing rapidly from copulatory opening for a distance nearly 1.5× distance between sclerites of oviducts and then forming a thin tube leading to base of spermathecal sac over a distance about 3.2× distance between sclerites of oviducts, base of spermathecal sac large and flat, distance between sclerites of oviducts 9.5.

Legs. **Leg I.** 167 long; femur I 43, *vF* simple, 37 long; genu I 33, σ' 36, σ" 18, Iσ': σ" = 2.0, *cG* 30, *mG* 42; tibia I 27, φ 101, *gT* 26, *hT* 27; tarsus I 66 long, 18 wide, ω_1 stout, obviously widened at apex, 14 long, ε 4, ω_2 7, ω_3 23, distance between *aa* and ω_1 about 11, *aa* 18 long, *ba* 20, *wa* 26, *ra* 23, *la* 21, *d* 26, *e* 6, *f* 18, *s* 5, *u* and *v* 4, *p* and *q* 5.5, empodium 14, claw 20. **Leg II**. 165 long; femur II 45, *vF* 45; genu II 31, σ 17, *cG* 27, *mG* 39; tibia II 24, φ 103, *gT* 23, *hT* 24; tarsus II 64 long, 17 wide, ω stout, almost cylindrical, 16 long, *ba* 20, *wa* 31, *ra* 25, *la* 18, *d* 28, *e* 6, *f* 13, *s* 5, *u* and *v* 4, *p* and *q* 5.5, empodium 14, claw 19. **Leg III**. 162 long; femur III 35; genu III 30, σ 18 (abnormlly 30), *kT* 41; tibia III 24, φ 122, *kT* 40; tarsus III 67 long, 13 wide, *w* setiform, 23, *r* setiform, 24, *d* 22, *e* 6, *f* 20, *s* 5.5, *u* 4.5, *v* 5.5, *p* and *q* 2.5,empodium 13, claw 19. **Leg IV**. 200 long; femur IV 41, *wF* 35; genu IV 34; tibia IV 28, φ 118, *kT* 35; tarsus IV 78 long, 13 wide, *w* setiform, 33, *r* spiniform, 14, *d* 23, *e* 6, *f* 20, *s* 5.5, *u* 4.5, *v* 5.5, *p* and *q* 2.5, empodium 13, claw 20.

MALE. Unknown.

Distribution. Australia.

Material examined. Holotype and 2 paratypes.

Type material. **Holotype** female: AUSTRALIA: **Intercepted in New Zealand**: 1/1 female (indicated) + 2 (paratype) females, 9 Oct 1978, B. Sukha, pineapples, NZAC. **Paratypes**: 1/2 females + holotype female, as holotype.

Habitat and host. Pineapple.

Etymology. The species is named in honor of the late Herbert Womersley, a famous Australian acarologist.

Remarks. Females of this newly described species, *T. womersleyi*, are similar to those of *T. curvipen*is Fain & Fauvel in having a pair of eyespots on prodorsal shield, coxal plate II being broad, and having a slender spermathecal duct; but *T. womersleyi* differs from the latter in supracoxal seta *scx* being expanded at bases of pectinations (Fig. 161) rather than slender and tapering from base to tip (Fig. 25) and setae *r* of tarsus IV being spiniform (Fig. 162) rather than setiform (Fig. 27). Females of *T. womersleyi* are also similar to those of *T. pacificus* sp. n. in the presence of eyespots, broad coxal plate II and shape of *scx*, but can be distinguished by setae *r* of tarsus IV being spiniform (Fig. 162) rather than setiform (Fig. 133), and the shape of spermathecal duct (Fig. 161, 131).

Tyrophagus xenoductus sp. n.

Fig. 164–173, Plates 4D, 5P, 9D, 13D, 14P, 15P, 19C, 20O, 24C, 29C, D, 30O, 31O, 35C

Diagnosis. **Female**. Eyespots present, faint; *scx* tapering from base to tip, with 8–10 moderate or short pectinations; d_1 about 3.2 (3.2–3.5)× length of c_1 and 2.8 (2.8–3.3)× length of d_2; d_2 about 1.1 × length of c_1; coxal plates I and II large, both with distinct concave posterior margins and both reaching the apex of their respective apodemes. Spermathecal duct small, narrowing rapidly from copulatory opening for a distance nearly 2.1× distance between sclerites of oviducts and then gradually forming a thin tube for a distance about 2.0× distance between sclerites of oviducts, and expanding rapidly near base of spermathecal sac, base of spermathecal sac small, forming a pair of sclerotised sturcture. Tarsus I ω_1 and tarsus II ω slender and distally pointed; setae *w* and *r* of tarsus IV setiform.

Male. Eyespots, coxal plates, solenidia I ω_1, and II ω as in female; d_1 about 2.7 (2.7–2.8)× length of c_1 and 2.7 (2.7–2.8)× length of d_2; d_2 about 1.0× length of c_1; aedeagus short, with one major curve, nearly cylindrical in basal 2/3 and narrowing gradually in distal 1/3, its internal diameter of distal 2/3 linear, lateral arms supporting aedeagus turning outwards; setae *w* and *r* of tarsus IV setiform; ratio (a+b): c = 3.3 (3.1–3.3).

Description. **Female** (Fig. 164–168, Plates 4D, 5P, 9D, 13D, 14P, 15P)

Idiosoma. 318 (318–335) long, 188 (188–231) wide. Chelicera 77 (77–80) long, cheliceral seta *cha* distally truncated, 4.5 (4.5–5) long, subcapitular setae *m* 27 (27–30), palpal supracoxal seta *elcp* smooth, 11 (11–12) long, dorsal palptibial seta 16 (16–18), lateral palptibial seta 11 (11–12), dorsal palptarsal seta 10 (10–12), palptarsal solenidion 4 (3–4). **Dorsum**. Prodorsal shield nearly pentagonal, its lateral and posteriolateral edeges slightly concave, 66 (66–71) long, 77 (77–82) wide between *ve-ve*. Eyespots present but not obvious. Grandjean's organ finger-like (11–12 long), its basal lobe with 2–3 spiniform teeth. Supracoxal seta *scx* tapering from base to tip, with 10 (8–10) moderate or short pectinations, 26 (26–27) long. Ratios: *vi*: *ve* = 2.1, *sci*: *sce* = 1.8, *sci–sci*: *sci–sce* = 1.4 (1.2–1.4). Lengths of setae: *vi* 89 (89–95), *ve* 43 (43–46), *sci* 169 (169–181), *sce* 96 (96–102); distances: *vi–vi* 13 (11–13), *vi–ve* 32 (32–34), *sci–sci* 27 (27–28), *sci–sce* 20 (20–23). Hysterosomal setae d_1 about 3.2 (3.2–3.5)× length of c_1 and 2.8 (2.8–3.3)× length of d_2; d_2 about 1.1 × length of c_1; lengths of setae: c_1 34 (33–34), c_2 193 (193–205), c_p 148 (136–148), c_3 53 (53–60), d_1 108 (108–115), d_2 38 (35–38), e_1 299 (299–331), e_2 209 (198–209), f_2 328 (328–332), h_1 356 (311–356), h_2 321 (321–344), h_3 242 (242–266); distances: c_1–c_1 75 (75–79), c_1–d_1 48 (43–48), d_1–d_1 29 (29–33), d_2–*gla* 33 (33–39), d_1–e_1 63 (63–72), e_1–e_1 69 (69–86). **Venter**. Coxal plates I and II large, both with distinct concave posterior margins and both reaching the apex of their respective apodemes. Setae *1a* 1.0 (1.0–1.1)× length of coxal plate II, 42 (42–45), *3a* 24 (24–25); *3b* 2.7 (2.4–2.7)× length of *3a*, 64 (59–64); *g* 21 (20–21), *4a* 63 (63–67). Pseudanal setae, ps_1 1.8 (1.7–1.8)× as long as ps_2, 164 (164–175) long, ps_2 about 3.9 (3.9–4.8)× length of ps_3, 90 (90–101) long, ps_3 23 (21–23). Adanal setae ad_1 very long, 105 (57–105), ad_2 long, 61 (23–61), ad_3 22 (21–22). Copulatory opening supported by a circular sclerotised pad, 7 (7–8) in diameter, spermathecal duct short, narrowing rapidly from copulatory opening for a distance nearly 2.1× distance between sclerites of oviducts and then gradually forming a thin tube for a distance about 2.0× distance between sclerites of oviducts, expanding rapidly near base of spermathecal sac, base of spermathecal sac small, with a pair of sclerotised structure, distance between sclerites of oviducts 8 (8–9).

Legs. **Leg I.** 186 (186–191) long; femur I 47 (45–47), *vF* simple, 48 (48–50) long; genu I 32 (32–35), σ' 42 (38–42), σ" 25 (25–31), Iσ': σ" = 1.7 (1.2–1.7), *cG* 38 (38–40), *mG* 42 (38–42); tibia I 28 (28–32), φ 112 (112–122), *gT* 38 (38–41), *hT* 39 (39–42); tarsus I 82 (82–90) long, 18 (18–21) wide, ω_1 slightly clavate and pointed at apex, 17 (17–18) long, ε 4 (3–4), ω_2 6 (5–6), ω_3 19 (19–21), distance between *aa* and ω_1 about 16 (13–16), *aa* 26 (24–26) long, *ba* 25 (24–25), *wa* 33 (30–33), *ra* 25 (23–25), *la* 20 (17–20), *d* 21 (20–21), *e* 5 (5–6), *f* 14 (12–14) , *s* 4.5 (4.5–5), *u* and *v* 5 (4–5), *p* and *q* 6 (6–7), empodium 14 (13–14), claw 13 (11–13). **Leg II**. 180 (171–180) long; femur II 43 (43–46), *vF* 56 (51–56); genu II 31 (31–33), σ 17 (14–16), *cG* 33 (33–34), *mG* 42 (39–42); tibia II 27 (27–28), φ 111 (111–121), *gT* 35 (32–35), *hT* 39 (39–43); tarsus II 76 (76–79) long, 17 (17–19) wide, ω nearly cylindrical and tapering rapidly at apex, 23 (23–24) long, *ba* 24 (24–26), *wa* 31 (31–34), *ra* 27 (21–27), *la* 20 (20–22), *d* 27 (27–29), *e* 6 (6–7), *f* 10 (10–13), *s* 4.5 (4.5–5), *u* and *v* 4 (4–5), *p* and *q* 6 (5–6), empodium 12 (12–13), claw 12 (11–12). **Leg III**. 195 (195–202) long; femur III 38 (38–40); genu III 31 (29–31), σ 19 (13–19), *nG* 42 (42–45); tibia III 27 (27–29), φ 122 (109–122), *kT* 46 (39–42); tarsus III 86 (82–86) long, 16 (16–18) wide, *w* setiform, 33 (29–33) long, *r* setiform, 21 (21–26) long, *d* 19 (19–23), *e* 5 (5–6), *f* 14 (14–16), *s* 5 (5–6), *u* 4 (4–4.5), *v* 5 (5–6), *p* and *q* 3 (2.5–3), empodium 12 (10–11), claw 12 (10–12). **Leg IV**. 216 (216–225) long; femur IV 61 (58–61), *wF* 43 (43–48); genu IV 39 (37–39); tibia IV 33 (33–35), φ 114 (108–114), *kT* 40 (40–42); tarsus IV 90 (87–90) long, 14 (14–15) wide, *w* setiform, 31 (31–33) long, *r* setiform, 22 (22–25) long, *d* 19 (19–22), *e* 6 (6–7), *f* 16 (16–18), *s* 6 (5–6), *u* 5 (4–5), *v* 5 (5–6), *p* and *q* 3 (2–3), empodium 14 (12–14), claw 11 (9–11).

Male (Fig. 169–173, Plates 19C, 20O, 24C, 29C, D, 30O, 31O, 35C)

Idiosoma. 284 (267–284) long, 163 (163–180) wide. Chelicera 62 (60–62) long, cheliceral seta *cha* conical, 4 (4–5) long, subcapitular setae *m* 22 (22–25), palpal supracoxal seta *elcp* smooth, 10 (10–11) long, dorsal palptibial seta 13 (12–13), lateral palptibial seta 10 (9–10), dorsal palptarsal seta 9 (9–10), palptarsal solenidion 3 (3–3.5). **Dorsum**. Prodorsal shield 57 (55–57) long, 62 (58–62) wide between *ve-ve*. Eyespots present but not obvious; Grandjean's organ finger-like 8 (8–9 long), its basal lobe with 2–3 spiniform teeth. *scx* as in female, 22 (19–22) long. Ratios: *vi*: *ve* = 2.0, *sci*: *sce* = 1.7 (1.7–1.8), *sci–sci*: *sci–sce* = 1.4. Lengths of setae: *vi* 71 (66–71), *ve* 36 (33–36), *sci* 165 (149–165), *sce* 93 (88–93); distances: *vi–vi* 10 (9–10), *vi–ve* 26 (26–28), *sci–sci* 25 (23–25), *sci–sce* 18 (16–18). Hysterosomal setae d_1 about 2.7 (2.7–2.8)× length of c_1 and 1.2 (0.9–1.2)× length of d_2; d_2 about 1.0× length of c_1; lengths of setae: c_1 27 (22–27), c_2 175 (156–175), c_p 131 (116–131), c_3 35 (30–35), d_1 73 (62–73), d_2 27 (23–27), e_1 272 (272–279), e_2 207 (198–207), f_2 272 (258–272), h_1 292 (284–292), h_2 296 (279–296), h_3 219 (206–219); distances: c_1–c_1 68 (62–68), c_1–d_1 38 (32–38), d_1–d_1 28 (28–31), d_2–*gla* 38 (32–38), d_1–e_1 51 (51–62), e_1–e_1 76 (72–76). **Venter**. Coxal plates I extending be-

yond apex of prosternal apodeme; coxal plates II broadly triangular, with posterior margin slightly convex. Setae *1a* 1.0× length of coxal plate II, 33 (27–33); *3a* 18 (15–18); *3b* 2.7 (2.7–2.9)× length of *3a*, 48 (43–48) long; *g* 16 (14–16), *4a* 44 (40–44). Aedeagus 16 (15–16) long, with one major curve, nearly cylindrical in basal 2/3 and narrowing gradually in distal 1/3, its internal diameter of distal 2/3 linear, basal 1/3 spindle-form, lateral arms supporting aedeagus turning outwards. Anal slit 51 (48–51) long, distance between anterior rim of anal slit and posterior margin of aedeagus 15 (15–17). Anal suckers about 16 (13–16) in diameter; anal discs 4 (3–4) in diameter, distances between right and left discs 33 (27–33). Pseudanal setae ps_1 about 3.1 (3.1–3.2)× length of ps_2, 145 (131–145) long, ps_2 4.3 (4.3–4.9)× length of ps_3, 47 (44–47) long, ps_3 11 (9–11); ps_2–ps_2 1.8 (1.7–1.8)× distance ps_1–ps_1, ps_1–ps_1 18 (17–18), ps_2–ps_2 33 (29–33).

Legs. **Leg I.** 151 (137–151)) long; femur I 37 (34–37), *vF* simple, 39 (35–39) long; genu I 25 (22–25), σ' 33 (29–33), σ" 28 (26–28), Iσ': σ" = 1.2 (1.1–1.2), *cG* 28 (24–28), *mG* 32 (26–32); tibia I 22 (19–22), φ 93 (89–93), *gT* 30 (25–30), *hT* 30 (28–30); tarsus I 63 (59–63) long, 15 (14–15) wide, ω_1 obviously clavate and rapidly tapering at apex, 15 (13–15) long, ε 3 (3–4), ω_2 4 (4–4.5), ω_3 13 (13–14), distance between *aa* and ω_1 about 8 (7–8), *aa* 17 (16–17) long, *ba* 19 (17–19), *wa* 30 (27–30), *ra* 16 (15–16), *la* 15 (12–15), *d* 20 (17–20), *e* 5 (5–6), *f* 9 (9–11), *s* 4 (4–4.5), *u* and *v* 4 (3–4), *p* and *q* 6 (5–6), empodium 12 (11–12), claw 13 (11–13). **Leg II**. 147 (138–147) long; femur II 36 (33–36), *vF* 43 (39–43); genu II 27 (26–27), σ 18 (16–18), *cG* 23 (22–23), *mG* 31 (29–31); tibia II 22 (20–22), φ 98 (98–101), *gT* 23 (19–23), *hT* 32 (29–32); tarsus II 61 (59–61) long, 13 (12–13) wide, ω almost cylindrical, 17 (16–17) long, *ba* 19 (17–19), *wa* 30 (27–30), *ra* 21 (19–21), *la* 15 (14–15), *d* 20 (18–20), *e* 5 (5–6), *f* 9 (9–11), *s* 5 (5–5.5), *u* 4, *v* 5 (4.5–5), *p* and *q* 3 (3–4), empodium 11 (10–11), claw 11 (10–11). **Leg III**. 150 (150–152) long; femur III 32 (30–32); genu III 25 (24–25), σ 21 (16–21), *nG* 36 (33–36); tibia III 23 (23–24), φ 102 (99–102), *kT* 33 (31–33); tarsus III 67 (67–68) long, 12 (11–12) wide, *w* setiform, 21 (21–23) long, *r* setiform, 19 (19–21) long, *d* 18 (18–20), *e* 5 (5–6), *f* 14 (14–15), *s* 5 (4.5–5), *u* 3 (3–4), *v* 5 (4.5–5), *p* and *q* 3 (2–3), empodium 11 (11–12), claw 10 (9–10). **Leg IV**. 171 (163–171) long; femur IV 35 (34–35), *wF* 29 (27–29); genu IV 30 (30–31); tibia IV 25 (23–25), φ 86 (86–91), *kT* 23 (22–23); tarsus IV 66 (64–66) long, 13 (12–13) wide, *w* and *r* situated at level between suckers, *w* setiform, 24 (22–24) long, *r* setiform, 16 (13–16) long, distances between basal rim of tarsus IV and proximal sucker *d* 26 (24–26), between *d* and *e* 17 (14–17), between *e* and *f* 13 (12–13), ratio (a+b): c = 3.3 (3.1–3.3), *f* 17 (17–19) long, *s* 5 (5–5.5), *u* 4 (3–4), *v* 5 (5–6), *p* and *q* 3 (2–3), empodium 12 (10–12), claw 8 (8–9).

Distribution. Tonga.

Material examined. Holotype and 7 paratypes.

Type material. **Holotype** female: TONGA: **Intercepted in New Zealand**: 1/1 female (indicated), 1 allotype male, 1 (paratype) male, 1 (paratype) tritonymph [+ *Tyrophagus pacificus* 1 female] (P.Q.A. 8563), 9 Mar 1977, S. Hevvies, bananas, NZAC. **Paratypes**: 1/ 2male, 1 tritonymph + holotype female, as holotype. TONGA: **Intercepted in New Zealand**: 1/2 females [+ *Tyrophagus pacificus* 2 females] (P.Q.A. 100), 27 Apr 1977, J. Bongiovanni, bananas, MAF/A. 1/2 females [+ *Tyrophagus pacificus* 1 female + *Calvolia* sp. 9 females] (P.Q.A. 859), 6 Jan 1978, S.M. Aldridge, bananas, MAF/A.

Habitat and host. Banana.

Etymology. The species name is a combination of *xeno* (foreign or alien) and *ductus* (a duct) for the shape of spermathecal duct.

Remarks. This species is distinct in having a slender, distally pointed ω_1 on tarsus I. Its females have a very small sclerotised base of spermathecal sac which is slightly larger than that of *T. javensis* (Oudemans) and *T. robertsonae* Lynch. The male of this species has a short aedeagus which is cylindrical in basal 2/3 and narrowing gradually in distal 1/3.

REFERENCES

Al-Safadi, M. M. 1987. The life cycle of the Acari *Tyrophagus similis*. *Journal of Zoology* 213(1): 141–146.

Angelkova, E. B. 1982. Acaroid mites (Acarina, Acaridiae) from nests of birds in Bulgaria. *Acta Zoologica Bulgarica* 20: 107–109.

Baker, E. W.; Delfinado, M. D.; Abbatiello, M. J. 1976. Terrestrial mites of New York II. Mites in birds' nests (Acarina). *Journal of the New York Entomological Society* 84(1): 48–66.

Bollaerts, D.; Breny, R. 1951. Les acariens nuisibles aux matières entreposées. *Revue de l'Agriculture Bruxelles* 4: 738–764.

Bostrom, S.; Johansson, E.; Harfast, B.; Lundqvist, L.; Backman, I.; Rosen, E. von; Hage-Hamsten, M. van. 1997. Characterization of the mite fauna (Acari) in Swedish barn dust. *International Journal of Acarology* 23(2): 127–132.

Cindea, E. 1978. Present state of research on the control of the pathogens and pests of vegetable crops. *Probleme de Protectia Plantelor* 6(4): 421–443.

Cobanoglu, S.; Bayram, S. 1998. Mites (Acari) and flies (Insecta: Diptera) from natural edible mushrooms (Morchella: Ascomycetes) in Ankara, Turkey. *Bulletin & Annales de la Societe Royale Belge d'Entomologie* 134(3): 187–198.

Cockayne, A. H.; Waters, R. 1916. The chaff-mite. Methods of control. *New Zealand Journal of Agriculture* 12: 372–379.

Crosby, T. K.; Dugdale, J. S.; Watt, J. C. 1998. Area codes for recording specimen localities in the New Zealand subregion. *New Zealand Journal of Zoology* 25: 175–183.

Cusack, P. D.; Evans, G. O.; Brennan, P. A. 1975. A survey of the mites of stored grain and grain products in the Republic of Ireland. *Scientific Proceedings of the Royal Dublin Society, Serie B* 3(20): 273–329 (only abstract seen).

Czaikowska, B.; Vrie, M. van de; Kropczynska, D. 1988. Mites of the genus *Tyrophagus* as pests of ornamentals in greenhouses. *Mededelingen van de Faculteit Landbouwwetenschappen, Rijksuniversiteit Gent* 53(2b): 799–809.

Estebanes-Gonzalez, M. L. 1997. Acarofauna of nests of wild birds in Mexico. *Acta Zoologica Mexicana* 71: 1–15.

———; Rodriguez-Navarro, S. 1991. Observations on some mites of the families Tetranychidae, Eriophyidae, Acaridae and Tarsonemidae (Acari), in horticultural crops from Mexico. *Folia Entomologica Mexicana* 83: 199–212 (only abstract seen).

Fain, A. 1976. Acariens récoltés par le Dr. J. Travé aux îles subantarctiques. II. Familles Acaridae, Anoetidae, Ereynetidae et Tarsonemidae (Astigmates et Prostigmates). *Acarologia* 18(2): 302–328.

———1977. Nouvelles observations sur les Acariens récoltés par le Dr J. Travé aux îles Saint-Paul et Nouvelle-Amsterdam (Astigmates). *Acarologia* 18(3): 553–567.

———1985. Observations sur les genres *Suidasia* Oudemans, 1905, *Tyrophagus* Oudemans, 1924 et *Madaglyphus* Fain, 1971 (Acari, Acaridae). *Revue de Zoologie Africaines* 99: 159–164.

———; Chmielewski, W. 1987. The phoretic hypopi of two acarid mites described from ant's nests : *Tyrophagus formicetorum* Volgin, 1948 and *Lasioacarus nidicolus* Kadzhaja and Sevastianov, 1967. *Acarologia* 28(1): 53–61 ,

———; Fauvel, G. 1993. *Tyrophagus curvipenis* n. sp. from an orchid cultivation in a greenhouse in Portugal (Acari: Acaridae). *International Journal of Acarology* 19(1): 95–100.

Fan, Q.-H.; Zhang, Z.-Q. 2004. *Revision of* Rhizoglyphus *Claparède (Acari: Acaridae) of Australasia and Oceania.* Systematic and Applied Acarology Society, London. 374 pp.

Fischer, S. 1993. Observation of a new pest of cucumber in western Switzerland, *Tyrophagus neiswanderi* Johnston & Bruce (Acari, Acaridae). *Revue Suisse de Viticulture, d'Arboriculture et d'Horticulture* 25(2): 103–104.

Gervais, F. L. P. 1844. Acarides. In Walckenaer's Histoire Naturelle des Insectes. Aptères. Volume 3, pp. 260–266 (not seen).

Giustina, W. D. 1981. The pests of the aerial parts of cucumber grown under cover. *Phytoma* 328: 9–12.

Grandjean, F. 1939. La chaetotaxie des pattes chez les Acaridae. *Bulletin de la Société zoologique de France* 64: 50–60.

Griffiths, D. A. 1970. A further systematic study of the genus *Acarus* L., 1758 (Acaridae, Acarina), with a key to species. *Bulletin of the British Museum (Natural History) Zoology* 19(2): 85–118.

———1979. The morpho-species and its relationship to the biological species in the genus *Tyrophagus* (Acaridae, Acarina). In: Rodriguez, J. G. (ed) *Recent Advances in Acarology*, *Proceedings of the 5th International Congress of Acarology*, East Lansing, Michigan 1: 199–212.

———; Atyeo, W. T.; Norton, R. A.; Lynch, C. A. 1990. The idiosomal chaetotaxy of astigmatid mites. *Journal of Zoology* 220: 1–32.

Hajiqanbar, H. R.; Irani-Nejad, K. H.; Chaichi, P. T. (2002) Records of astigmatic mites of family Acaridae from sugarbeet fields in Miandoab Plain. *Agricultural Science (Tabriz)* 12(2): 1, Pe1–Pe10 (abstract).

Hallas, T. E.; Solberg, H. 1989. Mites of stored hay on the Faroe Islands (Acari). *Entomologiske Meddelelser* 57(3): 151–155.

Halliday, R. B. 1998. *Mites of Australia: A Checklist and Bibliography*. CSIRO Publishing, Melbourne. 317 pp.

Hughes, A. M. 1948. *The Mites Associated with Stored Food Products*. Ministry of Agriculture and Fisheries. His Majesty's Stationery Office, London. 168 pp.

———1961. *The mites of stored food. Ministry of Agriculture, Fisheries and Food, Technical Bulletin no. 9*. Her Majesty's Stationery Office, London. 287 pp.

———1976. *The mites of stored food and houses, 2nd ed. Ministry of Agriculture, Fisheries and Food, Technical Bulletin no. 9.* Her Majesty's Stationery Office, London. 400 pp.

ICZN (International Commission on Zoological Nomenclature) 1985. Opinion 1298. *Tyrophagus* Oudemans, 1924 (Acarina): Clarification of name of type species and conservation. *Bulletin of Zoological Nomenclature* 42: 124–127.

Johnston, D. E.; Bruce, W. A. 1965. *Tyrophagus neiswanderi*, a new acarid mite of agricultural importance *Research Bulletin of Ohio Agricultural Experimental Station* 977: 1–17.

Jonge, J. T. de 1988. Remarkable mites and insects in and around buildings in 1986. *Entomologische Berichten* 48(1): 18–19.

Kazhdaya, G. Sh. 1996. Some data on acaroid mites in Saarland (with description of variability of *Forcellinia diamesa*, Acaroidea, Acariformes). *Zoologicheskii Zhurnal* 75(4): 620–624.

Klimov, P. B.; O'Connor, B. M. 2003. Phylogeny, historical ecology and systematics of some mushroom-associated mites of the genus *Sancassania* (Acari : Acaridae), with new generic synonymies. *Invertebrate Systematics* 17(4): 469–514.

Laffi, F. 1980. A mite injurious to melon seed-beds: *Tyrophagus similis* Volgin. *Informatore Fitopatologico* 30(7/8): 17–21.

Leskinen, L.; Klen, T. 1987. Storage mites in the work environment of farmers. *European Journal of Respiratory Diseases*, 71, supplement No. 152: 101–111.

Li, C. 1999. Preliminary study of the acaroid mites breeding in stored Chinese traditional medicinal materials. *Chinese Journal of Parasitic Disease Control* 12(1): 72–73.

Lo, P. L. 1995. Size and fecundity of soft wax scale (*Ceroplastes destructor*) and Chinese wax scale (*C. sinensis*) (Hemiptera: Coccidae) on citrus. *New Zealand Entomologist* 18: 63–69.

Lynch, C. A. 1989. Two new species of the genus *Tyrophagus* (Acari: Acaridae). *Journal of Zoology* 219(4): 545–567.

Martin, N. A.; Workman, P. 1985. Pest control in boxes of Cymbidium orchid flowers with dichlorvos-impregnated plastic. *Proceedings, New Zealand Weed and Pest Control Conference* 38: 169–171.

Meyer, M. K. P.; Rodrigues, M. C. 1966. Acari associated with cotton in Southern Africa (with reference to other plants). *Garcia de Orta* 1(2): 1–33.

Michael, A. D. 1903. *British Tyroglyphidae vol. 2.* Ray Society, London. 183 pp.

Mohanasundaram, M.; Parameswaran, S. 1991. Record of four mites associated with decaying or rotting agricultural crops in Tamil Nadu. *Madras Agricultural Journal* 78(1–4): 88.

Nakao, H.; Kurosa, K. 1988. Description of four species of acarid mites newly recorded from Japan, with reference to the damage caused to crops (Acari: Astigmata). *Japanese Journal of Applied Entomology and Zoology* 32(2): 135–142.

Oudemans, A. C. 1906. Review of the Acari hitherto found in New Guinea. *Nova Guinea* 5(1): 101–162.

———1916. Myrmekofile Acari uit Salatiga. *Entomologische Berichten* 4(88): 266–268.

———1924a. Acarologische Aanteekeningen LXXIV. *Entomologische Berichten* 136(VI): 241–260.

———1924b. Acarologische Aanteekeningen LXXV. *Entomologische Berichten* 136(VI): 265–274.

———1924c. Acarologische aanteekeningen LXXVII. *Entomologische Berichten* 136(VI): 317–336.

Papaioannou-Souliotis, P. 1991. House dust mites in Attiki. *Annales de l'Institut Phytopathologique Benaki* 16(2): 105–114.

Putatunda, B. N.; Abrol, D. P. 2003. Mites associated with bees in Jammu and Kashmir, India. *Zoos' Print Journal* 18(2): 1021–1024.

Ramsay, G. W. 1977. Arthropods associated with the Polynesian rat on the Tokelau Islands. *New Zealand Journal of Zoology* 4(4): 393–394.

———; Paterson, S. E. 1977. Mites (Acari) from *Rattus* species on Raoul Island. *New Zealand Journal of Zoology* 4(4): 389–392.

Reynaud, N.-C.; Gevrey, J.; Demont, P. 1981. *Tyrophagus longior*, a mite infesting a butcher's shop. I. Identification and the incubation period of eggs. *Bulletin de la Societe des Sciences Veterinaires et de Medecine Comparee de Lyon* 83(3): 135–138.

Rimbaud, E. 1983. First record of *Tyroglyphus longior* associated with canine dermatitis in Uruguay. *Veterinaria, Uruguay* 19(85): 70–74

Robertson, P. L. 1946. Tyroglyphid mites in stored products in New Zealand. *Transactions of the Royal Society of New Zealand* 76(2): 185–207.

———1959. A revision of the genus *Tyrophagus*, with a discussion on its taxonomic position in the Acarina. *Australian Journal of Zoology* 7(2): 146–181.

———1961. A morphological study of variation in *Tyrophagus* (Acarina), with particular reference to populations infesting cheese. *Bulletin of Entomological Research* 52: 501–529.

———1981. *Tyrophagus* Oudemans, 1924 (Acarina): proposals to clarify the name of the type species and to conserve the name of an important pest species. *Bulletin of Zoological Nomenclature* 38: 125–129.

Sadieva, B. E. 1984. A mite and the pathogen of brown mosaic. *Zashchita Rastenii* 7: 20.

Samšiòák, K. 1962. Beiträge zur Kenntnis der Gattung *Tyrophagus* Oudemans. *Èasopis Èeskoslovenské Spoleènosti Entomologické* 59: 266–280.

Schrank, F. P. 1781. *Enumeratio Insectorum Austriae Indigenorum*. *August Vindelicor, Klett*. 548 pp (not seen).

Southcott, R. V. 1976. Arachnidism and allied syndromes in the Australian region. *Records of Adelaide Children's Hospital* 1: 97–186.

Studzinski, A.; Malachowska, D. 1973. The occurrence of Acarina on cruciferous plants (Cruciferae) in Poland in the years 1970–1971. *Prace Naukowe Instytutu Ochrony Roslin* 15(2): 153–166. (abstract).

Teng, B.; Qiu, Z. X.; Wang, H. 1988. Investigation of mite infestation of respiratory tract in Chinese herb workers. *Chinese Journal of Parasitic Disease Control* 1(1): 38–39, 77.

Türk, E.; Türk, F. 1957. *Systematik und Ökologie der Tyroglyphiden Mitteleuropas*. In: Stammer, H. J. (ed) *Beiträge zur Systematik und Okologie mitteleuropaischer Acarina*, Bd 1: 3–226.

Turk, F. A. 1953. A synonymic catalogue of British Acari. *Annual Magazine of Natural History* 6: 81–99 (not seen).

USDA 1981. New North American record. *Plant Pest News* 1(2): 2.

Volgin, V. I. 1949. Materials on systematics of mites of the genus *Tyrophagus* Ouds., 1923 (Tyroglyphidae, Acarina). *Doklady Akademii Nauk USSR, Zoology* 65(3): 385–388.

Walter, D. E.; Hudgens, R. A.; Freckman, D. W. 1986. Consumption of nematodes by fungivorous mites, *Tyrophagus* spp. (Acarina: Astigmata: Acaridae). *Oecologia* 70(3): 357–361.

Wang, X. Z. 1985. A survey of the Acaroidea occurring in the east China. *Contributions from Shanghai Institute of Entomology* 5: 351–357.

Wildies, T. 2000. On the morphology of *Tyrophagus tropicus* Robertson, 1959 (Acari: Acaridae). *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 13(161): 147–150.

Womersley, H. 1941. Studies in Australian Acarina. (2). Tyroglyphidae (s. l.). *Records of South Australian Museum* 6: 451–488.

Zakhvatkin A. A. 1941. *Fauna of U.S.S.R. Arachnoidea. Vol. VI, No. 1: Tyroglyphoidea [Acari]*. American Institute of Biological Sciences, Washington DC. 573 pp. (Translation by Ratcliffe, A.; Hughes, A. M., 1959).

Zakladnoi, G. A. 2003. Can phosphine control grain mites? *Zashchita i Karantin Rastenii* No.9: 46–47.

Zhang, Z.-Q. 2003 *Mites of Greenhouses: Identification, Biology and Control.* CABI Publishing, Wallingford, UK, xii + 244 pp.

Appendix 1. Collection details for specimens examined. Species listed in alphabetical order according to species in New Zealand, followed by Australasian and Oceanian species not present in New Zealand (p. 67)

Species present in New Zealand

Tyrophagus communis sp. n.

Type material. **Holotype** female: NEW ZEALAND: **AK**: Pukekohe, Bioforce Ltd., 1/1 female (indicated) + 7 (paratype) females, 17 Nov 2004, J. Thompson, culture with *Neoseiulus cucumeris*, NZAC. **Paratypes**: 1/7 females + holotype female, as holotype. 3/13 females, 13 males + allotype male, as allotype. **HB**: Hastings, Zonda Research, 5/20 females, 7 males, 3 tritonymphs, 1 protonymph, 1 larva, 18 Oct 1999, J. Mitchell, culture, NZAC. Zonda Research, 1/1 male (indicated) + 3 (paratype) females, 6 (paratype) males, 28 Oct 1999, L. Rako, "new culture", NZAC.

Other material NEW ZEALAND: **AK**: Auckland, 1/1 female, 2 males (J10724), 15 May 1948, W. Carter, fungus culture No. 119, SAM. Auckland, 1/numerous females and males (J10727), 3 Jul 1944, D. Spiller, glass surface in house, SAM. Auckland, 3/8 females, 1 male [+ *Rhizoglyphus* sp. 5 females, 5 tritonymphs] (P.Q.A. 341), 30 Jun 1966, N.H. Hyde, garlic for export, MAF/A. 1/2 females, 1 male [+ *Tyrophagus curvipenis* 2 females, 3 males] (P.Q.A. 3325), 9 Oct 1972, T. Geldard, export garlic, MAF/A. Auckland, 1/1 female, 1 male, 1 tritonymph [+ *Tyrophagus longior* 1 male, 8 tritonymphs] (A6181), 26 Nov 1979, G. Gibson, strawberry, MAF/A. Auckland, Puketutu I, Manukau Harbour, 1/1 female [+ *Tyrophagus curvipenis* 1 male], Oct 1980, J. Clearwater, citrus borer, dead larva in wood, NZAC. Henderson, 1/1 male [+ *Tyrophagus longior* 1 female, 3 males] (A 213), 24 Nov 1981, collector unknown, strawberries for export, MAF/A. Auckland, 2/16 females, 13 males, 30 Aug 1982, L. Clark, wheat stores in lab., custom house, MAF/A. Howick: Botany Rd., 1/1 female, 1 male [+ *Tyrophagus longior* 1 female], 8 Nov 1985, D.C.M. Manson, strawberry fruit, MAF/A. Auckland, Mt Albert Research Centre, 1/3 females [+ *Tyrophagus neiswanderi* 1 female], 3 Jul 1987, D. Allen, scale culture Rm 3, NZAC. Pukekohe Research Orchard, 2/5 females, 3 males [+ *Tyrophagus neiswanderi* 2 females, 2 males] (1, 2), 5 Mar 1991, N.A. Martin, cucumber leaf sprayed with dicofol, NZAC. Auckland, Drury, 328 Karaka Rd, Hothouse, 2/2 females, 16 Jan 2005, L. Howe, *Capsicum* fruit: BO, NZAC. Auckland, Drury, 328 Karaka Rd., Hothouse, 1/1 female, 17 Jan 2005, L. Howe, *Capsicum* fruit: BP+BO, NZAC. Auckland, Drury, 328 Karaka Rd., Hothouse, 1/1 female [+ Mesostigmata 1 nymph], 17 Jan 2005, L. Howe, *Capsicum* fruit: 9011, NZAC. Auckland, Drury, 328 Karaka Rd., Hothouse, 1/1 female, 17 Jan 2005, L. Howe, *Capsicum* fruit: BN+BO, NZAC. Auckland, Drury, 328 Karaka Rd., Hothouse, 5/4 females, 1 male, 18 Jan 2005, L. Howe, *Capsicum* fruit, NZAC.Auckland, Drury, 328 Karaka Rd., Hothouse, 3/3 females, 18 Jan 2005, L. Howe, *Capsicum* fruit: BO, BP, BO+BP, NZAC. Auckland, Drury, 328 Karaka Rd., Hothouse, 3/1 female, 2 males, 19 Jan 2005, L. Howe, *Capsicum* fruit, NZAC. Mangere, NZ Gourmet, 16/34 females, 13 males, 24 Jan 2005, L. Howe, *Capsicum* fruit, NZAC. **OL**: Queenstown, Coronet Peak, 1/1 female, 2 males, 24 Apr 1978, A. Brown, spoon from kitchen of a house, MAF/A. **GB**: Gisborne, 1/1 female, 1 male (P.Q.A. 5281), 21 May 1981, M. Wing, garlic, MAF/A. **MB**: Blenheim, 1/5 females, 2 males, 1 tritonymph, 18 Jul 1958, collector unknown, strawberry tree fruit, MAF/A. **MC**: Lincoln, 1/6 females, 6 males, 8 May 1978, P.A. Burnett, garlic in plastic bag, MAF/A. Christchurch, near Sth New Brighton, 1/1 female, 2 males, 8 Nov 1976, Mrs James, "Kai-iwi" foil wrapped cheese, MAF/A. Christchurch, 1/11 females, 7 males (R. 2513), 14 Sept 1977, C. Buckley, fish house, MAF/A. Christchurch, 1/9 females, 4 males (R. 3870), 11 May 1982, collector unknown, beans in kitchen cupboard, MAF/A. **ND**: Kaitaia, 1/5 females, 2 males, 1 tritonymph, 1 protonymph, 20 Jun 1979, P.S. Bryant, California Mission, MAF/A. **RI/WA**: Woodville, 1/19 females, 5 males, 3 tritonymphs, 2 protonymphs, 1 Aug 1956, L.G. Morrison, Molactrate molasses blocks, MAF/A. **WI**: Wanganui, 1/6 females, 3 males, 7 tritonymph, 1 protonymph [+ Tarsonemidae 1 female], 19 Sept 1979, S.M. Nesbit, wheat grains ex silo, MAF/A. **WI/WN**: Manawatu dairy factory, 1/1 female, 28 Apr 1975, D.C.M. Manson, pallet and bag scrapings, dried milk powder, MAF/A. **WN**: Wellington, Wallaceville, 1/ females + *T. vanheurni* (J10726), Apr 1946, L.K. Whitton, pollen from hive, SAM. Levin, 1/8 females (19348), 19 Aug 1985, F. Jarmai, beehive, MAF/A. Levin, 1/6 females, 3 males, 14 May 1982, collector unknown, house, MAF/A. Levin, 1/28 females, 4 males, 13 Dec 1979, A. Body, raspberry jam, MAF/A. Wellington, Thorndon, 1/2 females, 9 males [+ *Acarus* sp. 1 female] (M 2248), 3 Jul 1984, P. Butler, food stuffs in household pantry, MAF/A. Wellington, Lower Hutt, 1/1 female (K. 253), 22 Mar 1978, R. Waters, mushrooms, MAF/A. **WO**: Hamilton area, 1/5 females, 4 males, 1 tritonymph, date unknown, Blade's Fumigation Ltd, kitchen in farmhouse, MAF/A. Waikato River, Hamilton, Univ. of Waikato, 1/1 female [+ *Tyrophagus vanheurni* 1 male], date unknown, J. Boubee, host unknown, NZAC. **Specific locality unknown**: 1/4 females, 17 Mar 1944, P.L. Robertson, dead *Prionoplus reticularis* larv., NZAC. 1/9 females, 15 males, date unknown, S.L. Haylett, in buffet, NZAC. 1/3 females [+ *Tyrophagus longior* 1 male] (A6117), 15 Nov 1979, G.J. Higgins, strawberries, MAF/A. 1/1 female (A. 4173), 18 Oct 1978, B.N. Bain, strawberries, MAF/A. 1/1 female (P.Q.A. 3245), 20 May 1978, N. Lomax, debris in container, MAF/A. 1/2 females (P.Q.AK. 6196), 16 Jul 1974, N. Sanison, garlic, MAF/A. 2/7 females (AK. 6665), 17 Apr 1975, R.D. Hay, Feijoa, MAF/A. 1/2 females, 3 males, 1 tritonymph (P.Q.AK. 8240), 22 Oct 1975, N.A.P. Lomax, asparagus, MAF/A. 1/10 females, 1 tritonymph [+ *Glycyphagus* sp. 1 tritonymph] (A. 184), 28 Jul 1977, R. Blackwell, garlic for export, MAF/A. 1/4 males, 1 tritonymph (P.Q.A. 1251), 26 Apr 1978, W. Geaney, garlic, MAF/A. 1/2 females, 1 tritonymph (P.Q.A. 173), 20 May 1965, B. Short, ex matua on nutmeg, MAF/A. 4/9 females, 5 males, 7 tritonymphs, 4 protonymphs (M. 77), Jul 1961, L.G. Morrison, saint paulia, MAF/A. **Intercepted in Queensland, Australia**: 1/1 female (DPIQ 350QA), 27 May 1996, collector unknown, fresh garlic Q7491, AQIS/QLD. 1/1 female (Q24796), 19 Oct 2001, collector unknown, capsicums, AQIS/QLD. 1/1 female (Q25143), 15

Jan 2002, collector unknown, capsicums, AQIS/QLD. 1/1 female (Q103598), date unknown, collector unknown, capsicums, AQIS/QLD. **Intercepted in New South Wales, Australia**: 1/1 female, 4 males, 1 tritonymph (P.Q.A. 766), 29 Jul 1964, P.C. Hunt, copra, MAF/A. 1/2 females (N28555), 1999, collector unknown, garlic, AQIS/NSW. 1/1 male (N29013, col: 57717), 21 Jun 1999, collector unknown, persimmons, AQIS/NSW. 1/1 female, 1 male, 1 tritonymph [+ *Tyrophagus curvipenis* 1 female, 1 tritonymph] (N35085), 25 Jul 2000, collector unknown, onions, AQIS/NSW. 1/1 female, 1 tritonymph (N44016, #83219), 3 Apr 2002, collector unknown, garlic, AQIS/NSW. 1/2 females (N108419), 28 Oct 2004, collector unknown, capsicum, AQIS/NSW. 1/1 female (N108461), 28 Oct 2004, collector unknown, capsicum, AQIS/NSW. 1/1 female + *Tyrophagus putrescentiae* 3 females (N108460), 3 Nov 2004, collector unknown, tulip bulbs, AQIS/NSW.

AFRICA: **Intercepted in New Zealand**: 1/2 females [+ *Tyrophagus tropicus* 1 female + *Proctolaelaps pygmaeus* 1 female] (P.Q.A. 2786), 3 Apr 1979, K. Shaw, cocoa beans, MAF/A.

ARGENTINA: **Intercepted in New Zealand**: 1/2 females, 3 males (P.Q.A. 2542), 25 Oct 1977, B. Barnett, *Citrus limon*, MAF/A.

AUSTRALIA: **ACT**: Canberra, D.S.I.R., 1/numerous females and males (J10730), Mar 1945, D. W., silverfish culture, SAM. Canberra, 1/2 females, 3 males (J10771), Jul 1957, S.W. Mouly, *Locusta migratoria*, SAM. Canberra, 3/16 females, 1 male (J10794, J10795, J10796), Jul 1907, collector unknown, culture of *Tineola biselliella*, SAM. Canberra, National Botanic Gardens, 5/5 males, 21 Apr 1992, S. Walker, agar tissue culture of orchids, ANIC. Australian National University, 9/5 females, 6 males, Aug 1993, E.J. Wright, culture of *Tribolium*, ANIC. Canberra, CSIRO stored grain lab, 10/12 females, 1 tritonymph, 17 Dec 2002, D. Rees, lab culture of *Psocoptera*, ANIC. **NSW**: New South Wales, Sydney, Northern Suburbs Hospital, 1/2 mites (J10720), Sept 1945, collector unknown, human urine, SAM. Sydney, 1/5 females (J10732), Jul 1943, H. Gordes, sheep faeces, SAM. Sydney, 5/5 females, 1 male, 8 Aug 1989, E.J. Wright, Sydney Grain Terminal, ANIC. Batemans Bay, 11/7 females, 4 males (no. 92/137), Apr 1992, M. Evers, mixed grain, horse fodder, young stock foods, ANIC. South Coogee, 5/4 females, 1 male, 17 Jul 1994, N. Hall, mealworm culture, ANIC. Gundaroo, 1/1 female, Jan 1995, K.L. Strong, rooster feathers "Tintinhull", ANIC. Bungendore, 10/28 females, 7 males, 8 Jan 1996, D. Taylor, chaff, ANIC. Barmedan, Graincorp silo, 7/7 females, 24 Jul 1998, N. Starick, damp grain, ANIC. near Griffith, Cocoparra National Park, 24/23 females, 1 male, 27 Jul 1998, D. James, sample C7, ANIC. Gosford Horticultural Institute, 5/56 females, 9 males, 4 tritonymphs, 7 Aug 2003, M. Steiner, glasshouse, sample #1047, ANIC. **QLD**: Woodford District, 1/ females (J10721), Oct 1946, H. J., soil, SAM. Cairns, 2/10 females (J10751, J10752), 31 Aug 1949, J.G. Brooks, house, SAM. 1/18 mites (J10772), 4 Jan 1952, E.H. Derrick, from culture of *Sporotrichum*, SAM. Queensland, Oakey, 5/2 females, 3 males, 1 Nov 1992, B. Bridgeman, dust in grain silo, ANIC. Queensland, Oakey, 23/11 females, 12 males, 1 Nov 1992, B. Bridgeman, stored sorghum, ANIC. **SA**: Adelaide, 1/3 females + Winterschmidtidae 1 female (J10717), Aug. 1933, H. Womersley, on *Cryptes baccarum*, SAM. Adelaide, 1/females (J10718), Aug 1939, H. Womersley, on decaying coconut, SAM. Adelaide, 4/5 females, 18 males, 3 tritonymphs, 1 protonymph (J10758, J10759, J10760, J10761), 12 Jun 1952, collector unknown, soya beans, Nutrition Lab., SAM. Port Adelaide, 1/3 females, 1 male, 1 tritonymph (J10767), Jan 1954, collector unknown, bark scrapings, SAM. Port Adelaide, 2/6 females, 2 males, 1 tritonymph + *T. javensis* 4 females (J10766, J10767), Jan 1954, H. Womersley, bark scrapings, SAM. South Australia, Stirling, Cleland Wildlife Park, 1/1 male (ANIC IAS 2002–148), 30 Oct 2002, collector unknown, kangaroo diet, ANIC. **WA**: Perth, 1/2 females, 2 males (J10722), 27 Apr 1931, H. Womersley, SAM. **Lelu Island**: Kusaie, 1/1 female (J10774), 24 Feb 1953, JEG Cla, Nipa palm leaves, SAM. **Specific locality unknown**: 1/3 females (J10754), 91–A.38(1A), A.N.A.R.E., rabbit, SAM. Nanphatu, 1/3 females, 2 males (J10756), 7 Oct 1951, collector unknown, *Nauphota* (cockroach), SAM. 1/11 females, 5 males (J10757), Oct 1948, water jar, cockroach colony, SAM. Moke, 7/2 females, 3 males, 2 protonymphs (J10775, J10776, J10777, J10778, J10780, J10782, J10783), 2 Oct 1957, J.H. B., dust-bed, cracks & floor, Tultols house, SAM. Moke, 1/1 female, 1 male + Mesostigmata 1 (J10779), 2 Oct 1957, J.H. B., material on living room floor, Tultols house, SAM. Moke, 1/1 male (J10781), 2 Oct 1957, J.H. B., dust beneath banana leaf matting, Kuree house, No. 2 village, SAM. Q.I. M.R., 1/5 males, 3 tritonymphs (J10789), 16 Oct 1948, H.J., from *Calolampra* colony, SAM. 1/1 female (Q25293), 5 Feb 2002, collector unknown, palm seed, AQIS/QLD. **Intercepted in New Zealand**: 1/1 female, 1 male, 1 tritonymph (P.Q.A. 575), 18 Apr 1962, collector unknown, pineapple, MAF/A. 1/4 females, 3 males, 1 tritonyhmph (P.Q.A. 1154), 27 May 1970, J.N. Garnham, Kentia palm seed, MAF/A. 1/4 females (P.Q.A. 6101), 29 Apr 1974, L.M. Lysaght, Kentia palm, MAF/A. 1/4 females (P.Q.M. 2041), 26 May 1977, J. Jones, *Cissus antarctica* seed, MAF/A. 1/1 female [+ *Tyrophagus similis* 3 females] (P.Q.A. 3104), 15 Apr 1978, J. Jones, *Narcissus* bulbs, MAF/A. 1/5 females, 3 males (P.Q.M. 256), 28 Aug 1978, P. Cody, *Virgilia divaricata*, MAF/A. 1/3 females, 1 male (P.Q.A. 4797), 2 Apr 1979, L. Dollimore, host unknown, MAF/A. 1/2 females (P.Q.A. 308), 18 Dec 1981, M.R. Wing, seeds, MAF/A. 1/1 female (NPPRL 09/2002/1036), 5 Mar 2002, collector unknown, Hyacinth air cargo, MAF/A. 1/1 female (NPPRL 09/2002/1038), 5 Mar 2002, collector unknown, *Iris* bulbs, air cargo, MAF/A. 1/2 females, 1 tritonymph (NPPRL 09/2002/4408), 11 Oct 2002, collector unknown, *Coffea arabica*, MAF/A. 1/1 female (NPPRL 09/2003/4850), 25 Sept 2003, collector unknown, tomatoes, MAF/A. 1/1 female (NPPRL 09/2002/1031), date unknown, collector unknown, *Ranunculus* bulb, MAF/A. 1/1 female (NPPRL 09/2002/1033), date unknown, collector unknown, *Freesia* bulbs, MAF/A. 1/1 female (NPPRL 09/2002/2330), date unknown, collector unknown, bulbs, air cargo, MAF/A. 3/3 females, 1 male (NPPRL 09/2003/3889, NPPRL 09/2003/4852, NPPRL 09/2004/3058), date unknown, collector unknown, tomatoes, MAF/A. LORD HOWE I: **Intercepted in New Zealand**: 1/1 female, 4 males (P.Q.A. 1197), 25 Jun 1970, P.G. Whitham, palm seed, MAF/A. NORFOLK I: **Intercepted in New Zealand**: 1/1 female (B92704), 15 Jul 2004, collector unknown, pine tree seeds, AQIS/QLD. 1/11 females, 7 males, 3 tritonymphs [+ *Proctolaelaps pygmaeus*] (AK 4461), 22 Dec 1978, N. Lomax, host unknown, MAF/A. 1/1 male (NPPRL 09/2003/

4643), date unknown, collector unknown, palm seed, MAF/A.
BRAZIL: **Intercepted in New Zealand**: 1/13 females, 4 males (P.Q.A.K. 2708), 9 Dec 1977, K. Goodwin, orchids, MAF/A.
CHILE: **Intercepted in New Zealand**: 1/14 females (P.Q.A. 9085), 13 Apr 1977, B.J. Winfield, *Lauris nobilis* leaves, MAF/A.
CHINA: **Intercepted in New Zealand**: 1/1 female, 2 males (NPPRL 09/01/2643), 3 Aug 2001, collector unknown, garlic, MAF/A. 1/1 female (NPPRL 09/2003/6140), date unknown, collector unknown, Ya pear, MAF/A. 1/1 male (NPPRL 09/2003/7111), date unknown, collector unknown, Ya pear, MAF/A. **HONG KONG**: **Intercepted in New Zealand**: 1/1 male (P.Q.A. 8), 13 Jan 1965, J.H. Stackett, water chestnut (*Scirpus tuberosus*), MAF/A. 1/6 females, 2 males, 1 tritonymph, 5 Mar 1965, C.A. F. Jaques, chinese food (dried shell fish), MAF/A. 1/1 male (P.Q.N. 246), 22 Apr 1965, C.A.F. Jaques, dried vegetable leaf, MAF/A. 1/2 males [+ *Rhizoglyphus* sp. 1 protonymph, 1 larva] (P.Q.A. 226), 2 Nov 1967, N.H. Hyde, *Colocasia esculenta* bulbs, MAF/A. 1/12 females, 6 males, 6 tritonymphs, 1 protonymph (A. 1190), 25 Jun 1970, S. Hilder, dried food, MAF/A. 1/4 females (P.Q.A. 3090), 13 Apr 1978, N. Lomax, orange, MAF/A. 1/4 females (P.Q.A. 3401), 12 Jun 1978, K. Hawkes, lychee, MAF/A. 1/3 female [+ *Tyrophagus tropicus* 1 female] (P.Q.A. 1740), 18 Aug 1978, V. Ovens, dried fruit, MAF/A. 1/1 female, 3 males [+ *Tyrophagus tropicus* 2 females, 1 male, 1 tritonymph] (P.Q.A. 4872), 26 Apr 1979, R. Barnett, dried lychees, MAF/A. 1/2 females, 1 male, 1 protonymph [+ *Blattisocius dentriticus* 2 females] (P.Q.R. 4784), 8 Dec 1980, K. Shaw, red dates, MAF/A. 1/1 female, 2 males [+ *Carpoglyphus lactis* 3 females, 4 males] (P.Q.R. 4784), 8 Dec 1980, K. Shaw, red dates, MAF/A. TAIWAN: **Intercepted in New Zealand**: 1/5 females, 1 male (P.Q.R. 1780), 8 Feb 1972, I.D. Kilduff, orchids, MAF/A. 1/3 females, 2 males (P.Q.R. 1780), 8 Feb 1972, I.D. Kilduff, Orchidaceae, MAF/A.
COOK IS: **Intercepted in New Zealand**: 1/1 female (P.Q.A. 177), 7 Sept 1967, J.A. Hooper, calyx end of orange, MAF/A. 1/1 female (P.Q.A. 213), 3 Aug 1977, D.W. White, banana, MAF/A. 1/5 females (P.Q.A. 363), 20 Sep 1977, R. Blackwell, copra, MAF/A. 1/33 females, 18 males [+ Mesostigmata 2] (P.Q.A. 4237), 31 Oct 1978, J. Chignell, capsicums, MAF/A. 1/4 females (P.Q.A. 3826), 3 Jan 1980, A. Habraken, taro, MAF/A. 1/7 females, 2 males (P.Q.A. 6425), 19 Jan 1980, P.C. Smith, banana, MAF/A.
CRETE: **Intercepted in New Zealand**: 1/1 female (P.Q.A. 2850), 26 Jan 1978, E. Baigent, seeds & spices, MAF/A.
ECUADOR: **Intercepted in New Zealand**: 1/1 female, 1 male (P.Q.A. 7817), 2 Apr 1976, R. Blackwell, banana, MAF/A. 1/1 male (P.Q.A. 7934), 16 Jun 1976, D.G. Voice, banana, MAF/A. 1/1 female, 4 males (P.Q.A. 70), 14 Jun 1977, G.J. Higgins, banana, MAF/A. 1/1 female (R.2497), 29 Aug 1977, collector unknown, banana, MAF/A. 1/4 females (P.Q.A.), 27 Oct 1977, J.R. Tabak, banana, MAF/A. 1/1 male (P.Q.A. 2986), 12 Jun 1978, K. Kennett, banana, MAF/A. 1/1 female, 1 male [+ *Calvolia* sp. 1 female] (P.Q.A. 2552), 12 Feb 1979, N. Lomax & J. Sumner, banana, MAF/A. 1/1 female, 1 male (NPPRL 09/2001/3919), 9 Nov 2001, collector unknown, banana, MAF/A. 1/3 females (NPPRL 09/2001/4650), 21 Dec 2001, collector unknown, banana, MAF/A. 1/2 females, 1 male (NPPRL 09/2002/3551), 4 Aug 2002, collector unknown, banana, MAF/A. 2/2 females, 1 male, 1 tritonymph (NPPRL 09/2002/5193), 23 Sep 2002, collector unknown, banana, MAF/A. 1/1 female (NPPRL 09/2002/378), date unknown, collector unknown, banana, MAF/A. 1/1 male (NPPRL 09/2002/3381), date unknown, collector unknown, banana, MAF/A. 2/1 female, 3 males, 1 tritonymph (NPPRL 09/2002/4944, NPPRL 09/2002/4946), date unknown, collector unknown, banana, MAF/A. 2/3 females, 3 males (NPPRL 09/2002/5436), date unknown, collector unknown, banana, MAF/A. 1/1 male, 1 tritonymph (NPPRL 09/2002/1250), date unknown, collector unknown, banana Aw 9125, MAF/A. 1/2 males (NPPRL 09/2004/2471), date unknown, collector unknown, banana, MAF/A.
FIJI: **Intercepted in New Zealand**: 1/3 females, 4 males, 1 tritonymph (A. 8409), 30 Jan 1976, J.P. Chignell, garlic, MAF/A. 1/2 females, 1 male, 1 tritonymph (P.Q.R. 2213), 22 Mar 1976, C.H. Cook, egg plant, MAF/A. 1/4 females, 1 male (P.Q.A. 2441), 24 Sep 1977, S. Bowman, *Theobromia cacao*, MAF/A. 1/1 female (P.Q.A. 3194), 28 Jun 1979, R. Steele, lemon, MAF/A. 1/2 females (NPPRL 09/2002/2980), 21 Jun 2002, collector unknown, yams, MAF/A. 1/3 females [+ Ascidae 3 females] (NPPRL 09/2003/2029), 22 Apr 2003, collector unknown, curry leaves, MAF/A. 1/1 female, 2 males (NPPRL 09/2003/4372), date unknown, collector unknown, coconuts, MAF/A. 1/1 female [+ *Rhizoglyphus minutus*] (NPPRL 09/2003/6548), date unknown, collector unknown, taro, MAF/A.
GREECE: **Intercepted in New Zealand**: 1/1 male (P.Q.M. 236), 2 Apr 1965, C.A.F. Jaques, dahlia bulbs, tubers, MAF/A. 1/1 female (P.Q.A. 443), 6 Dec 1965, A.C. Hall, unknown plant roots, MAF/A.
GERMANY: **Intercepted in New Zealand**: 1/1 female [+ *Tyrophagus neiswanderi* 1 male] (P.Q.A. 3465), 28 Apr 1974, P.D. Brown, corn, MAF/A. **Intercepted in Queensland, Australia**: 1/1 female (Q100644, 10808QA), 6 Dec 2002, collector unknown, Cycad palm seed, AQIS/QLD.
INDIA: **Aurangabad**: Marathwada University, 2/6 females, 3 tritonymphs, 28 Nov 1980, Hijay Bahekar, host unknown, MAF/A. **Intercepted in New Zealand**: 1/1 female, 1 male (P.Q.A. 2461), 1 Oct 1977, L. Blandchard, orchids, MAF/A. 1/1 female (P.Q.A. 8786), 1 Nov 1976, N. Lomax, orchids, MAF/A. 1/3 females, 1 male (P.Q.A. 2777), 5 Jan 1978, K. Shaw, orchids, MAF/A. 1/1 female (NPPRL 09/2002/3794), 26 Aug 2002, collector unknown, roses, MAF/A.
INDONESIA: **Intercepted in Queensland, Australia**: 1/1 female, 2 tritonymph (Q18708), 15 Jun 2000, collector unknown, *Vanilla* beans, AQIS/QLD.
ITALY: **Intercepted at Gisborne in New Zealand**: 1/3 females, 1 male [+ Mesostigmata 1 female], 2 Apr 1980, collector unknown, seed of *Acer pseudoplatanus*, MAF/A.
JAMAICA: **Intercepted in New Zealand**: 2/106 females, 91 males, 2 tritonymphs, 10 Jan 1957, collector unknown, oranges, MAF/A.
JAPAN: **Intercepted in New Zealand**: 1/5 females (NPPRL 09/2001/3310), 3 Oct 2001, collector unknown, tulip bulbs, MAF/A.
MADAGASCAR: **Intercepted in Queensland, Australia**: 1/1 female, 1 protonymph [+ *Sancassania* sp. 1 male] (BIN76287), 6 Feb 2004, collector unknown, palm and cycad seed, AQIS/QLD. **Intercepted in New Zealand**: 1/2 females [+ *Rhizoglyphus* sp. 1 heteromorphic male] (NPPRL

09/2004/1698), date unknown, collector unknown, palm leaves, MAF/A.
MALTA: **Intercepted in New Zealand**: 1/2 females (P.Q.N. 6), 23 Feb 1979, P.G. Whitham, caper seed, MAF/A.
NETHERLANDS: **Intercepted in New Zealand**: 4/6 females, 1 male, 1 tritonymph (P.Q.J. 56), 5 Dec 1961, collector unknown, onions, MAF/A. 1/1 male [+ *Glycyphagus* sp.] (P.Q.A. 280), 2 Jul 1965, C.A.F. Jaques, Gladioli corms, MAF/A. 1/3 females, 7 males, 8 tritonymphs, 1 protonymph (P.Q.A. 185), 12 Jun 1969, P.G. Whitham, Gouda cheese, MAF/A. 1/3 females, 2 males (P.Q.NA. 9), 9 Feb 1978, R.F. Lowe, *Freesia* sp. bulb, MAF/A. 5/11 females, 6 males (P.Q.A. 2191), 30 Nov 1978, J. Hammond, cheese, MAF/A. 1/4 females, 1 male, 1 tritonymph (NPPRL 09/2002/1041), 6 Mar 2002, collector unknown, *Iris* bulbs, MAF/A. 1/5 females, 1 tritonymph (NPPRL 09/2002/4827), 1 Nov 2002, collector unknown, *Iris* bulbs, MAF/A. 1/1 male (NPPRL 09/2002/4653), date unknown, collector unknown, *Muscari* bulbs, MAF/A. 1/5 females (NPPRL 09/2002/4654), date unknown, collector unknown, *Narcissus* bulbs, MAF/A. 1/2 females, 1 male, 1 tritonymph (NPPRL 09/2002/4827), date unknown, collector unknown, *Iris* bulbs, MAF/A. 1/2 females, 1 male, 1 tritonymph (NPPRL 09/2002/5390), date unknown, collector unknown, *Iris* bulbs, MAF/A. 1/4 females (NPPRL 09/2003/441), date unknown, collector unknown, *Iris* bulbs, MAF/A. 1/1 female, 1 tritonymph (NPPRL 09/2003/5757), date unknown, collector unknown, *Iris* bulbs, MAF/A.
PAPUA NEW GUINEA: Buna, 1/3 females (J10733), 27 Jul 1943, F.J. A, SAM. Bulolo, 1/1 male (J10753), Aug 1954, H. Womersley, passalid, SAM. Lae, 1/3 females (J10790, J10791), May 1954, H. Womersley, millipede *Polyconoceris alaskis*, SAM. **Intercepted in Queensland, Australia**: 1/1 male (Q27049), 21 Jun 2002, collector unknown, vanilla pods, AQIS/QLD.
PHILIPPINES: **Intercepted in Queensland, Australia**: 1/1 female, date unknown, collector unknown, rice plant, AQIS/QLD. **Intercepted in New Zealand**: 1/1 female (NPPRL 09/2003/305), date unknown, collector unknown, banana, MAF/A.
SAMOA: **Intercepted in New Zealand**: 1/1 female, 1 male, 2 tritonymphs [+ *Tyrophagus tropicus* 1 male, 2 tritonymphs] (P.Q.A. 3577), 6 Jun 1973, P.G. Whitham, banana, MAF/A. 1/3 females (P.Q.A. 7949), 25 Jun 1976, D.A. Dean, banana, MAF/A. 1/4 females (P.Q.A. 7948), 26 Jun 1976, J. Henderson, banana, MAF/A.
SINGAPORE: **Intercepted in New Zealand**: 1/2 females, 2 males (NPPRL 09/2003/572), date unknown, collector unknown, container, MAF/A. 1/2 females, 5 males [+ *Rhizoglyphus* sp. 1 female] (P.Q.A. 999), 21 Apr 1970, M.L. Robertson, garlic, MAF/A. 3/8 females, 4 males [+ *Sancassania krameri* 3 females] (P.Q.A. 6169), 3 Jul 1974, G.S. Benson, peanuts, MAF/A.
SOLOMON IS: **Intercepted in Queensland, Australia**: 1/1 female (Q25030), 9 Jan 2002, collector unknown, coconuts, AQIS/QLD.
SPAIN: **Intercepted in New Zealand**: 1/6 females, 2 males, 1 tritonymph, 1 protonymph (P.Q.A. 245), 10 Aug 1963, L. Barloer, Almonds, MAF/A.
THAILAND: **Intercepted in New Zealand**: 1/6 females, 4 males, 1 tritonymph [+ oribatida 1 female] (A 2754), 24 Dec 1977, S. Bowman, orchid plants, MAF/A.
TOKELAU IS.: 1/1 female, 1 male, 1 tritonymph (P.Q.E. 146), 14 Apr 1980, R. German, coconuts, MAF/A.
TONGA: **Intercepted in New Zealand**: 1/1 female, 1 male, 1 tritonymph [+ *Rhizoglyphus* sp. 1 female + 1 oribatid] (P.Q.A. 400), 10 Aug 1966, N. Emery, tomatoes, MAF/A. 1/3 females (P.Q.A. 7362), 16 Feb 1976, J.L. Burton, banana, MAF/A. 1/4 females (P.Q.A. 6370), 25 Sept 1974, C.H. Brett, coconuts, MAF/A. 1/6 females [+ *Sancassania* sp. 1 male] (P.Q.A. 2461), 29 Oct 1974, F. Mead, citrus, MAF/A. 1/1 female (P.Q.A. 6483), 3 Dec 1974, J.J. Bongiovanni, taro, MAF/A. 1/1 male (P.Q.A. 7357), 12 Feb 1976, D. Longhurst, coconuts, MAF/A. 1/4 females, 1 male (P.Q.A. 7361), 16 Feb 1976, J.L. Burton, banana, MAF/A. 1/4 females (P.Q.A. 7373), 18 Feb 1976, D. Longhurst, taro, MAF/A. 1/1 female (P.Q.A. 7405), 8 Mar 1976, M.J. Leonard, banana, MAF/A. 1/2 females, 1 tritonymph (P.Q.A. 7412), 9 Mar 1976, V. Rands, banana, MAF/A. 1/2 females, 2 males (P.Q.A. 106), 2 Aug 1977, R. Mulholland, banana, MAF/A. 1/1 female (P.Q.A. 550), 19 Oct 1977, R. Steele, coconuts, MAF/A. 1/1 female (P.Q. A 167), 22 Jul 1977, C.M. Rogers, banana, MAF/A. 1/2 females, 2 males (P.Q.A. 574), 26 Oct 1977, S.J. Andrews, tomato, MAF/A. 1/1 female (P.Q.A. 3971), 7 Sept 78, N. Lomax, host unknown, MAF/A. 1/1 female [+ Winterschmidtiidae 1 male] (P.Q.A. 863), 9 Jan 1978, B. Barrett, banana, MAF/A. 1/1 female + [*Tyrophagus pacificus* 2 females] (P.Q.A. 963), 7 Feb 1978, M.J. Leonard, banana, MAF/A. 1/3 females (P.Q.A. 1653), 31 Jul 1978, R. Bayliss, taro, MAF/A.
TURKEY: **Intercepted in New Zealand**: 1/3 females, 1 male (P.Q.S. 3), 1 Apr 1960, collector unknown, developing on mould in hazel nuts, MAF/A. 1/3 females, 6 males, 3 tritonymphs (P.Q.S. 3), 1 Apr 1960, collector unknown, developing on mould in hazel nuts, MAF/A. 1/1 female, 2 males, 1 tritonymph, 13 May 1970, collector unknown, figs, MAF/A. 1/5 females (P.Q.A. 6588), 27 Feb 1975, M. Brett, dried Fig, MAF/A. 1/1 female (P.Q.M. 156), 5 May 1978, P. O'Donoghue, dried Fig, MAF/A.
U.K.: Reading, Berks, 1/12 females, 6 males (P.L.R. Col. 186 (1)), 7 Mar 1951, collector unknown, cheshire cheese, ANIC. **Intercepted in New Zealand**: 1/3 females [+ *Tyrophagus longior* 1 male] (P.Q.A. 353), 11 Jul 1966, R.J. Bishop, gladioli bulbs, MAF/A.
U.S.A.: **Intercepted in New Zealand**: 1/2 females (P.Q.A. 525), 30 Aug 1966, N.H. Hyde, *Caladium* bulbs, MAF/A. 1/4 females, 2 males (P.Q.A. 2), 27 Jul 1967, N.H. Hyde, *Caladium* bulbs, MAF/A. 1/4 females (P.Q.A. 4), 27 Jul 1967, W.A. Apt, *Caladium*, MAF/A. 1/2 females, 1 male (P.Q.A. 960), 26 Mar 1970, P.G. Whitham, potato, MAF/A.1/5 females (P.Q.A. 8634), 1 Apr 1977, S.J. Andrews, pimentoes, MAF/A. 1/1 male (P.Q.A. 2593), 6 Nov 1977, P. Doherty, *Plumeria* sp., MAF/A. 1/4 females (P.Q.A. 705), 25 Nov 1977, L. Blanchard, peanuts, MAF/A. 1/11 females, 2 males (A 1447), 8 Jun 1978, M.J. Leonard, dried food stuffs, MAF/A. 1/2 females, 2 males, 1 tritonymph (P.Q.A. 113), 27 Oct 1981, R.H. Steele, palm seeds, MAF/A. 1/1 female (NPPRL 09/2002/585), 4 Feb 2002, collector unknown, oranges, MAF/A. 1/2 females, 1 male [+ *Acarus* sp. 1 female] (NPPRL 09/2002/2352), 16 Apr 2002, collector unknown, gladiolus, MAF/A. 1/14 females, 2 males, 5 tritonymphs, 1 protonymph (NPPRL 09/2002/4827), date unknown, collector unknown, *Iris* bulbs, MAF/A. 1/6 females, 5 males, 6 tritonymphs, 2 protonymphs (NPPRL 09/2003/3514), date unknown, collector unknown, dormant

bulb, MAF/A. **Intercepted in Queensland, Australia**: 2/2 females (Q25069), 8 Jan 2002, collector unknown, palm seed, AQIS/QLD. **Intercepted in New South Wales, Australia**: 1/1 female [+ *Tyrophagus neiswanderi* 1 male] (#N19 946), date unknown, collector unknown, orange, AQIS/NSW. 1/1 male (N42256, #79808), 6 Dec 2001, collector unknown, lemons, AQIS/NSW.
VANUATU: **Intercepted in Queensland, Australia**: 1/1 female (Q25338), 22 Jan 2002, collector unknown, coconuts, AQIS/QLD.
WEST AFRICA: **Intercepted in New Zealand**: 4/4 females, 3 males (P.Q.M. 1270), 11 May 1973, G. Aiken, *Theobroma cacao*, MAF/A.
Note: intercepted banana from Ecuador, Philippines and Tonga is assumed to be fruit of *Musa sapientum*.

Tyrophagus curvipenis Fain & Fauvel

Type material. **Holotype** male: PORTUGAL, 1/1 male + 1 (paratype) female, Dec 1991, M.T. Malé, orchids cultivated in a greenhouse, IRScNB. **Paratypes**: 1/1 female + holotype male, as holotype; 1/1 male, 3 tritonymphs, Dec 1991, G. Fauvel, IRScNB.
Other material. NEW ZEALAND: **AK**: Auckland, 1/2 females, 3 males [+ *Tyrophagus communis* 2 females, 1 male] (P.Q.A. 3325), 9 Oct 1972, T. Geldard, garlic, MAF/A. Auckland, Mt Albert Research Centre, 9/1 female, 2 males, 7 tritonymphs (N.42, 246555), May 1974, B.M. May, mummified loquat fruit, NZAC. Tiritiri Matangi Is., Hauraki Gulf, 5/5 females, May 1976, H. Moller, *Rattus exulans*, NZAC. Auckland, Titirangi, 2/6 females, 1 male, 10 Nov 1976, D. Steven, feeding on the pollinia of *Cymbidium* sp., MAF/A. Auckland, Orakei Basin, 1/4 females, 2 males, 13 Sept 1977, J. Craig & M. Halstead, swallow nest 77/105, NZAC. Auckland, 1/4 females, 1 male, 1 tritonymph, 26 Apr 1988, A. Cibilich, calyx of Granny Smith apple (in sooty mould) in store, MAF/A. Auckland, Glen Eden, 1/1 female, 1 male [+ *Tyrophagus* sp. 1 female], 8 Apr 1979, M. Lessiter, avondale spider egg cluster, NZAC. Auckland, Puketutu I, Manukau Harbour, 1/1 male [+ *Tyrophagus communis* 1 female], Oct 1980, J. Clearwater, citrus borer, dead larva in wood, NZAC. Auckland, Kumeu, 2/2 females, 6 Jun 1984, T. Batchelor, Persimmon FUYU, mis. MB Fumigation, NZAC. Auckland, Mt Albert, 1/1 female, 6 Jun 1984, T. Batchelor, Persimmon fumigation MB, NZAC. Auckland, DSIR, Kumeu Research Orchard, 1/5 females, 1 male, 1 tritonymph, Apr-Jun 1988, V. Holt, Grapefruit, unsprayed fruit/leaf, NZAC. Auckland, Pt Chevalier, 3/13 females, 4 males, 1 tritonymph, 6 Sep 1988, D. Gardiner, *Miomantis caffra* ootheca-living but damaged, feeding on dead eggs & embryos, NZAC. Auckland, Taupaki, 3/8 females, 4 males (1), Jul 1991, C. Stemens, senile nest of *Vespula germanica*, NZAC. Auckland, 1/4 females, 2 males, 29 Apr 1993, J. Clearwater, feeding on dead *Stathmopoda* larva, NZAC. Auckland, MARC, Mt Albert, 7/6 females, 1 male (1), 15 Aug 1997, M. Sandanayaka, barley originated from Lincoln in late July 1997, NZAC. Auckland, Kingsland, 1/4 females (Surveillance 3/01/661), 14 Mar 2001, M. O'Donnell, hydrangea leaf, MAF/L. Auckland, 3/2 females, 1 male, 1 Oct 2001, J. Todd, roots of clover, NZAC. Auckland, 1/1 female, 1 tritonymph (Surveillance 3/2001/2310), 1 Nov 2001, M. O'Donnell, associated with coccid scale on *Buxus* sp., MAF/L. Auckland, Tamaki, 1/1 female, 5 males, 20 Nov 2004, Q.-H. Fan, honeybee hive, NZAC. NEW ZEALAND: **BP**: Te Puke, Bay of Plenty, 1/4 females, Dec 1974, D. Horning, sphecids stick-trap, NZAC. **CO**: Cromwell (Co), 1/1 female, 1 tritonymph (Stonefruit Survey 97/1358), 28 Aug 1997, M. O'Donnell, bark of apricot, MAF/L. Central Otago, 2/5 females, 2 males, 1 tritonymph, 2 larvae (Stonefruit Survey 97/1457), 10 Sep 1997, M. O'Donnell, mummified apricot fruit, MAF/L. Central Otago, 1/1 tritonymph (Stonefruit Survey 97/2001, Co 60), 27 Nov 1997, M. O'Donnell, bark of cherry, MAF/L. Central Otago, 1/1 female (Stonefruit Survey 97/2109), 11 Dec 1997, M. O'Donnell, foliage of cherry, MAF/L. Roxburgh (Co), 1/1 tritonymph (Stonefruit Survey 97/1687), 1997/98, D. Bejakovich, bark of nectarine, MAF/L. Roxburgh (Co), 1/1 female (Stonefruit Survey 3/97/1687), 1997/98, D. Bejakovich, bark of nectarine, MAF/L. **HB**: Hastings: Haumoana, 1/1 female [+ *Tyrophagus longior* 3 females] (H 874), 21 Jul 1970, C.L.J. Ryan, cucumber leaves (variety Princess), MAF/A. Havelock North Ecology Div., 2/2 female [+ *Tyrophagus longior* 1 female + *T. similis* 3 females, 1 tritonymph], 14 Nov 1977, collector unknown, nest of *Sturnus vulgaris*, box 8, nest 77/158, NZAC. Havelock North Ecology Div., 1/1 female, 1 male [+ oribatid 1 nymph], 4 Jan 1978, collector unknown, nest at power pole 5, nest 78/3, NZAC. Havelock North Ecology Div., 1/3 females [+ *Tyrophagus similis* 4 females, 1 tritonymph], 4 Jan 1978, collector unknown, nest at power pole 19, nest 78/4, NZAC. **KE**: Kermadec Is, Raoul I, 1/1 female, 13 Aug 1973, J. Ireland, dead *Rattus norvegicus* at hostel, NZAC. **MC**: Christchurch, 1/1 female [+ Mesostigmata 1] (Bee Surveillance 3/99/1212), 1999, M. O'Donnell, washed off bee, MAF/L. **ND**: Kerikeri, 1/8 females, 2 males, 1 larva, Jul 1991, J.G. Charles, feeding on eggs of *Ceroplastes communis*, NZAC. **NN**: Nelson, 1/1 male, 12 Nov 1969, H. Kissling, sparrow nest material, NZAC. Nelson, Quarantine Room, 1/2 females, 14 Apr 1969, collector unknown, *Coleophora* tubes, NZAC. Nelson, 1/1 male (Subtropical Survey 3/99/105), 22 Jan 1999, M. O'Donnell, kiwi fruit, MAF/L. **SC**: South Canterbury G Sugrue, 1/1 male (Bee Surveillance 3/99/1257), 5 Apr 1999, M. O'Donnell, honeybee hive, MAF/L. **WI**: Palmerston North, 1/2 females, 3 males, 4 tritonymphs (38), 31 Jul 1974, A. Spiers, associated with galls ex *Populus nigra* var. *italica*, MAF/A. Manawatu, 3/5 females, 6 males [+ *Tyrophagus longior* 2 males], 28 Apr 1975, D.C.M. Manson, pallet and long scrapings, dried milk powder, MAF/A. **WN**: Levin, Ohau, Muhunoa East Rd., 1/3 females, 1 male, 8 Jun 1976, J.C. Wyllie, black currant stem, MAF/A. **WO**: Waitomo, Ruakuri Cave, 5/4 females, 1 male, 18 Nov 1998, I.R. Millar, netted in small stream, NZAC. Marangi, 1/2 females, 1 male (Surveillance 3/01/883), 5 Apr 2001, M. O'Donnell, leaves of Nashi, MAF/L. **Specific locality unknown**: 1/3 females, 3 tritonymphs (Surveillance 3/2001/1764), date unknown, M. O'Donnell, black currents, MAF/L. 1/4 females (P.Q.A. 8317), 3 Dec 1976, J. Bongiovanni, grapefruit, MAF/A. 1/1 female (P.Q.A. 9064), 4 Apr 1977, J. Chignell, passionfruit, MAF/A. 1/1 female, 1 protonymph (P.Q.A. 2511), 13 Oct 1977, J.R. Tabak, grapefruit, MAF/A. 1/1 female [+ *Tyrophagus longior* 3 females, 1 male] (A 5623), 29 Nov 1982, M. Lennard, export strawberries, MAF/A. **Intercepted in New South Wales, Australia**: 1/1 female, 1 tritonymph [+ *Tyrophagus communis* 1 female, 1 male, 1 tritonymph] (N35085), 25 Jul 2000, collector unknown, onions, AQIS/NSW. 1/1 female (N41717, #78752), 31 Oct 2001, collector unknown, lemons, AQIS/NSW. 1/1 female (N41718, #78757), 8 Nov

2001, collector unknown, lemons, AQIS/NSW. 1/1 tritonymph (N41925, #79161), 15 Nov 2001, collector unknown, lemons, AQIS/NSW. 1/1 protonymph (N44478, #84065), 2 May 2002, collector unknown, kiwifruit, AQIS/NSW. 1/1 protonymph (N44518, #84147), 13 May 2002, collector unknown, shallots, AQIS/NSW. 1/2 females, 1 tritonymph (N44558, #84227), 15 May 2002, collector unknown, kiwifruit, AQIS/NSW. 1/1 male (N44821, #84716), 29 May 2002, collector unknown, kiwifruit, AQIS/NSW. 1/1 protonymph (N45682, #86215), 3 Jul 2002, collector unknown, shallots, AQIS/NSW. 1/1 female (N107274, 021582NA), 12 Jul 2004, collector unknown, onions, AQIS/NSW. 1/1 female [+ *Tyrophagus longior* 1 female + Acaridae 1 tritonymph] (N102757, #13320NA), 20 Aug 2003, collector unknown, onions, AQIS/NSW. **Intercepted in Queensland, Australia**: 1/1 female (Q103598, 15364QA), 25 Feb 2004, collector unknown, capsicums, AQIS/QLD. 2/1 female, 1 male (Q105028, 3*40430058), 13 Feb 2004, collector unknown, capsicums, AQIS/QLD. AUSTRALIA: **NSW**: Sydney, 1/1 female (J10785), 1941, Raym., nests of *Exuneura concinnula*, SAM. **Intercepted in New Zealand**: 1/1 male (P.Q.A. 365), 21 Sep 1977, J. Chignell, tree onion bulbs, MAF/A. 1/2 females (P.Q.R. 9010), 2 Jul 1978, J. Westall, bird-of-paradise flower, MAF/A. 1/1 female (NPPRL 09/2002/3902), 3 Sep 2002, collector unknown, mandarin, MAF/A. 1/10 females, Nov 1981, collector unknown, *Disonycha* & *Agasicles* beetles, NZAC. FRANCE: **Intercepted in New Zealand**: 1/1 female (P.Q.M. 405), 1 Dec 1978, M.M. Gay, apples, MAF/A.

Tyrophagus longior (Gervais)

Type material. **Neotype** male (designated by Robertson 1959): NETHERLANDS: Gouda, 1/2 males (No. 237 (3, 4)), 26 Mar 1954, P.L. Robertson, cheese, BMNH.

Other material. NEW ZEALAND: **AK**: Auckland: Kumeu, 1/1 female, 1 male (A 6033), 28 Oct 1979, R. Steele & J.A. Anderson, strawberries for export, MAF/A. Auckland, 1/1 male (A 6073), 5 Nov 1979, J. Holton, export strawberries, MAF/A. Auckland, 1/1 male, 8 tritonymphs [+ *Tyrophagus communis* 1 female, 1 male, 1 tritonymph] (A6181), 26 Nov 1979, G. Gibson, strawberry, MAF/A. Papakura, 1/7 females, 1 male (P.Q.A. 8217), 11 Nov 1980, G. Gibson, strawberries, MAF/A. Auckland: Kumeu, 1/2 females, 3 males (A 5107), 23 Nov 1981, J.F. Allan, export strawberries, MAF/A. Henderson, 1/1 female, 3 males [+ *Tyrophagus communis* 1 male] (A 213), 24 Nov 1981, collector unknown, strawberries for export, MAF/A. Howick: Botany Rd., 1/1 female [+ *Tyrophagus communis* 1 female, 1 male], 8 Nov 1985, D.C.M. Manson, strawberry fruit, MAF/A. **CO**: Alexandra: property of Mr C. Rowley, 2/13 females, 7 males, 14 May 1964, W.S. Kemp, ryegrass seed, MAF/A. Clyde, Earnscleugh Res. Orch., 2/9 females, 4 males, 1 tritonymph (1, 2), 26 Apr 1991, G.F. McLaren, mallow leaves, NZAC. Central Otago, 1/1 female (NPPRL Ref. 97/1516), 18 Sep 1997, M. O'Donnell, nectarine bark, MAF/L. **HB**: Havelock North Ecology Div., Box 3, 1/4 females, 14 Nov 1977, collector unknown, nest of *Sturnus vulgaris*, nest 77/162, NZAC. Havelock North Ecology Div., Power pole by Don's office, 2/4 females, 4 males, 14 Nov 1977, collector unknown, nest 77/156, NZAC. Havelock North Ecology Div., 2/2 females, 2 males, 3 tritonymphs, 14 Nov 1977, collector unknown, nest 9 78/2, NZAC. Havelock North Ecology Div., 1/1 female, 1 male [+ *Tyrophagus similis* 1 female], 14 Nov 1977, collector unknown, box at end of storeroom, nest 77/159, NZAC. Havelock North Ecology Div., 3/3 females, 1 male [+ *Tyrophagus similis* 5 females, 1 male + *Tyrophagus curvipenis* 1 female + *Lepidoglyphus destructor* 2 females], 14 Nov 1977, collector unknown, nest of *Sturnus vulgaris*, box 4, nest 77/160, NZAC. Hastings: Haumoana, 8/9 females, 4 males [+ *Tyrophagus curvipenis* 1 female] (H 874), 21 Jul 1970, C.L.J. Ryan, cucumber leaves (variety Princess), MAF/A. **MB**: Rai Valley, 4/22 females, 14 males (1, 2, 3, 4), 19 Jul 1945, P.L. Robertson, export cheese shelves, NZAC. **MC**: Christchurch, 1/49 females [+ *Carpoglyphus lactis*], Sep 1962, R. Wilson, bee frames, NZAC. Leeston: N.Z. Farmers Co-op Store, 1/1 male, 1 tritonymph, 5 Jul 1974, C. Dorrett & K.G. Somerfield, damaged peas, MAF/A. Christchurch: Horotane Valley, 2/6 females, 2 Jun 1977, G. Mavromatis, cucumber leaves, MAF/A. Christchurch: Horotane Valley, 1/3 females [+ Mesostigmata 1 female], 17 Jun 1977, G. Mavromatis, property of R. Mundy, MAF/A. Leeston, 1/11 females, 4 males (350/A), 6 Nov 1979, K.G. Somerfield, barley, MAF/A. Christchurch, 2/5 females, 2 males, 24 Jun 1987, R.P. Macfarlane, *Bombus* nests, NZAC. Ashburton, 1/2 males (8.9 x 108.9), date unknown, collector unknown, grass seed, MAF/A. Woodlands, 1/4 females, 2 males, 1 tritonymph [+ *Lepidoglyphus destructor* 1 female], 3 Aug 1967, I. Johnston, bulked wheat, NZAC. **ND**: Whangarei, 1/1 females, 2 males [+ Mesostigmata 5], 19 Nov 1944, B.B. Q, wedding cake, NZAC. **NN**: Nelson, 1/14 females, 4 males (113, sample 1), 10 May 1945, P.L. Robertson, tomato chutney, NZAC. Nelson, Cawthron Institute, 1/7 females, 5 males, 19 Jan 1949, P.L. Robertson, cheese, NZAC. Nelson, 2/9 females, 7 males, 16 Nov 1949, P.L. Robertson, cell 1 parents, NZAC. Nelson, 1/2 females, 2 males, 10 Jan 1950, P.L. Robertson, cell 7 1st generation, NZAC. Nelson, 1/5 females, 1 tritonymph, 12 Jan 1950, P.L. Robertson, cell 3 1st generation, NZAC. **SC**: South Canterbury, 1/2 females, 1 male, 1 abnormal male (S. 245), 19 May 1976, J.A. Smith, barley, MAF/A. **SL**: Clinton, 1/3 females, 1 male [+ *Lepidoglyphus destructor* 5 females], 2 Aug 1967, R. Whiteside, bulked wheat, NZAC. Owaka: Balclutha, 7/7 females, 18 males, 10 tritonymphs, 2 protonymphs, 19 Mar 1970, G.A.H. Helson, ryegrass seed, MAF/A. **TK**: New Plymouth, 1/66 females and males [+ *Acarus farinae* + *Glycyphagus domesticus* + *Lepidoglyphus cadaverum*] (8, samples 1–5), 16 Dec 1942, P.L. Robertson, cheese in cool storage, NZAC. New Plymouth, 1/58 females and males [+ *Acarus farinae* + *Glycyphagus domesticus*] (9, samples 1–5), 16 Dec 1942, P.L. Robertson, cheese in cool storage, NZAC. New Plymouth, 1/18 females, 6 males, 2 tritonymphs, 3 larvae [+ *Acarus farinae* 3 females, 1 male] (5, samples 5, 6), 16 Dec 1942, P.L. Robertson, cheese in cool storage, NZAC. New Plymouth, 1/61 females and males [+ *Acarus farinae* + *Glycyphagus domesticus*] (10, samples (6–10) 1–5), 16 Dec 1942, P.L. Robertson, cheese in cool storage, NZAC. Eltham: Co-op, Rennet Co. Ltd, 3/6 females, 7 males, 1 tritonymph, 1 protonymph [+ *Tyrophagus savasi* 2 females, 1 male + *T. vanheurni* 1 female, 2 males], 27 Oct 1972, G.A.H. Helson, cheese, MAF/A. **WI**: Massey College cool store, 2/4 female [+ *Acarus farinae* 3 females + *Glycyphagus domesticus* 5 females] (100, sample 2, 3), Sep 1942, P.L. Robertson, cheese, NZAC. Manawatu dairy factory, 2/1 female, 2 males

[+ *Tyrophagus longior* 4 females, 5 males], 28 Apr 1975, D.C.M. Manson, pallet and bag scrapings (dried milk powder), MAF/A. **WN**: Levin: Kimberley Rd., 1/1 female, 1 male, 2 Mar 1972, S.K. Wong, bird's nest in poplar tree, MAF/A. **WO**: Waitomo, Ruakuri Cave, 2/1 female, 1 male, 18 Nov 1998, I.R. Millar, netted in small stream, NZAC. **South Island**: 1/6 females, 1 male, 3 Aug 1932, J. Muggeridge, grass seed, BMNH. **Specific locality unknown**: 1/5 females, 1 male, 17 Mar 1944, P.L. Robertson, dead *Prionoplus reticularis* larv., NZAC. 3/4 females (1, 2, 3), 3 Aug 1932, J. Muggeridge, grass seed in store, NZAC. ship's stores "Straat Colombo", 1/3 females, 1 tritonymph [+ *Acarus* sp. 1 female] (A 6930), 15 Sep 1975, L.M. Webber, onions, MAF/A. 1/3 females, 1 male, 2 tritonymphs (P.Q.A. 2597), 9 Nov 1977, G.J. Higgins, strawberries, MAF/A. 1/2 females, 3 males, 4 tritonymphs (P.Q.A. 2601), 29 Nov 1977, T. Cullen, strawberries, MAF/A. 1/1 male [+ *Tyrophagus communis* 3 females] (A6117), 15 Nov 1979, G.J. Higgins, strawberries, MAF/A. 1/4 females (AK 6299), 16 Dec 1979, D. Smith, strawberry, MAF/A. 1/4 females (A 5601), 8 Nov 1982, M. Lennard, export strawberry, MAF/A. 1/3 females, 1 male [+ *Tyrophagus curvipenis* 1 female] (A 5623), 29 Nov 1982, M. Lennard, export strawberries, MAF/A. 1/1 male (NPPRL Ref. 3/03/2367), 2003, M. O'Donnell, bee surveillance, MAF/L. **Intercepted in New South Wales, Australia**: 1/1 female (N26448), 8 Oct 1998, collector unknown, tamarillos, AQIS/NSW. 1/1 male (N27520, col. 54798), 25 Jan 1999, collector unknown, avocadoes, AQIS/NSW. 1/1 female [+ *Tyrophagus curvipenis* 1 female + Acaridae 1 tritonymph] (N102757, #13320NA), 20 Aug 2003, collector unknown, onions, AQIS/NSW.

AUSTRALIA: **WA**: Western Australia, Perth, 31/27 females, 2 males, 2 tritonymphs, Jan 1993, D. Roberts, prosciutto in meat works, ANIC. **Intercepted in New Zealand**: 1/1 female (NPPRL Ref. 09/2003/4175), 2003, collector unknown, mandarin, MAF/A.

ECUADOR: **Intercepted in New Zealand**: 1/4 females, 1 male (A 768), 7 Dec 1977, A. Carrick, *Musa sapientum*, MAF/A.

NETHERLANDS: Gouda, 1/2 females (P.L.R. Col. 237 (30, 31)), 26 Mar 1954, P.L. Robertson, cheese, ANIC. Gouda, 1/2 males (P.L.R. Col. 237 (5, 6)), 26 Mar 1954, P.L. Robertson, cheese, ANIC. **Intercepted in New Zealand**: 1/1 male (PQR 301), 17 May 1965, H. Wiggins, Onion and shallots, MAF/A. 1/2 females, 1 male (P.Q.A. 1692), 9 Aug 1978, D. Farr, *Dahlia* tubers, MAF/A. 1/2 females, 2 males [+ *Tyrophagus similis* 1 male] (21132), 8 Jul 1986, J. Nightingala, Dahlia, MAF/A.

PHILIPPINES: **Intercepted in New Zealand**: 1/1 female, 1 male [+ 1 *Calvolia* sp. female] (P.Q.R. 2575), 7 Nov 1977, D.H. Roberts, banana, MAF/A.

U.K.: **Nottinghamshire**: Toton, 1/14 females, 3 males, 3 tritonymphs, Jul 1955, collector unknown, cucumber leaves, BMNH. **Intercepted in New Zealand**: 3/1 female, 2 males [+ *Tyrophagus communis* 3 females] (P.Q.A. 353), 11 Jul 1966, R.J. Bishop, gladioli bulbs, MAF/A. 1/1 female (P.Q.R. 2344), 13 Dec 1976, T. Clark, combine harvester, MAF/A. 1/3 females, 4 males, 6 tritonymphs (P.Q.R. 2547), 14 Oct 1977, L.M. Neal, harvester, MAF/A. 1/4 females [+ *Tyrophagus similis* 1 male] (P.Q.A. 2891), 8 Feb 1978, N. Lomax, Dahlia bulb, MAF/A. 1/3 females, 3 males [+ *Tyrophagus similis* 1 female] (P.Q.A. 6349), 27 Dec 1979, A. Habrake, acorns *Quercus* sp. in Kew gardens, MAF/A. 1/2 females, 4 males (P.Q.A. 6349), 27 Dec 1979, A. Habrake, acorns *Quercus* sp. in Kew gardens, MAF/A.

U.S.A.: **Intercepted in New Zealand**: 1/4 females (No. 263), 16 Jul 1982, J.J. Fahey, fig leaves in P.E.Q., MAF/A. 1/1 female (NPPRL Ref. 09/2004/766), 2004, collector unknown, pomelo, MAF/A.

Tyrophagus macfarlanei sp. n.

Type material. **Holotype** female: NEW ZEALAND: **Intercepted in Queensland, Australia**: 1/1 female (Q22444), 16 May 2001, collector unknown, carrots, NZAC.

Tyrophagus neiswanderi Johnston & Bruce

Type material. **Paratypes**: U.S.A.: Ohio, Wooster, 1/1 female, 1 male (IA-434), 1 Apr 1963, D.E. Johnston & J.H. Gregory, cucumber in greenhouse, U.S.D.A. Holotype female and allotype male (1/1 female, 1 male (Acy 65/26)), and paratypes (1/ female, 1 tritonymph (Acy 65/26)), of *Tyrophagus africanus* Meyer & Rodrigues: SOUTH AFRICA: Barberton, Katoen**,** 8 Aug 1960, M.K.P. Meyer, ARC-PPRI. **Other material**. NEW ZEALAND: **AK**: Auckland, 1/1 male (P.Q.A 998), 21 Apr 1970, N.F. Emery, diseased onions for export, MAF/A. Pukekohe, 1/1 female [+ *Acarus* sp. 3 females] (P.Q. 6265), 10 Sep 1974, K Jan Shaw, garlic, MAF/A. Pukekohe, 1/1 male (P.Q.E. 30), 13 Apr 1976, G. Aiken, onions, MAF/A. Pukekohe, 1/3 females, 1 male, 8 Mar 1983, N.A. Martin, orchids, NZAC. Pukekohe, 2/5 females, 1 male, 1 tritonymph (1, 2), 22 Mar 1983, collector unknown, orchid pots, NZAC. Pukekohe, 1/3 females, 2 males, 5 Apr 1983, N.A. Martin, pots in orchid house, NZAC. Pukekohe, 1/4 females, 2 males, 1 tritonymph, 5 Apr 1983, N.A. Martin, orchid house floor, NZAC. Auckland, Mt Albert Research Centre, 1/2 females, 2 males, 7 Apr 1983, N.A. Martin, lab colony, NZAC. Ti Point, Leigh, 1/1 female, 2 males, 23 Sept 1985, R.A.J. White, *Cymbidium*, MAF/A. Pukekohe Research Station, 1/6 females, 1 male [+ *Tyrophagus communis* 2 females] (19737), 22 Oct 1985, J.J.C. Scheffer, garlic cloves, MAF/A. Auckland, Albany, 1/1 male, 13 Nov 1985, M. Stukey, host unknown, NZAC. Mangere (J. Chong), 1/7 females, 2 males (21039/134/6), 18 Jun 1986, A. Cibilich, sticky tapes around grape vines, MAF/A. Auckland, Mt Albert Research Centre, 1/1 female [+ *Tyrophagus communis* 3 females], 3 Jul 1987, D. Allen, scale culture Rm 3, NZAC. Tuakau, 1/7 females, 1 male, 1 tritonymph (1058), 29 Jun 1988, J. Iqbal, *Phalaenopsis* orchid flower buds, MAF/A. Auckland AQS, 1/2 females, 2 males, 3 tritonymphs, 3 protonymphs (26426), 4 Sep 1988, collector unknown, Pepino (*Solanum muricatum*) ex N.Z. Export Reject, MAF/A. Pukekohe, 2/17 females, 3 males, 23 Aug 1990, P. Workman, greenhouse cucumber leaves, NZAC. Pukekohe Research Orchard, 2/2 females, 2 males [+ *Tyrophagus communis* 5 females, 3 males] (1, 2), 5 Mar 1991, N.A. Martin, cucumber leaf sprayed with dicofol, NZAC. Auckland, Ramarama, Cooper Rd., 2/10 females, 1 male (1, 2), 2 May 1991, A. Nieuweahuijsen, *Cymbidium* orchid flower buds & leaves, NZAC. Auckland, Waimauku, Taha Rd, 1/1 female, 9 Apr 1997, T. Marais, green house tomatoes, NZAC. Mt Albert, 2/1 female, 1 male, 10 Aug 1998, P.J. Workman, orchid flower, NZAC. Auckland, Quarantine house PDD, 1/1 fe-

male, 1 male (A 103), 6 Apr 1962, T. over de Linden, grape leaves with galls, BMNH. Auckland, Quarantine house PDD, 1/1 female, 1 tritonymph (A 103), 9 Apr 1962, T. over de Linden, bud on gooseberry culture, BMNH. **BP**: Tauranga, 1/3 females (12850), 15 Nov 1982, R. Gosney, *Cymbidium* pollen caps, MAF/A. Tauranga, 1/4 females, 2 males [+ *Acarus* sp. 1 male] (14256), 7 Jul 1983, L.Casten, *Cymbidium* pollen caps, MAF/A. Tauranga, Greenhouse Park Ltd., 1/5 females, 3 tritonymphs (1993 (22572)), 9 Jun 1987, A. Gillanders, miniature cymbidium orchid, MAF/A. Katikati, Greenhouse Park, 4/14 females, 3 males, 7 tritonymphs (1, 2, 3, 4), 25 Sep 1990, M. Penney, sprayed commercial *Cymbidium* orchid flowers, NZAC. **MC**: Christchurch, 2/5 females, 3 males [+ *Tyrophagus vanheurni* 1 female, 1 male], 27 Aug 1979, L. Heath, *Capsicum frutescens* in glasshouse, MAF/A. Lincoln, DSIR, Canterbury Agricultural Science Centre, 2/7 females, 7 males (1, 2), 10 Apr 1991, T. Jessop, plant material, quarantine room, NZAC. **ND**: Omahuta, 1/1 female, 2 males, Feb 1974, G.R. Williams, short tailed bat, NZAC. Whangarei, 1/2 females, 1 male, 1 tritonymph, 5 Oct 1978, G.E. Grant, orchid blooms, MAF/A. Maunga-turoto Dairy Factory, Northland, 1/7 females, 3 males, Aug 1989, F. Norman, NZAC. Whangarei, 6/15 females, 17 males, 4 larvae, 26 Aug 1998, P.J. Workman, *Cymbidium* orchid (flower), NZAC. Nelson, Richmond, 2/1 female, 3 males, 30 Sep 1982, C. Barton, *Cymbidium* orchids, MAF/A. Nelson, 1/1 female, 1 male, 4 Aug 1983, N.A. Martin, orchid flower, NZAC. Nelson, 1/3 females, 2 tritonymphs (NPPRL Ref. 3/03/1043), 2003, M. O'Donnell, *Prunus* leaves, MAF/L. **TK**: Patea, 1/2 females, 2 males, 4 tritonymphs, 25 Sep 1984, P. Thomsen, cucumber leaves in glasshouse, MAF/A. **WI**: Palmerston North, 1/1 male, 15 Sep 1960, P May Clansen, Geranium, NZAC. **Specific locality unknown**: 1/6 females, 3 males (P.Q.F. 149), 21 Sep 1978, G.E. Grant, orchids, MAF/A. **Intercepted in New South Wales, Australia**: 1/1 female (N108381, 023509NA), 25 Oct 2004, collector unknown, capsicums, AQIS/NSW. 1/2 females (N108476), 4 Nov 2004, collector unknown, *Zantedeschia* bulbs, AQIS/NSW. **Intercepted in Queensland, Australia**: 1/1 female (Q103647, 15351QA), 18 Feb 2004, collector unknown, capsicums, AQIS/QLD. 1/1 female (BIN 39249), 23 Jun 2004, collector unknown, onions, AQIS/QLD.

AUSTRALIA: **Intercepted in New Zealand**: 1/1 female (NPPRL Ref. 09/2003/4064), 2003, collector unknown, oranges, MAF/A.

GERMANY: **Intercepted in New Zealand**: 1/1 male [+ *Tyrophagus communis* 1 female] (P.Q.A. 3465), 28 Apr 1974, P.D. Brown, corn, MAF/A.

NETHERLANDS: **Intercepted in New Zealand**: 1/3 females, 1 male (P.Q.M. 741), 5 May 1969, J.E. Cross, bulbs (Amaryllidaceae) vallarta species, MAF/A. 1/1 female, 2 males (NPPRL Ref. 09/2002/286), 16 Jan 2002, collector unknown, flower bulbs, MAF/A.

SOUTH AFRICA: **Intercepted in Auckland, New Zealand**: 1/3 males, 1 tritonymph (P.Q. A7335), 20 Aug 1980, M.R. Wing, bulbs of *Amaryllis hippeastrum*, MAF/A.

U.K.: England, Slough, 2/2 females, 1 male (Acy 89/532), 6 Sept 1989, S. Lynch, Culture X89/124, ARC-PPRI. **Intercepted in Auckland, New Zealand**:1/1 male [+ *Tyrophagus communis* 4 females, 1 male] (P.Q.A. 814), 21 Dec 1977, J. Chignell, *Narcissus* bulbs, MAF/A. 1/1 female (P.Q.A. 3371), 10 Jun 1978, S.J. Andrews, *Epiphyllum* sp., MAF/A. 1/3 males, 4 tritonymphs (P.Q.A. 2969), 14 May 1979, N. Lomax, soil and plant material (in garden, in a jar), MAF/A.

U.S.A.: **Ohio**: Olmstead Falls, 2/16 females, 4 males (IA-583), 1 May 1964, R.B. Neiswander, cucumber, Ohio State Univ. 1/1 male (IA-583), 1 May 1964, R.B. Neiswander, Lab culture of specimens feeding on cucumer plants, Ohio State Univ. 1/7 females, 2 males (Al 12994), 5 Jun 1964, collector unknown, lab culture, Ohio State Univ. 1/23 females, 7 males, 1 tritonymph (Al 12994), 7 Jun 1964, collector unknown, lab culture, Ohio State Univ. Ohio, Olmstead Fall, 1/16 females, 3 males (IA-583), 1 May 1964, R.B. Neiswander, cucumber, Ohio State Univ. Hot Dept. OSU, 1/4 females (AL 12993), 29 Apr 1965, W. Brooks, fruits and foliage of cucumber, Ohio State Univ. **Intercepted in Auckland, New Zealand**: 1/2 females, 2 males, 1 protonymph (P.Q. 7237), 27 Jul 1980, J.R. Tabob, orchids, MAF/A. 1/1 female, 2 tritonymphs, 1 protonymph (P.Q. A7431), 6 Sep 1980, E. Baigent, orchids, MAF/A. 2/1 female, 1 male (09/04/265), date unknown, collector unknown, lemons, MAF/A. 1/2 females, 1 male (09/2002/751), date unknown, 18 Feb 2003, oranges, MAF/A. 1/2 females (09/2002/3597), C. Weston, 7 Aug 2002, *Hibiscus* sp., MAF/A. **Intercepted in New South Wales, Australia**: 1/1 male [+ *Tyrophagus communis* 1 female] (#N19 946), date unknown, collector unknown, orange, AQIS/NSW. 1/1 female (N42257, #79809), 6 Dec 2001, collector unknown, lemons, AQIS/NSW.

Tyrophagus putrescentiae (Schrank)

Type material. **Neotype** male (designated by Roberston 1959): NETHERLANDS: Hilversum, 1/1 male (No. 17, P6984), 22 Apr 1902, Oudemans, humus, RMNH.

Other material. NEW ZEALAND: **WN**: Lower Hutt, 1/1 female (K. 253), 22 Mar 1978, R. Waters, mushrooms, MAF/A. **Intercepted in New South Wales, Australia**: 1/3 females + *Tyrophagus communis* 1 female (N108460), 3 Nov 2004, collector unknown, tulip bulbs, AQIS/NSW.

AUSTRALIA: **TAS**: Bass Strait, Fisher Island, 2/5 females, 3 males (J10764, J10765), 2 Jan 1953, R. Mykytowycz, burrows & nests of mutton birds, *Puffinus tenuirostris*, SAM. **Intercepted in Auckland, New Zealand**: 1/1 female (NPPRL Ref. 09/2002/1031), date unknown, collector unknown, *Ranunculus* sp. bulbs, MAF/A.

BRAZIL: **Intercepted in Auckland, New Zealand**: 1/13 females, 4 males (PQAK. 2708), 9 Dec 1977, K. Goodwin, orchids, MAF/A.

CHINA: mainland: I**ntercepted in Auckland, New Zealand**: 1/1 female, 2 males (NPPRL Ref. 09/2001/2643), 3 Aug 2001, collector unknown, garlic, MAF/A. Taiwan, **Intercepted in Queensland, Australia**: 1/1 female, 1 male (Q18479), 5 May 2000, collector unknown, palm seed, AQIS/QLD.

ECUADOR: **Intercepted in Auckland, New Zealand**: 1/2 males (NPPRL Ref. 09/2002/2471), unknown, collector unknown, banana, MAF/A.

GERMANY: Landesaustalt für Fischerei Berlin, 3/1, female, 2 males (No. 17, P6981, No. 12, P6979, No. 13, P6980), Dec 1930, G. Harre, dooden *Tinca tinca*, RMNH.

JAPAN: **Intercepted in New Zealand**: 1/5 females (NPPRL Ref. 09/2001/3310), 3 Oct 2001, collector unknown, tulip bulbs, MAF/A.

NETHERLANDS: Bremen, 1/13 females [+ *Rhizoglyphus* sp. 1] (No. 15, P6982), 29 Nov 1928, Hyacinth, F. Koenike, RMNH. Arnhem, 1/1 female (P6987), Feb 1932, *Citrus aurantium*, Zuid-Europa, Oudemans, RMNH. **Intercepted in Auckland, New Zealand**: 1/2 females, 2 males (P.Q.M. 60), 4 Dec 1962, H.R. Dalley, tulip bulbs, NZAC (Figures). 1/1 male (NPPRL Ref. 09/2002/4653), date unknown, collector unknown, muscari bulb, MAF/A. 1/5 females (NPPRL Ref. 09/2002/4654), date unknown, collector unknown, *Narcissus* bulbs, MAF/A.
U.S.A.: **Intercepted in Auckland, New Zealand**: 1/2 females, 1 male [+ *Acarus* sp. 2 females] (NPPRL Ref. 09/2002/2352), 16 May 2002, collector unknown, *Gladiolus*, MAF/A. 1/1 female (NPPRL Ref. 09/2002/585), 4 Feb 2002, collector unknown, oranges, MAF/A.

Tyrophagus robertsonae Lynch, 1989

Type material. **Holotype** male: U.S.A., S. Carolina, Savannah River Ecology Laboratory, 1/1 male (indicated) + 1 (paratype) male, 2 (paratype) tritonymphs (1989.3.6.14), D. Coleman. Rec'd Slough Lab., 1968, soil, BMNH. **Paratypes**: 1/1 male, 2 tritonymphs + holotype (1989.3.6.14), as holotype, 1/4 females, 4 males (1989.3.6.22), as holotype.
Other material. NEW ZEALAND: **MC**: Lincoln, Canesis Network Ltd., 12/22 females, 3 tritonymphs, 7 protonymphs (#05–622 Z), 26 Jan 2005, C. Shorter, culture, NZAC. Lincoln, Canesis Network Ltd, 2/1 female, 1 male, 18 Feb 2005, C. Shorter, culture, NZAC. **Intercepted in New South Wales, Australia**: 1/1 female (N44425), 26 Apr 2002, collector unknown, onions, AQIS/NSW. 1/7 females (N35112), 7 Jun 2000, collector unknown, onions, AQIS/NSW.
THAILAND: **Intercepted in Queensland, Australia**: 1/1 female (B93875), 20 Jul 2004, collector unknown, mangosteen, AQIS/QLD.

Tyrophagus savasi Lynch, 1989

Type material. **Holotype** male: ENGLAND: Manchester, 1/1 male (indicated) + 4 (paratype) males (1989.3.6.1), Via: Dr A.M. Hughes. Rec'd Slough Lab., 1967, biscuits, BMNH. **Paratypes**: 1/4 males + holotype male (1989.3.6.1), as holotype. 1/4 females (1989.3.6.3), as holotype.
Other material. NEW ZEALAND: **DN**: Dunedin, Leith Valley, 1/1 female (#05–680 Z), 23 Jun 2005, D. O'Connell, *Coprosma lucida*, NZAC. **TK**: Eltham: Co-op, Rennett Co. Ltd., 3/2 females, 2 males [+ *Tyrophagus longior* 5 females, 6 males, 1 tritonymph, 1 protonymph + *T. vanheurni* 2 females, 3 males], 27 Oct 1972, G.A.H. Helson, cheese, MAF/A. **WN**: Levin, 1/1 female, 3 tritonymphs, 2 larvae [+ *Acarus* sp. 1 tritonymph, 3 larvae], 23 Apr 1965, J.F. Pritchard, cheese, MAF/A. 1/8 females, 2 males, 2 tritonymphs (P.Q.A. 208), 28 Dec 1977, P. Phillips, *Narcissus* bulbs, MAF/A. 2/1 female, 2 males (NPPRL Ref. 3/03/688 (1), (5)), 2003, collector unknown, washed off bees (Bee Surveillance), MAF/L.

Tyrophagus similis Volgin, 1949

Other material. NEW ZEALAND: **AK**: Auckland, Mt Albert, 1/3 females, 1 male, 15 Mar 1977, P. Singh, nematode culture, NZAC. **DN**: Dunedin, 1/1 female [+ *Mycetoglyphus fungivorus* 2 females and 2 males], Feb 1976, F.J. Austin, black backed gull colony nests and debris, NZAC. **HB**: Havelock North Ecology Div., 1/1 female [+ *Tyrophagus longior* 1 female, 1 male], 14 Nov 1977, collector unknown, box at end of storeroom, nest 77/159, NZAC. 1/1 female [+ *Tyrophagus longior* 1 female + *Lepidoglyphus* sp. 2 females], 14 Nov 1977, collector unknown, nest of *Sturnus vulgaris,* box 1, nest 77/163, NZAC. 1/2 females, 1 male [+ *Tyrophagus longior* 1 female, 1 male], 14 Nov 1977, collector unknown, nest of *Sturnus vulgaris*, box 4, nest 77/160, NZAC. 2/3 females, 1 tritonymph [+ *Tyrophagus curvipenis* 2 female + *T. longior* 1 female], 14 Nov 1977, collector unknown, nest of *Sturnus vulgaris*, box 8, nest 77/158, NZAC. 1/3 females, 1 male, 4 Jan 1978, collector unknown, nest at power pole 5, nest 78/3, NZAC. 1/4 females, 1 tritonymph [+ *Tyrophagus curvipenis* 3 females], 4 Jan 1978, collector unknown, nest at power pole 19, nest 78/4, NZAC. **MB**: Blenheim, 1/8 females, 4 males, 3 tritonymphs (Q 82), 7 Mar 1974, D.W. McCallum, garlic Ivory orchards, MAF/A. **MC**: Lincoln, 1/5 females, 1 protonymph (J10725), Aug 1935, L. M, host unknown, SAM. Christchurch, Bradley, 1/1 male, 3 May 1980, A.M. F., K 'fruit' fruit, NZAC. Southbridge, 2/2 females (NPPRL Ref. 3/01/2284), 2001, collector unknown, growing tips of spinach, MAF/L. **NN**: Nelson, Transport Nelson Holdings Farm, 3/20 females, 3 males [+ *Rhizoglyphus robini* 1 male] (461244), 22 Sept 1969, N.A. Martin, host unknown, NZAC. Nelson, 88 Valley, Parkes Farm, 1/12 females (Grid Ref. S20 369064, C144), 11 Nov 1969, N.A. Martin, NZAC. 3/14 females, 2 males, 8 tritonymphs (Grid Ref. S20 369064, C148), 11 Nov 1969, N.A. Martin, NZAC. 1/1 male (Grid Ref. S20 369064, C149), 11 Nov 1969, N.A. Martin, NZAC. 3/1 female, 2 tritonymphs (Grid Ref. S20 369064, H21), 14 Jul 1970, N.A. Martin, NZAC. 1/1 male (Grid Ref. S20 369064, B173), 14 Oct 1970, N.A. Martin, NZAC. 1/1 male (Grid Ref. S20 369064, C7), 17 Nov 1970, N.A. Martin, NZAC. 1/1 tritonymph (Grid Ref. S20 369064, C13), 17 Nov 1970, N.A. Martin, NZAC. Nelson, Richmond, Swamp Rd, 1/1 female, 1 tritonymph, 30 Jul 1972, F. Doyce, white heron (*Egretta alba modesta*), NZAC. **TK**: Hawera, 1/2 males (L829, P.E.Q. 22750), 15 Oct 1981, L.T.W. Mattson, orchid, MAF/A. **WA**: Masterton, 1/1 male, 1 tritonymph, 1 protonymph [+ *Sancassania* sp. 1 female, 2 tritonymphs, 1 deutonymph, 1 protonymph] (288), 19 Nov 1979, A. Bennet, bean seeds in vegetable garden, MAF/A. **WN**: Waikanae, 2/2 males [+ *Myctoglyphus fungivorus* 5 females, 2 males, 2 tritonymphs + *Sancassania* sp. 1 tritonymph], 21 Oct 1965, A. Mear, bean plumules in soil, MAF/A. Levin, glasshouse, Lower Hutt, 1/4 females, 1 male, 3 tritonymphs (M174 (repeat)), 11 Jun 1971, Lesley Muir, spinach, MAF/A. Levin, HRC, Kimberley Rd., 7/27 females, 20 males, 19 tritonymphs, 16 protonymphs, 1 larva [+ *Sancassania* sp. 2 females], 7 Jun 1973, D. Steven, sandy soil in pots of Rama ryegrass, MAF/A.
AUSTRALIA: **NSW**: Broken Hill, 1/2 females [+ *Schwiebea* sp. 1 female] (J10731), date unknown, Chad, on dead *Rhopoea* larva [grub], SAM. Lisatow, 1/3 females, 1 male (J10762), 18 Sep 1957, K.M. Moore, ex larva of *Zenarge turneri*, SAM. Lisatow, 1/4 females, 1 male (J10763), 18 Sep 1957, K.M. Moore, ex larva of *Zenarge turneri*, SAM. **SA**: Adelaide Plains, Adelaide, 2/7 females, 9 males (J10714, J10715), Feb 1934, D.C. S, in mushrooms, SAM. Adelaide Plains, Stepney, 1/8 females, 6 males, 1 tritonymph

(J10716), 20 Jun 1945, collector unknown, attacking mushrooms, SAM. Flinders Ranges, Wirrabara, 1/1 female, 2 males (J10786), Sep 1952, collector unknown, host unknown, SAM. Kangaroo Island, 4 mile, SW of American River, 6/3 females, 1 male, 2 tritonymphs (J10745, J10746, J10747, J10748, J10749, J10750), 21 Sep 1959, H.M. Cooper, in tea-tree scrub on tableland, SAM. Mt Lofty Ranges, Waitpinga, 3/3 females (J10742, J10743, J10744), 26 May 1960, collector unknown, moss, SAM. Mt Lofty Ranges, 3 km [2 mile] N. of Myponga, at approx. 500 ft, 8/15 females, 7 males, 2 tritonymphs (J10734, J10735, J10736, J10737, J10738, J107394, J10740, J10741), 4 Jun 1962, H.M. Cooper, host unknown, SAM. **VIC**: Mt Dandenong, 1/1 female, 2 males (J10711), 17 May 1932, J.W. R, bat debris, SAM. Victoria, K.T.R.S. Frankston, 5/1 female, 2 males, 2 tritonymphs (5476), 14 Feb 1973, R. Shepherd, Rabbit (*Oryctolagus cuniculus*), VM. **WA**: Wooroloo, 1/3 females, 3 males (J10723), Aug 1932, H. Womersley, host unknown, SAM. Jennacubbine, 31 26'S, 116 43'E, 5/2 females, 2 males, 1 tritonymph (Horbury-18), 26 Jul 1995, R. Horbury, pasture, ANIC. **Intercepted in New Zealand**: 1/3 females [+ *Tyrophagus communis* 1 female] (P.Q.A. 3104), 15 Apr 1978, J. Jones, *Narcissus* bulbs, MAF/A. 2/11 females, 3 males (P.Q.A 4468), 25 Dec 1978, J. Bongiovanni, seeds and debris from tent, MAF/A.
NETHERLANDS: U.K.: Kent, Ashford, Wye, 1/5 females, 2 males (184(1)) (as holotype, allotype, and paratypes of *Tyrophagus oudemansi* Robertson), 5 Mar 1951, W Jan St.G. Light, mushrooms, BMNH. **Intercepted in New Zealand**: 1/1 female, 3 males, 2 tritonymphs (PQJ 154), 19 Mar 1970, C.A.F. Jaques, dahlia tubers, MAF/A. 1/1 female (PQA 3454), 10 Apr 1974, M.B. Henwood, *Lilium* bulbs, MAF/A. 1/1 male [+ *Tyrophagus longior* 2 females, 2 males] (21132), 8 Jul 1986, J. Nightingala, Dahlia, MAF/A.
SOUTH AFRICA: Randebosch CP, 1/1 female, 1 male (J10729), 5 Aug 1930, H. Womersley, host unknown, SAM.
U.K.: **Intercepted in New Zealand**: 1/1 male [+ *Tyrophagus longior* 4 females] (P.Q.A. 2891), 8 Feb 1978, N. Lomax, *Dahlia* bulb, MAF/A. 1/1 female [+ *Tyrophagus longior* 3 females, 3 males] (P.Q.A. 6349), 27 Dec 1979, A. Habrake, acorns *Quercus* sp. in Kew gardens, MAF/A.

Tyrophagus vanheurni Oudemans

Type material. **Lectotype** male (designated by Robertson 1959): NETHERLANDS: Twello, 1/1 lectotype male + 4 females + 1 male (No. 6, P6993), 10 Mar 1924, van Heurn, cocosnoot, RMNH.
Other material. NEW ZEALAND: **AK**: Auckland, Titirangi, 2/4 females, 2 males (1, 2), 7 Oct 1976, I. Gordon, injured living *Macadamia* husk, NZAC. Pukekohe, 1/2 males [+ Acaridae 1 male] (216), 13 Nov 1985, Thompson, host unknown, NZAC. Auckland, Mt. Albert, 1/1 female, 1 male, 12 Aug 1988, P. Herbert, *Orthodera ministralis* ootheca on male scale insect, NZAC. **AU**: Auckland Is, Masked I, DSIR Ecology Division, 1/1 female, Feb 1973, collector unknown, *Mus musculus*, NZAC. Auckland Is, Erebus Cove, DSIR Ecology Division, 1/1 female, Feb 1973, collector unknown, *Mus musculus*, NZAC. Auckland Is, Camp Cove, DSIR Ecology Division, 1/4 males, 2 tritonymphs [+ *Glycyphagus domesticus* 1 tritonymph], Feb 1973, collector unknown, *Mus musculus*, NZAC. **BP**: Te Puke, 1/1 female, Dec 1974, R. Tustam, sphecids stick-trap, NZAC. **CL**: Little Barrier Is., 1/3 females [+ *Glycyphagus domesticus* 1 female] (36), 30 Jul 1953, collector unknown, *Rattus exulans*, NZAC. **HB**: Hawkes Bay, Haumoana, 1/1 female, 1 tritonymph [+ Glycyphagidae 1 female], 21 Aug 1970, collector unknown, dead house-fly and dead fruit flies, NZAC. **KE**: Kermadec Is, Raoul I, 3/6 females (1, 2, 28), Jul-Aug 1950, collector unknown, *Rattus norvegicus*, NZAC. Kermadec Is, 1/1 female, 13 Aug 1973, J. Ireland, dead *Rattus norvegicus* at hostel, NZAC. Kermadec Is, 1/1 female, 25 Sep 1973, J. Ireland, dead *Rattus exulans* at hostel, NZAC. **MC**: Christchurch, 1/5 females, 2 males [+ *Tyrophagus communis* 1 female, 1 male], 27 Aug 1979, L. Heath, *Capsicum frutescens* in glasshouse, MAF/A. Christchurch, Barry's Bay Christchurch Coolstores, 1/1 female [+ Glycyphagidae 2 females] (NPPRL Ref. 88/691), 25 Jul 1988, A. Cooke, settlers, MAF/L. **ND**: Waipoua forest, 1/1 female, 4 males, 1 larva, 22 Nov 1944, P.L. Robertson, debris in collection of *Culex antipodeus*, NZAC. Mokohinau Is, 1/1 male (105), 24–28 Nov 1973, collector unknown, *Rattus exulans*, NZAC. Omahuta, 1/2 females, 1 male [+ *Glycyphagus destructor* 1 female], Feb 1974, G.R. Williams, short-tailed bat, NZAC. **SI**: Leas Bay Stewart I, 4/17 females, 10 males, 9 tritonymphs (103), 14 Apr 1974, collector unknown, *Rattus exulans*, NZAC. **TK**: Eltham: Co-op, Rennet Co. Ltd, 3/2 females, 2 males [+ *Tyrophagus longior* 5 females, 6 males, 1 tritonymph, 1 protonymph + *T. savasi* 2 females, 3 males], 27 Oct 1972, G.A.H. Helson, cheese, MAF/A. Hawera, 2/13 females, 2 males, 29 Apr 1975, D.C.M. Manson, cheese of kiwi factory, MAF/A. **TO**: Murupara, 1/1 female (NPPRL Ref. 3/99/667/3), 6 Apr 1999, G. & P. Martin, bee surveillance, washings off bees, MAF/L. Murupara, 2/2 females (NPPRL Ref. 3/99/668), 7 Apr 1999, G. & P. Martin, bee surveillance, washings off bees, MAF/L. Murupara, 1/1 male (NPPRL Ref. 3/99/735/1), 15 Apr 1999, G. & P. Martin, bee surveillance, washings off bees, MAF/L. **WI**: Kimbolton, 1/1 female (NPPRL Ref. 3/99/441/6), 11 Mar 1999, K. Matthewman, bee surveillance, washings off bees, MAF/L. **WN**: Wellington, 1/1 male [+ *Carpoglyphus lactis* 1 female], 15 Jun 1955, collector unknown, *Rattus rattus*, NZAC. Wellington, Wallaceville, 1/ females + *T. communis* (J10726), Apr 1946, L.K. Whitton, pollen from hive, SAM. **WO**: Waikato River, Hamilton, Univ. of Waikato, 1/1 male [+ *Tyrophagus communis* 1 female], date unknown, J. Boubee, host unknown, NZAC.
AUSTRALIA: Macquarie I, 5/1 female, 7 males, 46 tritonymphs, 2 larvae (80), 1959, collector unknown, *Rattus rattus* (2 heads only), NZAC.
NETHERLANDS: Twello, 1/4 females, 1 male + 1 lectotype male (No. 6, P6993), as lectotype. 27/27 females (remounted) (No. 4, P6991), Mar 1924, other data as lectotype.
TUVALU: Funa Futi Atoll, Ellice Is., 1/1 female (53), 16–30 Sept 1951, collector unknown, *Rattus exulans*, NZAC.
U.K.: Witts, Westbury, 2/2 females, 2 males (P.L.R. Var. Ser. III, Nos. 83, 84, P.L.R. Var. Ser. III, Nos. 7, 8), 8 Dec 1950, collector unknown, Welsh cheddar cheese in store, ANIC.

Australasian and Oceanian species *not present* in New Zealand

Tyrophagus australasiae (Oudemans)

Type material. **Lectotype** male (designated by Robertson 1959), INDONESIA (as Nieuw Guinea): Jamur, 1/lectotype male + 1 male (No. 8, P6921), 6 Aug 1903, De Beaufort and Lorentz, on the head of a crowned pigeon (*Goura* sp.), labelled "*Tyroglyphus australasiae* Oudemans 1915, ♂ dors., vent., No. 8, P6921, Op kop van gowia, Jamoer, (Nieuw Guinea), 6.8.1903, De Beaufort en Lorentz", RMNH.
Other material. INDONESIA, Salatiga, 1/3 males (including a male designated as lectotype of *T. javensis* by Robertson (1959) (misidentification, discussed below in *T. javensis*)) (No. 6, P6610), Mar 1915, P.V.D. Goof, on eggs of ant *Plagiolepis longipes*, labelled "*Tyroglyphus australasiae* Oudemans, ♂ dors., vent., lat., No. 6, P6610, Op eieren van *Plagiolepis longipes* (mier), Salatiga, Maart 1915, P.V.D. Goof", RMNH.

Tyrophagus javensis (Oudemans)

Type material. **Lectotype** female (designated in this study): INDONESIA (Nederlandsch Oost Indie): 1/1 female (No. 2, 2020, P6756), Java, Salatiga, Mar 1915, van der Goof, workings of ant (*Plagiolepis longipes* Jerd.), RMNH.

Other material. AUSTRALIA: SA: Adelaide Plains, Port Adelaide, 1/4 females + *T. communis* 3 females, 1 male (J10766), Jan 1954, H. Womersley, bark scrapings, SAM.
Intercepted in Auckland, New Zealand: 1/2 females, 1 tritonymph (NPPRL Ref. 09/2003/4582), 2003, collector unknown, water melon, MAF/A.
ECUADOR: **Intercepted in Auckland, New Zealand**: 1/3 females (P.Q.A. 8333), 7 Dec 1976, T. Cullen, banana, MAF/A. 1/1 male [+ Winterschmidtiidae 1 male] (NPPRL Ref. 09/2001/4424), 7 Dec 2001, collector unknown, banana, MAF/A. 1/2 females [+ Winterschmidtiidae 1 female] (NPPRL Ref. 09/2002/550), 4 Feb 2002, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2002/572), 4 Feb 2002, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2002/759), 5 Feb 2002, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2002/4299), 2002, collector unknown, banana, MAF/A. 1/1 male (NPPRL Ref. 09/2002/4537), 2002, collector unknown, banana, MAF/A. 1/2 females (NPPRL Ref. 09/2004/2232), 2004, collector unknown, banana, MAF/A.
PANAMA: **Intercepted in Auckland, New Zealand**: 1/1 female (NPPRL Ref. 09/2004/3372), 2004, collector unknown, banana, MAF/A.
PHILIPPINES: **Intercepted in Auckland, New Zealand**: 1/1 female (P.Q.A. 522), 18 Oct 1977, D. Farr, banana, MAF/A. 1/6 females (P.Q.A. 548), 19 Oct 1977, R. Steele, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2001/2602), 30.vii.2001, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2002/4379), 2002, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2003/590), 2003, collector unknown, banana, MAF/A. 1/1 female [+ oribatid 1] (NPPRL Ref. 09/2003/933), 2003, collector unknown, banana, MAF/A. 1/1 female [+ Winterschmidtiidae 2 females, 1 tritonymph] (NPPRL Ref. 09/2003/5735), 2003, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2003/6968), 2003, collector unknown, pineapple, MAF/A. 1/1 female [+ *Tyrophagus destructor* 1 female + Winterschmidtiidae 2 females] (NPPRL Ref. 09/2003/6992), 2003, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2003/6625), 2003, collector unknown, banana, MAF/A. 1/2 females (NPPRL Ref. 09/2004/501), 2004, collector unknown, banana, MAF/A. 1/1 male (NPPRL Ref. 09/2004/1073), 2004, collector unknown, banana, MAF/A. 1/1 female, 1 tritonymph (NPPRL Ref. 09/2004/1183), 2004, collector unknown, banana, MAF/A. 1/1 female, 1 tritonymph (NPPRL Ref. 09/2004/1303), 2004, collector unknown, banana, MAF/A. 1/2 females, 1 male, 1 tritonymph [+ Winterschmidtiidae 2 females] (NPPRL Ref. 09/2004/1692), 2004, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2004/2231), 2004, collector unknown, banana, MAF/A. 1/1 female, 1 tritonymph (NPPRL Ref. 09/2004/2319), 2004, collector unknown, banana, MAF/A. 1/1 female [+ Winterschmidtiidae 1 tritonymph] (NPPRL Ref. 09/2004/2531), 2004, collector unknown, banana, MAF/A. 1/1 female [+ Winterschmidtiidae 2 females, 1 tritonymph] (NPPRL Ref. 09/2004/2695), 2004, collector unknown, banana, MAF/A. 1/1 tritonymph [+ Winterschmidtiidae 1 female] (NPPRL Ref. 09/2004/2847), 2004, collector unknown, banana, MAF/A. 1/3 females (NPPRL Ref. 09/2004/2956), 2004, collector unknown, banana, MAF/A. 1/3 females (NPPRL Ref. 09/2004/3169), 2004, collector unknown, banana, MAF/A. 1/3 females (NPPRL Ref. 09/2004/3426), 2004, collector unknown, banana, MAF/A. 1/2 females, 1 tritonymph (NPPRL Ref. 09/2004/3346), 2004, collector unknown, banana, MAF/A. 1/1 female, 1 male (NPPRL Ref. 09/2004/3454), 2004, collector unknown, banana, MAF/A. 1/2 females (NPPRL Ref. 09/2004/3457), 2004, collector unknown, banana, MAF/A. 1/3 tritonymphs (NPPRL Ref. 09/2004/3478), 2004, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2004/3769), 2004, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2004/3786), 2004, collector unknown, banana, MAF/A. 1/2 females (NPPRL Ref. 09/2004/3810), 2004, collector unknown, banana, MAF/A. 1/1 female (NPPRL Ref. 09/2004/3810), 2004, collector unknown, banana, MAF/A. 1/1 female, 1 larva [+ Tarsonemidae 1 female] (NPPRL Ref. 09/2004/3913), 2004, collector unknown, banana, MAF/A. 1/1 female, 1 protonymph (NPPRL Ref. 09/2004/3989), 2004, collector unknown, banana, MAF/A. 1/1 male (NPPRL Ref. 09/2004/4072), 2004, collector unknown, banana, MAF/A. 1/1 female [+ oribatid 1] (NPPRL Ref. 03/04/1948), 2004, collector unknown, banana, MAF/L. 1/5 females [+ Winterschmidtiidae 1 female] (NPPRL Ref. 03/04/2426), 2004, collector unknown, banana, MAF/L. 1/3 females (NPPRL Ref. 03/04/2701), 2004, collector unknown, banana, MAF/L.
SINGAPORE: **Intercepted in Auckland, New Zealand**: 1/1 male, 2 larvae (NPPRL Ref. 09/2003/6492), 2003, collector unknown, banana, MAF/A.
THAILAND: **Intercepted in Auckland, New Zealand**: 1/1 female, 1 tritonymph (NPPRL Ref. 09/2002/2194), 2002, collector unknown, banana, MAF/A.
Note: banana is assumed to be *Musa sapientum* in above records.

Tyrophagus pacificus sp. n.

Type material. **Holotype** female: NIUE I, **Intercepted in New Zealand**: 1/1 female (indicated) + 11 (paratype) females, 1 (paratype) male, (P.Q.A. 2439), 15 Jan 1979, T. Pattison, plant parts, NZAC. **Paratypes**: 1/11 females, 1 male + holotype female, as holotype.

Other material. COOK IS: **Intercepted in New Zealand**: 1/1 female, 1 male (P.Q.A. 8620), 23 Mar 1977, D. Rogers, banana, NZAC.

FIJI: **Intercepted in New Zealand**: 1/2 females, 2 tritonymphs [+ Tarsonemidae 1 female] (P.Q.A. 6576), 18 Feb 1980, S. Aldridge, guavas, MAF/A. 1/3 females, 1 male (P.Q.H. 107), 5 Aug 1963, C.A.F. Jaques, part of coconut in sea, MAF/A.

SAMOA: 1/1 female (P.Q.A. 6072), 4 Apr 1974, P.D. Brown, *Cerbera mallam* seeds, MAF/A.

TONGA: **Intercepted in New Zealand**: 2/1 female, 1 male, 1 tritonymph [+ *Calvolia* sp. 1 female] (P.Q.A. 8313), 3 Dec 1976, M.B. Piles, banana, MAF/A. 1/4 females (P.Q.A. 8547), 3 Mar 1977, H.J. Webbev, banana, MAF/A. 1/2 females [+ Tarsonemidae 2 females] (P.Q.A. 164), 22 Jul 1977, T. Pattison, banana, MAF/A. 1/1 female [+ Tarsonemidae 1 nymph] (P.Q.A. 8797), 10 May 1977, D.W. White, banana, MAF/A. 1/4 females, 3 tritonymphs [+ Winterschmidtiidae 5 mites] (A. 971), 8 Feb 1978, P.J. Doherty, banana, MAF/A. 1/2 females [+ Winterschmidtiidae 2 mites] (A. 1620), 14 Jul 1978, S.M. Herries, banana, MAF/A. 1/1 female (P.Q.A. 1622), 14 Jul 1978, S.M. Herries, banana, MAF/A. 1/1 female [+ Tarsonemidae 2 females] (P.Q.A. 1623), 17 Jul 1978, K.J. Shaw, banana, MAF/A. 1/1 female (P.Q.A. 1730–34), 17 Aug 1978, K.J. Shaw, banana, MAF/A. 1/6 females, 4 males, 2 tritonymphs, 1 protonymph [+ Winterschmidtiidae 2 females] (A. 1827), 1 Sep 1978, J. Still, banana, MAF/A. 1/1 male, 6 tritonymphs (P.Q.A. 2136), 16 Nov 1978, T. Pattison, banana, MAF/A. TONGA & SAMOA: 1/1 male (A. 8076), 7 Sep 1976, M.B. Piles, banana, MAF/A.

Other material. TONGA: **Intercepted in New Zealand**: 1/1 female (NPPRL Ref. 09/2003/1215), date unknown, collector unknown, coconut, MAF/A. 1/1 female [+ *Tyrophagus xenoductus* holotype female, 2 (paratype) males, 1 (paratype) tritonymph (P.Q.A. 8563), 9 Mar 1977, S. Hevvies, bananas, NZAC. 1/2 females [+ *Tyrophagus xenoductus* 2 paratype females] (P.Q.A. 100), 27 Apr 1977, J. Bongiovanni, bananas, MAF/A. 1/1 female [+ *Tyrophagus pacificus* 2 females + *Calvolia* sp. 9 females] (P.Q.A. 859), 6 Jan 1978, S.M. Aldridge, bananas, MAF/A.

Tyrophagus perniciosus Zakhvatkin

Other material. AUSTRALIA: **QLD**: Stanthorpe, 1/1 female (J10784), 21 Sep 1953, A. May, on tomato (large numbers, serious damage to seed & newly germinating plants), SAM. **SA**: Adelaide Plains, 1/1 female (J10768), 15 Oct 1957, collector unknown, in budgerigar cage, SAM. **SA**: Adelaide Plains, 1/4 females, 5 males, 7 tritonymphs, 1 protonymph (J10769), 15 Oct 1957, collector unknown, in budgerigar cage, SAM. **SA**: Adelaide Plains, 5/5 females (J10770), 15 Oct 1957, collector unknown, in budgerigar cage, SAM.

Tyrophagus tropicus Robertson

Type material. **Holotype** male: NIGERIA: **Lagos**: 1/1 male + 1 (paratype) male (P.L.R. Var. Ser. X (9, 10)), 31 Oct 1951, collector unknown, palm kernel dust, BMNH. **Allotype** female: 1/1 female + 1 (paratype) female (P.L.R. Var. Ser. X (49, 50)), other data as holotype. **Paratypes**: 1/1 male + holotype male (P.L.R. Var. Ser. X (9, 10)), as holotype; 1/1 female + allotype female (P.L.R. Var. Ser. X (49, 50)), as allotype.

Other material. AFRICA: 1/1 female + *Tyrophagus communis* 2 females + *Proctolaelaps pygmaeus* 1 (P.Q.A. 2786), 3 Apr 1979, K. Shaw, Cocoa beans, MAF/A.

CHINA: **Hong Kong**: 1/1 female + *Tyrophagus communis* 3 females (P.Q.A. 1740), 18 Aug 1978, V. Ovens, dried fruit, MAF/A. 1/2 females, 1 male, 1 tritonymph + *Tyrophagus communis* 1 female, 3 males (P.Q.A. 4872), 26 Apr 1979, R. Barnett, dried lychees, MAF/A.

MALAYSIA: **Intercepted in New Zealand**: 2 females, 1 male (A 1306), 15 May 1978, collector unknown, dried fruit, MAF/A.

NIGERIA: **Lagos**: 1/2 males (P.L.R. Var. Ser. X, Nos. 11, 12), other data as holotype, ANIC. 1/2 females (P.L.R. Var. Ser. X, Nos. 65, 66), other data as holotype, ANIC.

SAMOA: **Intercepted in New Zealand**: 1 male, 1 protonymph + *Tyrophagus communis* 1 female, 1 male, 2 tritonymphs (P.Q.A. 3577), 6 Jun 1973, P.G. Whitham, bananas, MAF/A.

WEST AFRICA: **Intercepted in New Zealand**: 1 male (P.Q.M. 1270), 11 May 1973, G. Aiken, *Theobroma cacao*, MAF/A.

Tyrophagus womersleyi sp. n.

Type material. **Holotype** female: AUSTRALIA: **Intercepted in New Zealand**: 1/1 female (indicated) + 2 (paratype) females, 9 Oct 1978, B. Sukha, pineapples, NZAC. **Paratypes**: 1/2 females + holotype female, as holotype.

Tyrophagus xenoductus sp. n.

Type material. **Holotype** female: TONGA: **Intercepted in New Zealand**: 1/1 female (indicated), 1 allotype male, 1 (paratype) male, 1 (paratype) tritonymph [+ *Tyrophagus pacificus* 1 female] (P.Q.A. 8563), 9 Mar 1977, S. Hevvies, bananas, NZAC. **Paratypes**: 1/2 males, 1 tritonymph + holotype female, as holotype. TONGA: **Intercepted in New Zealand**: 1/2 females [+ *Tyrophagus pacificus* 2 females] (P.Q.A. 100), 27 Apr 1977, J. Bongiovanni, bananas, MAF/A. 1/2 females [+ *Tyrophagus pacificus* 1 female + *Calvolia* sp. 9 females] (P.Q.A. 859), 6 Jan 1978, S.M. Aldridge, bananas, MAF/A.

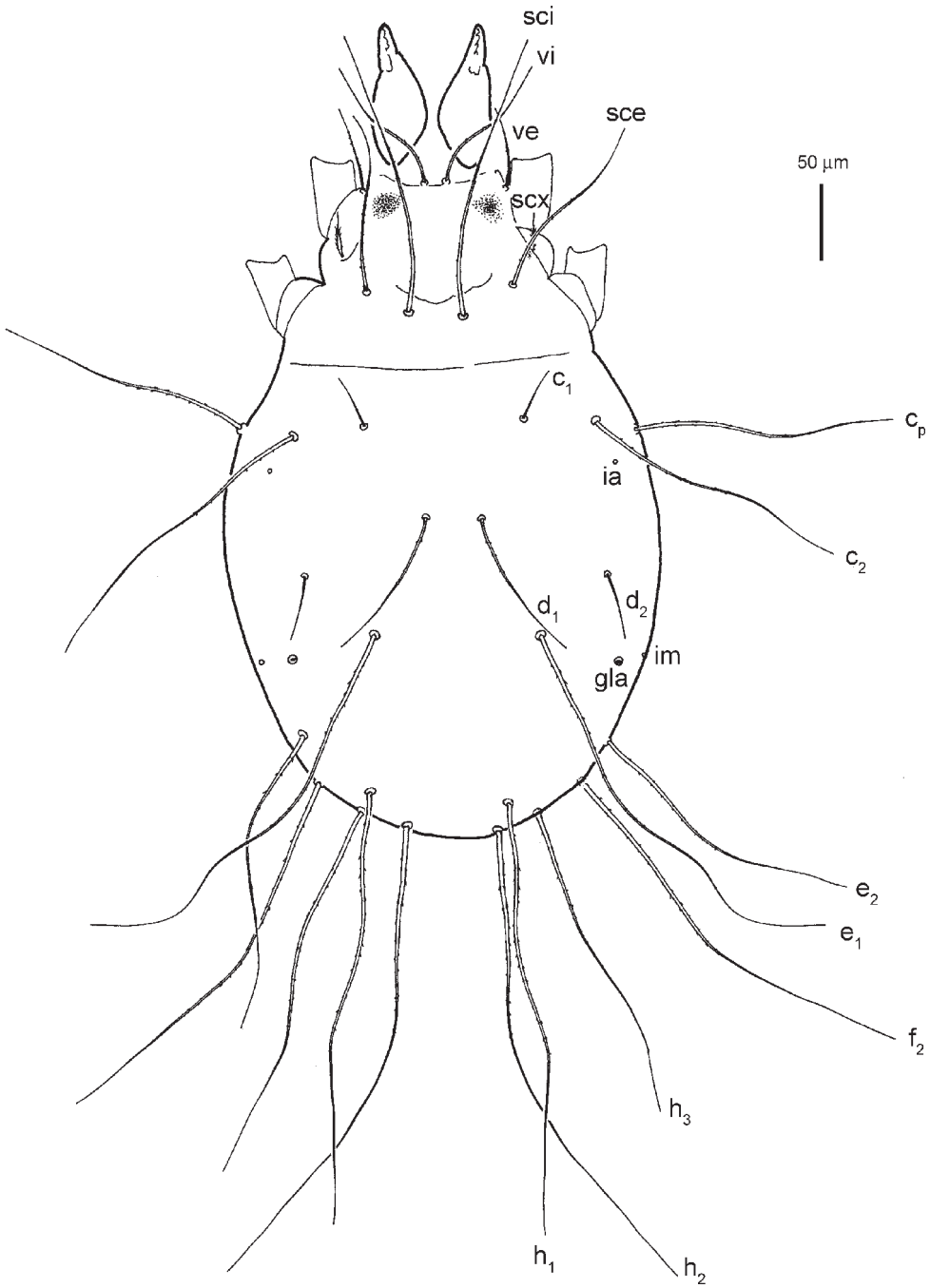


Fig. 1. *Tyrophagus communis* **sp. n.** (female). Dorsal view of idiosoma.

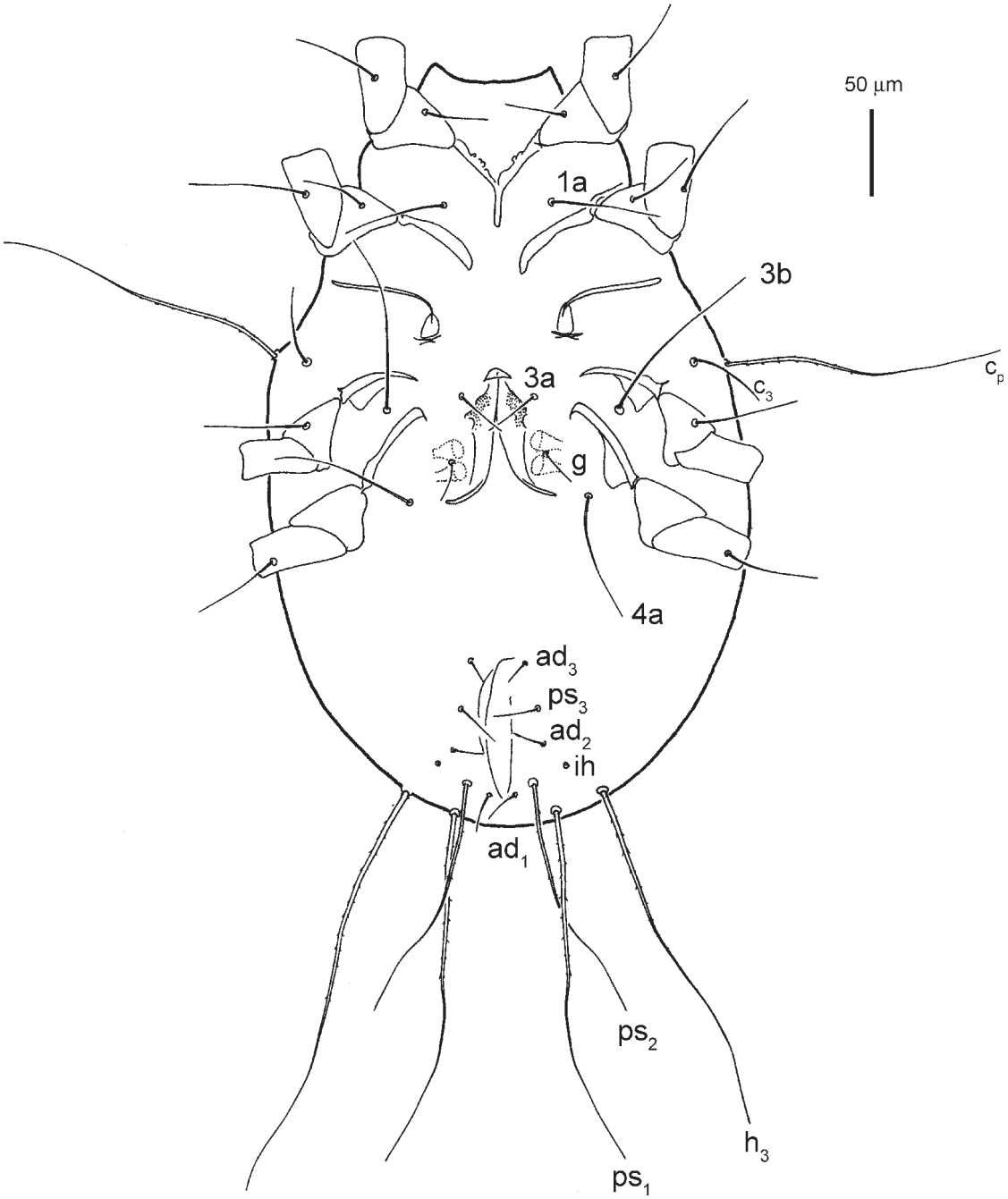


Fig. 2. *Tyrophagus communis* **sp. n.** (female). Ventral view of idiosoma.

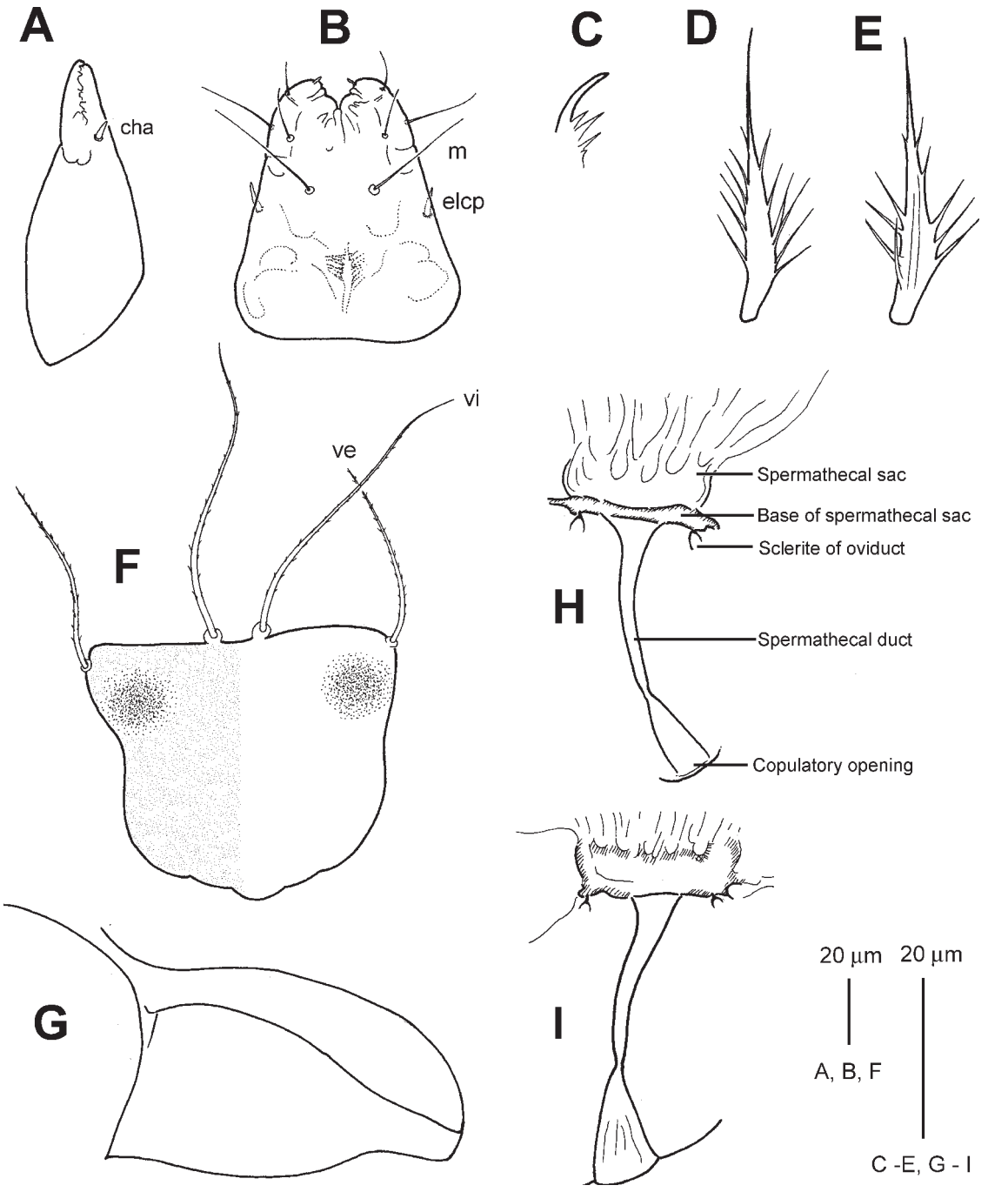


Fig. 3. *Tyrophagus communis* **sp. n.** (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, supracoxal seta; F, prodorsal shield; G, coxa II; H, copulatory opening and spermatheca; I, copulatory opening and spermatheca.

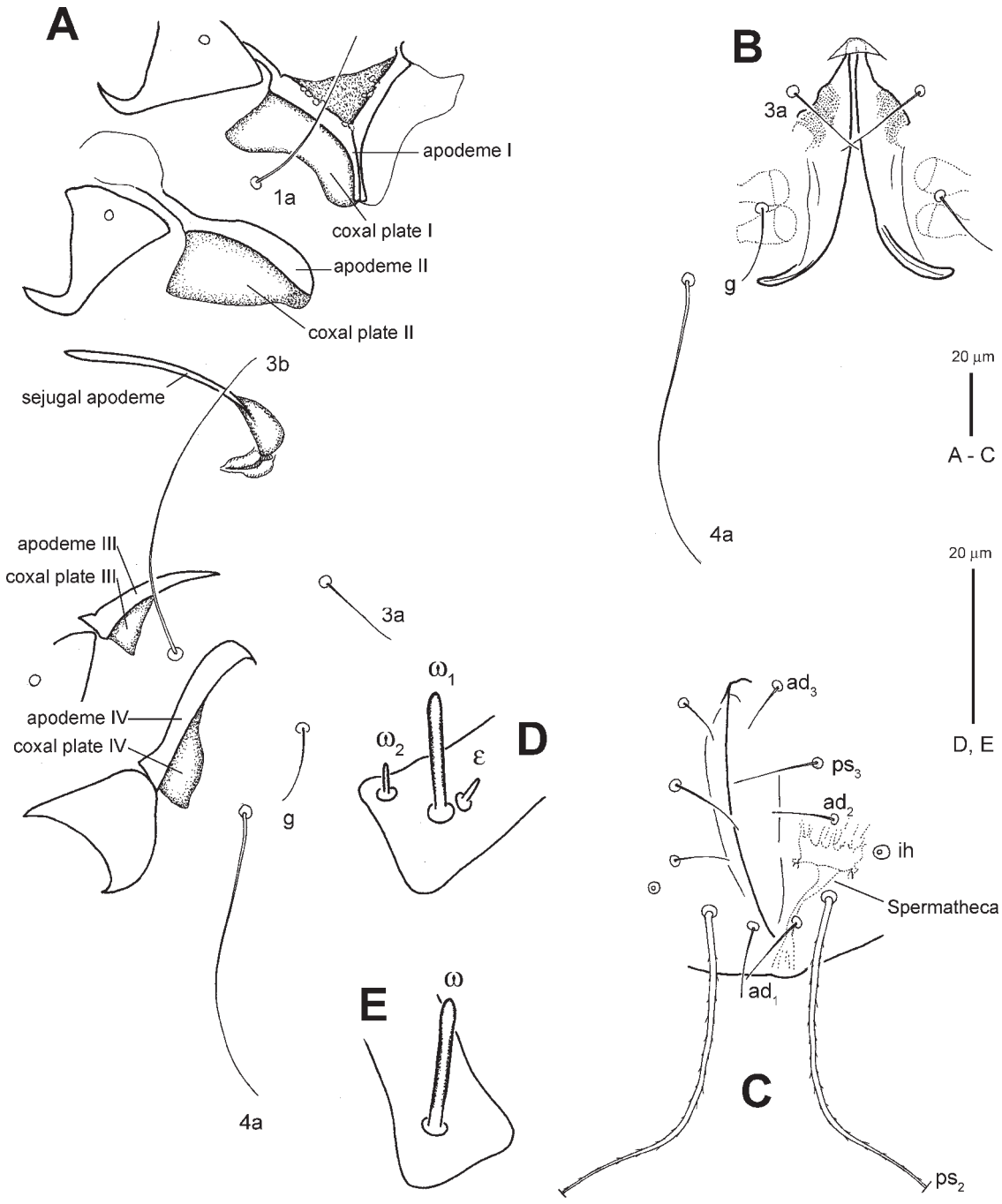


Fig. 4. *Tyrophagus communis* **sp. n.** (female). A, coxae I–IV; B, genital opening; C, anus; D, solenidia and famulus of tarsus I; E, solenidion of tarsus II.

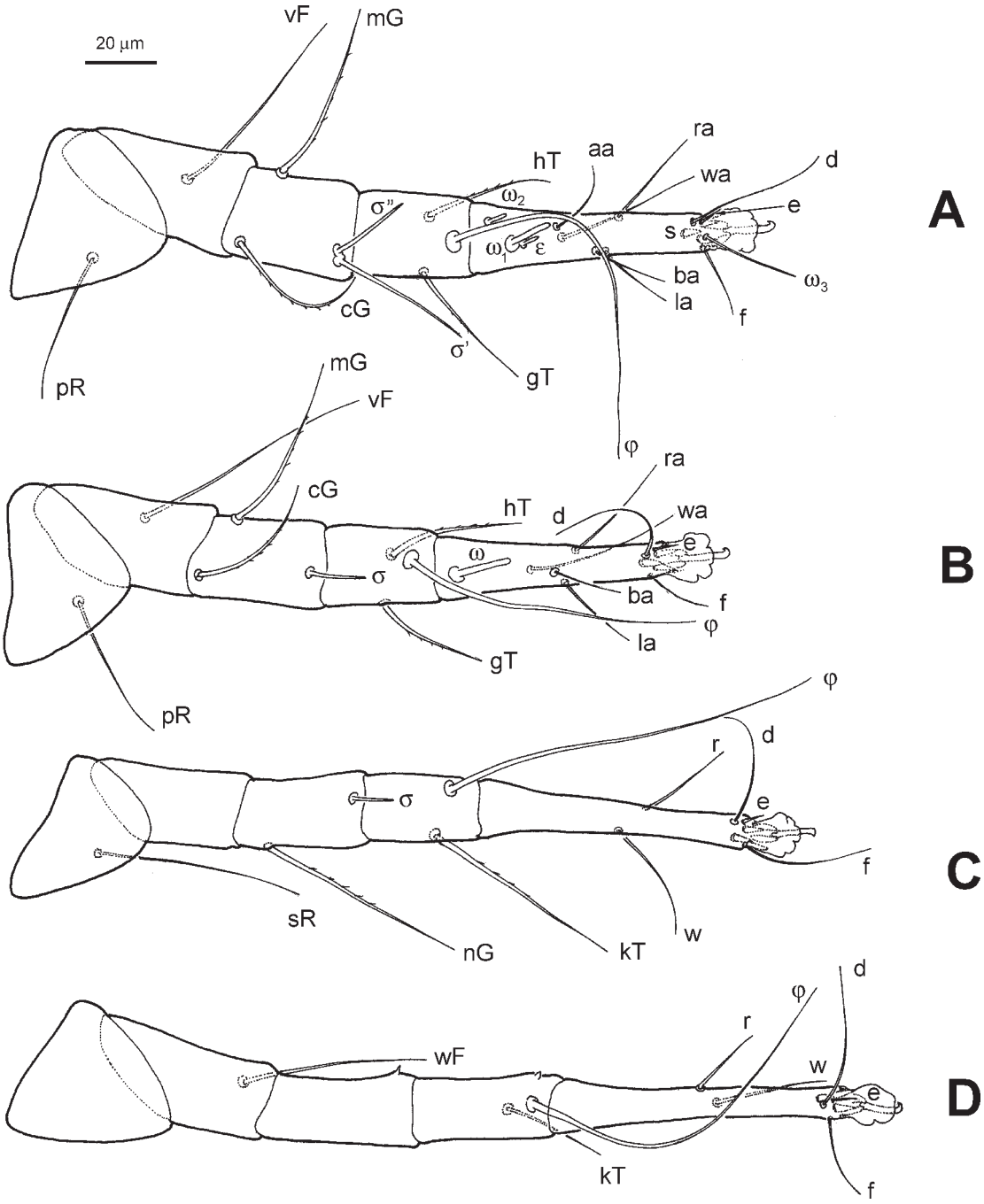


Fig. 5. *Tyrophagus communis* **sp. n.** (female). A, leg I; B, leg II; C, leg III; D, leg IV.

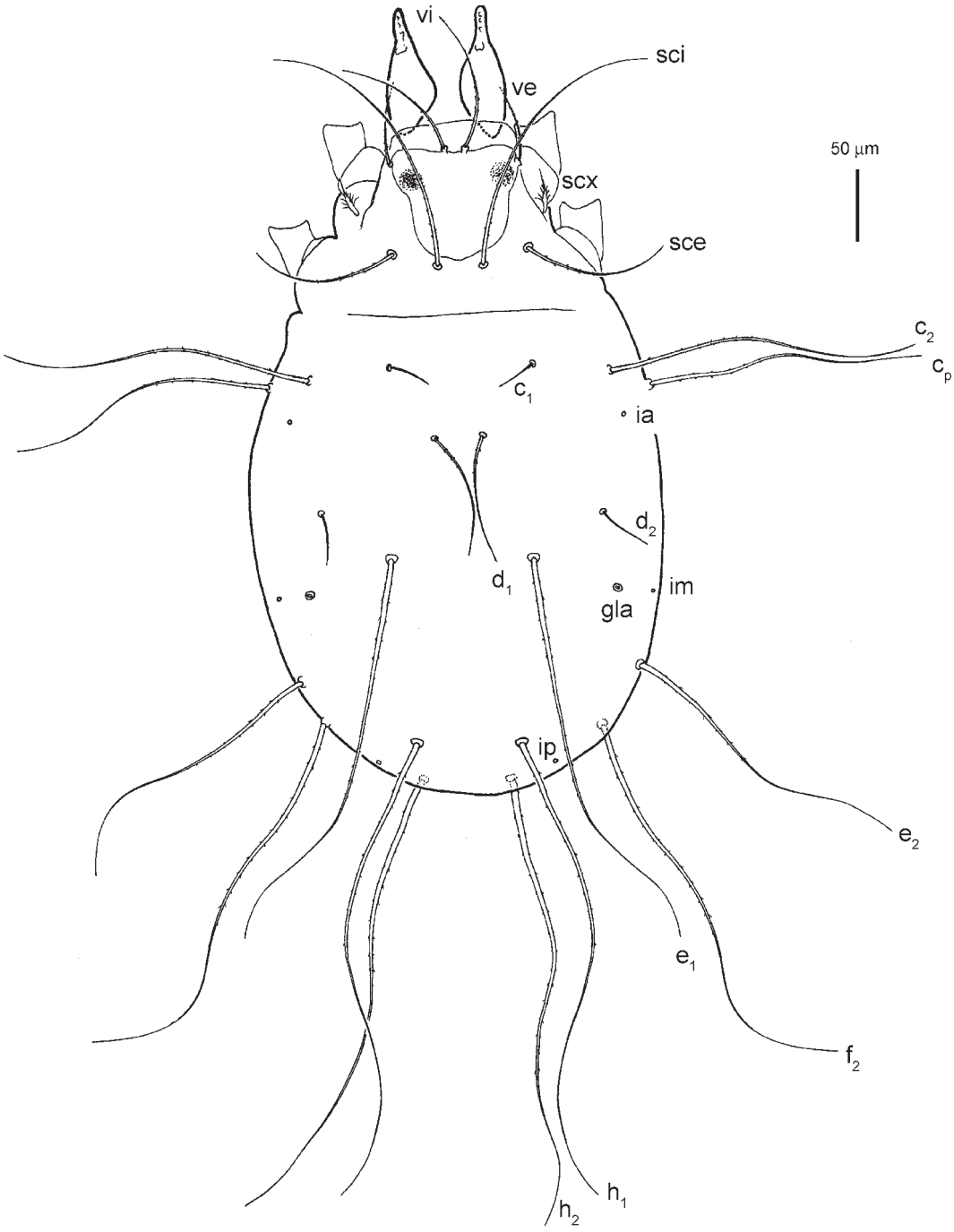


Fig. 6. *Tyrophagus communis* **sp. n.** (male). Dorsal view of idiosoma.

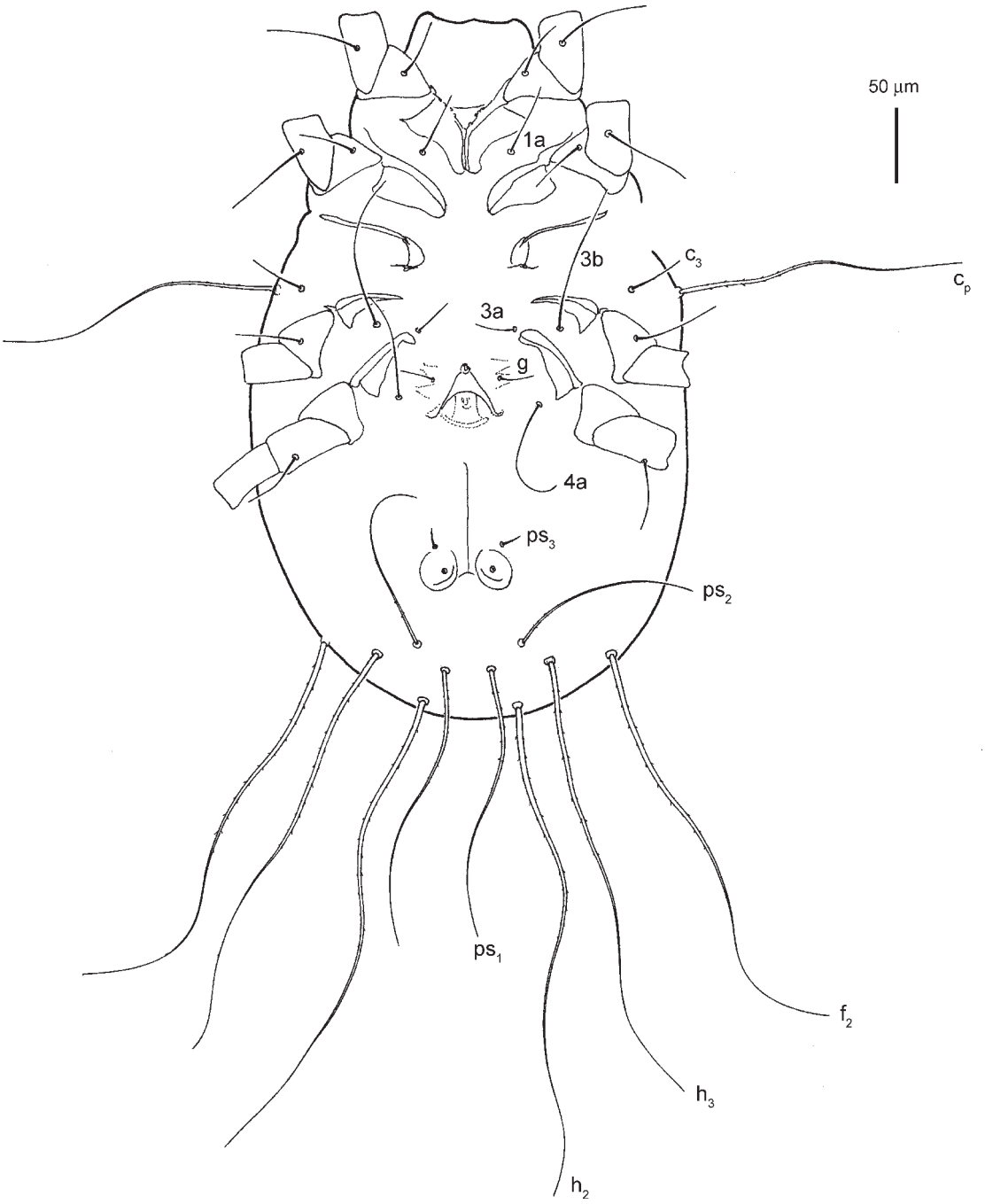


Fig. 7. *Tyrophagus communis* **sp. n.** (male). Ventral view of idiosoma.

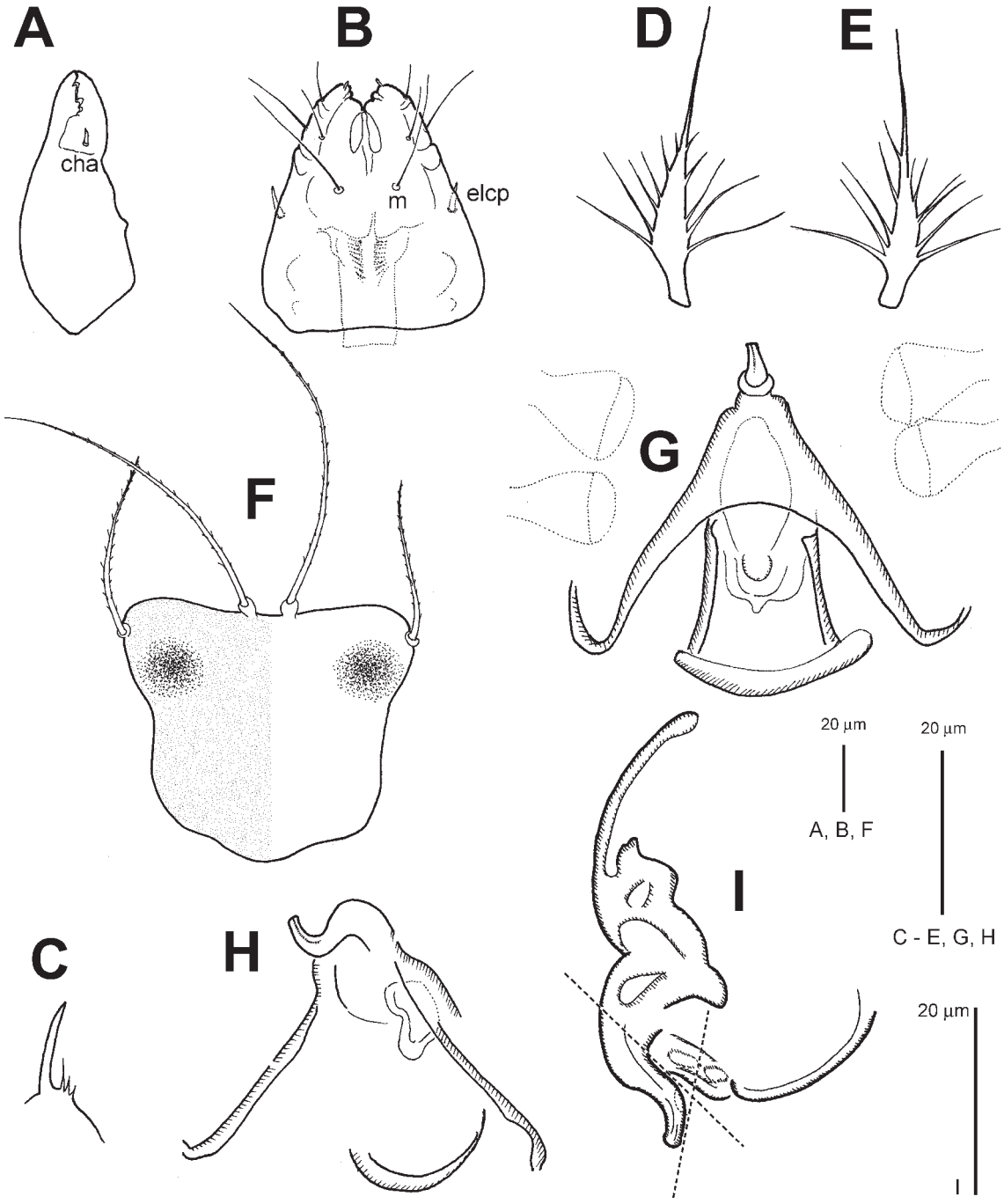


Fig. 8. *Tyrophagus communis* **sp. n.** (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, supracoxal seta; F, prodorsal shield; G, ventral view of aedeagus; H, lateral view of aedeagus; I, lateral view of aedeagus.

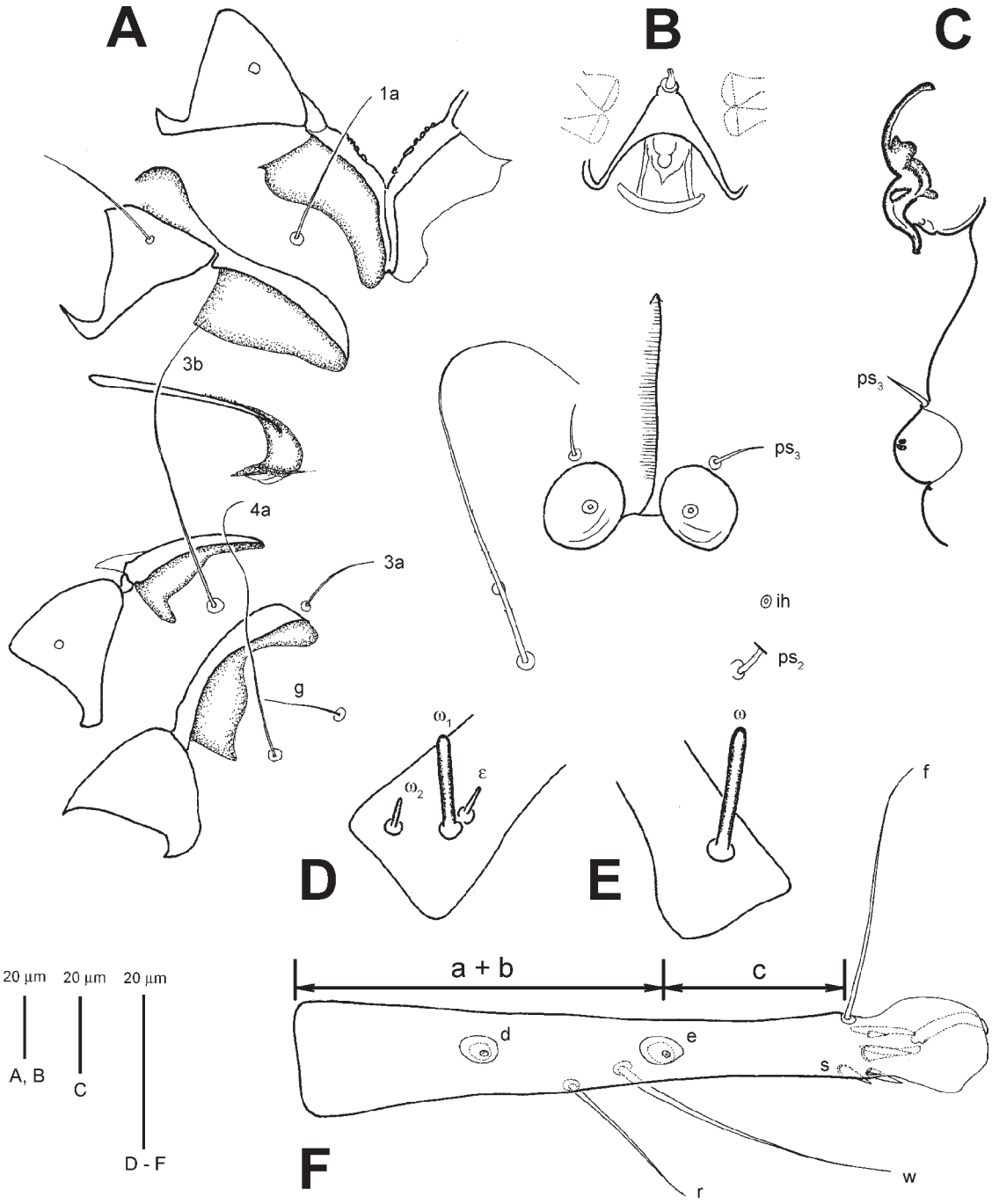


Fig. 9. *Tyrophagus communis* **sp. n.** (male). A, coxae I–IV; B, ventral view of aedeagus and anus; C, lateral view of aedeagus and anal sucker; D, solenidia and famulus of tarsus I; E, solenidion of tarsus II; F, tarsus IV.

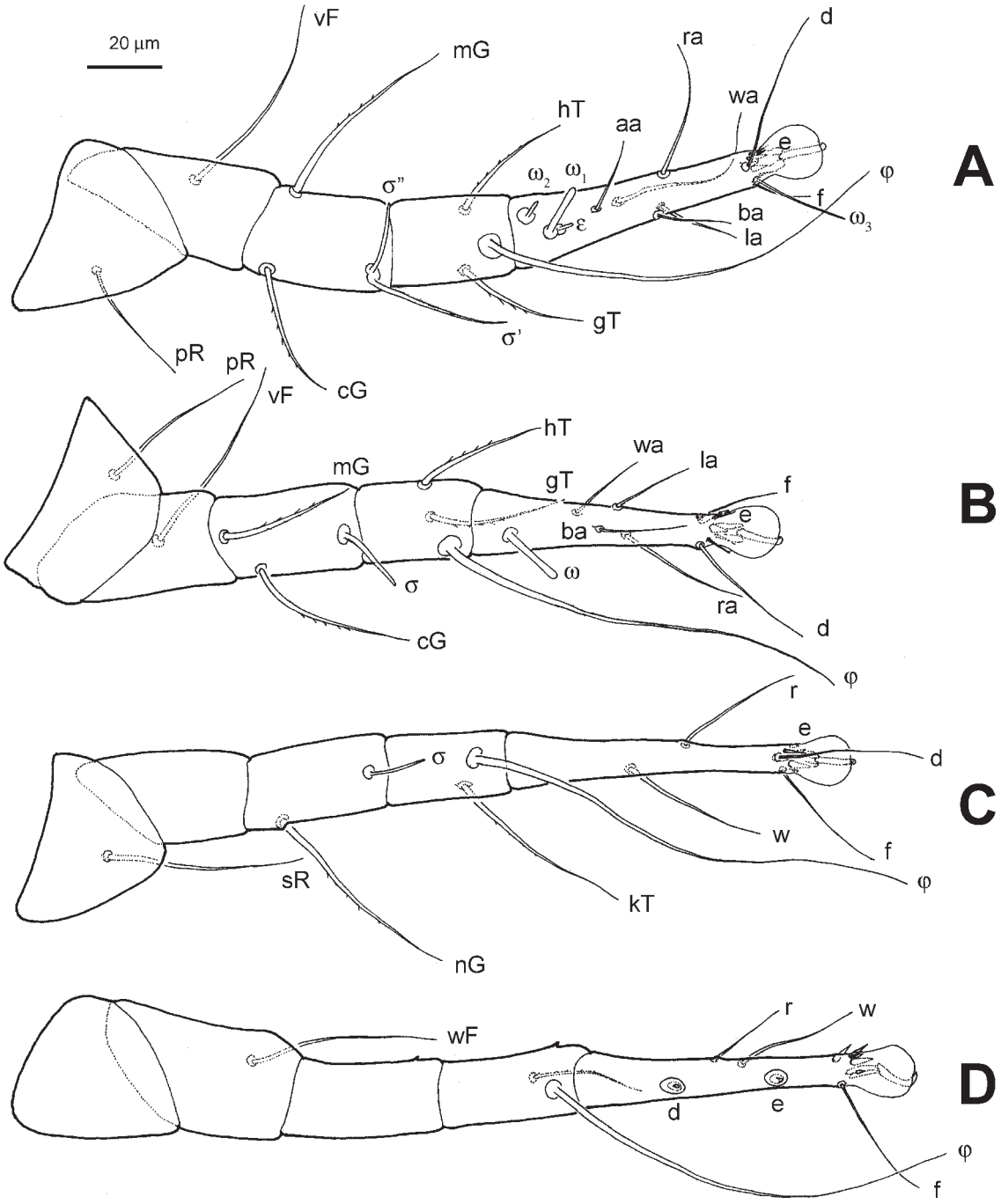


Fig. 10. *Tyrophagus communis* **sp. n.** (male). A, leg I; B, leg II; C, leg III; D, leg IV.

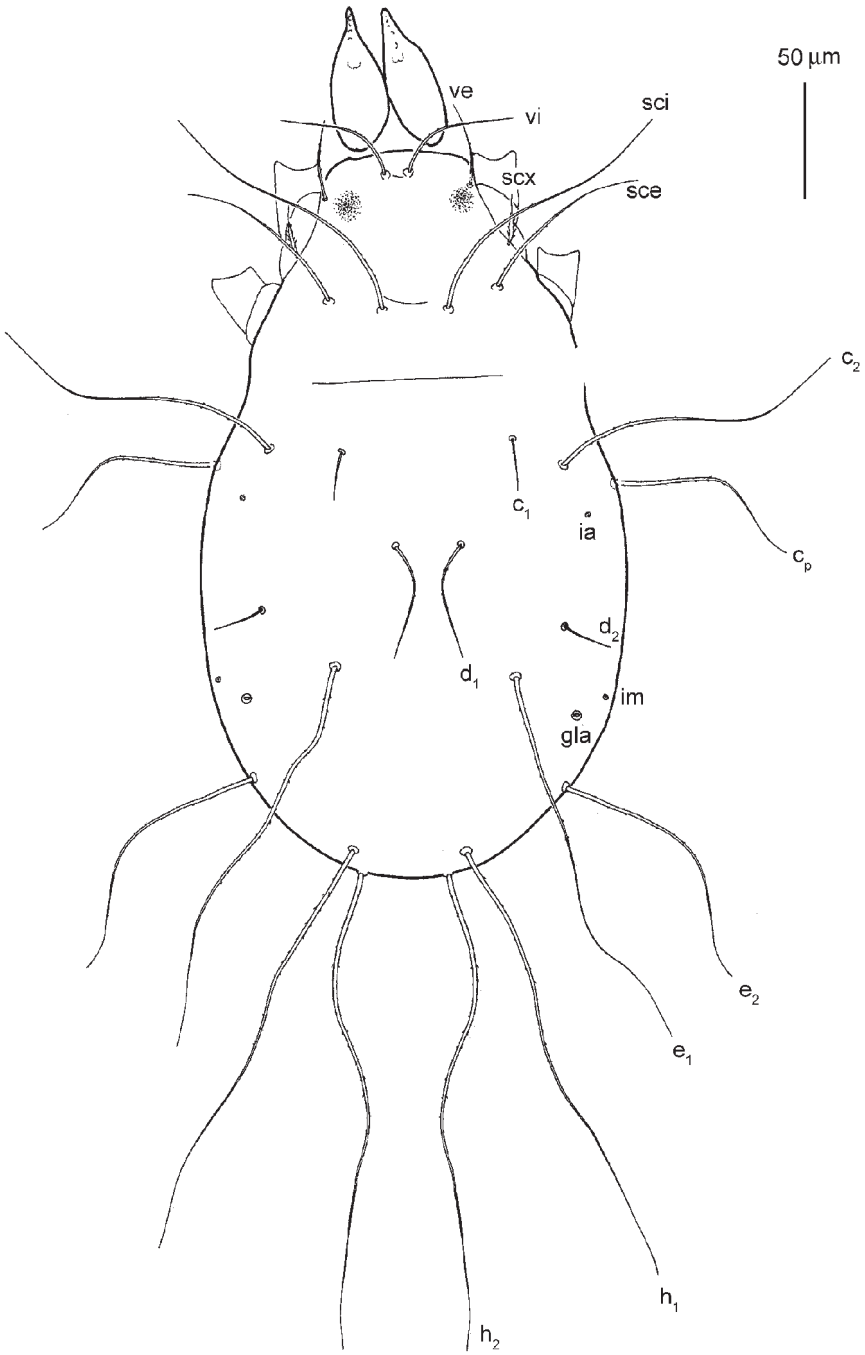


Fig. 11. *Tyrophagus communis* **sp. n.** (tritonymph). Dorsal view of idiosoma.

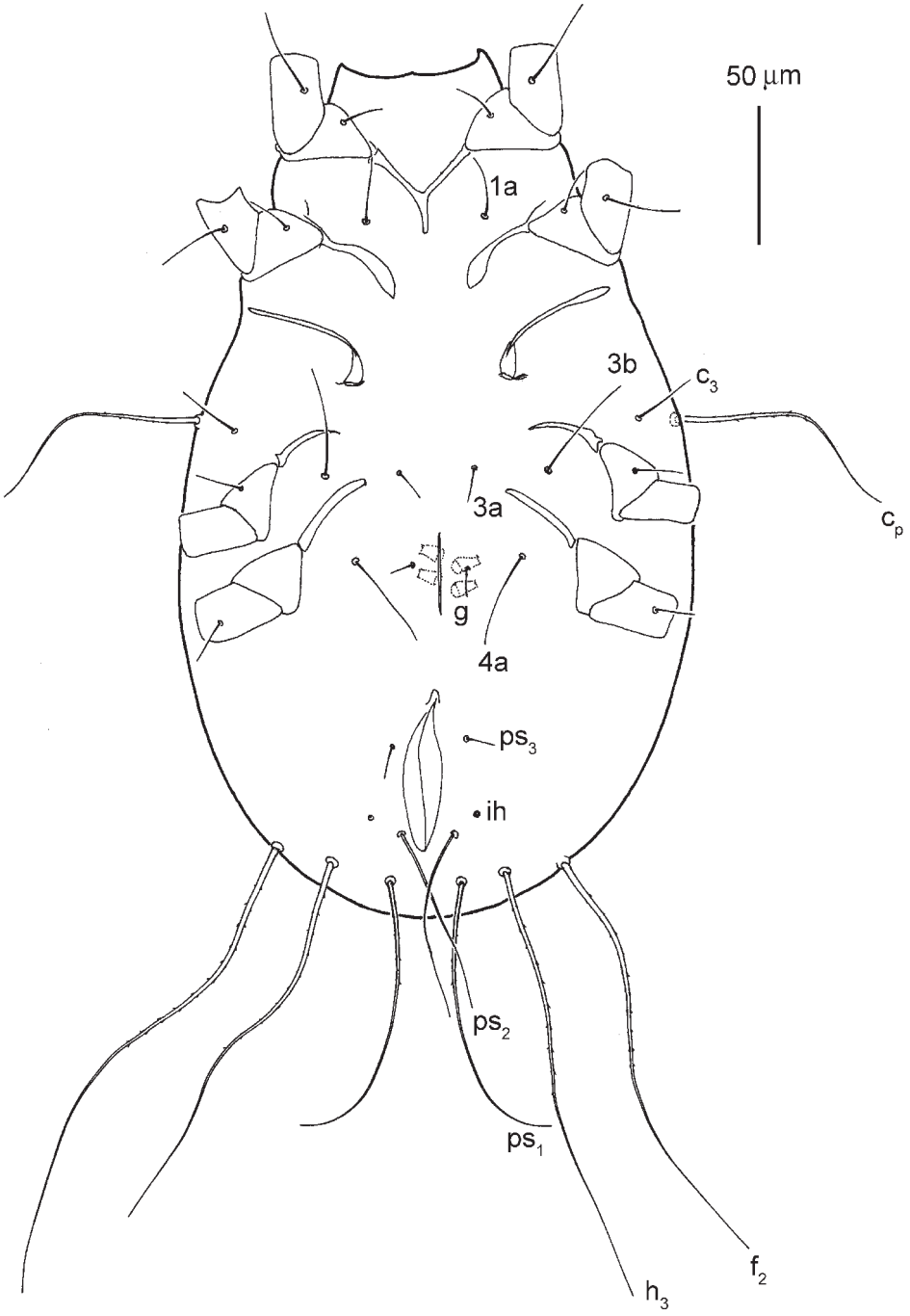


Fig. 12. *Tyrophagus communis* **sp. n.** (tritonymph). Ventral view of idiosoma.

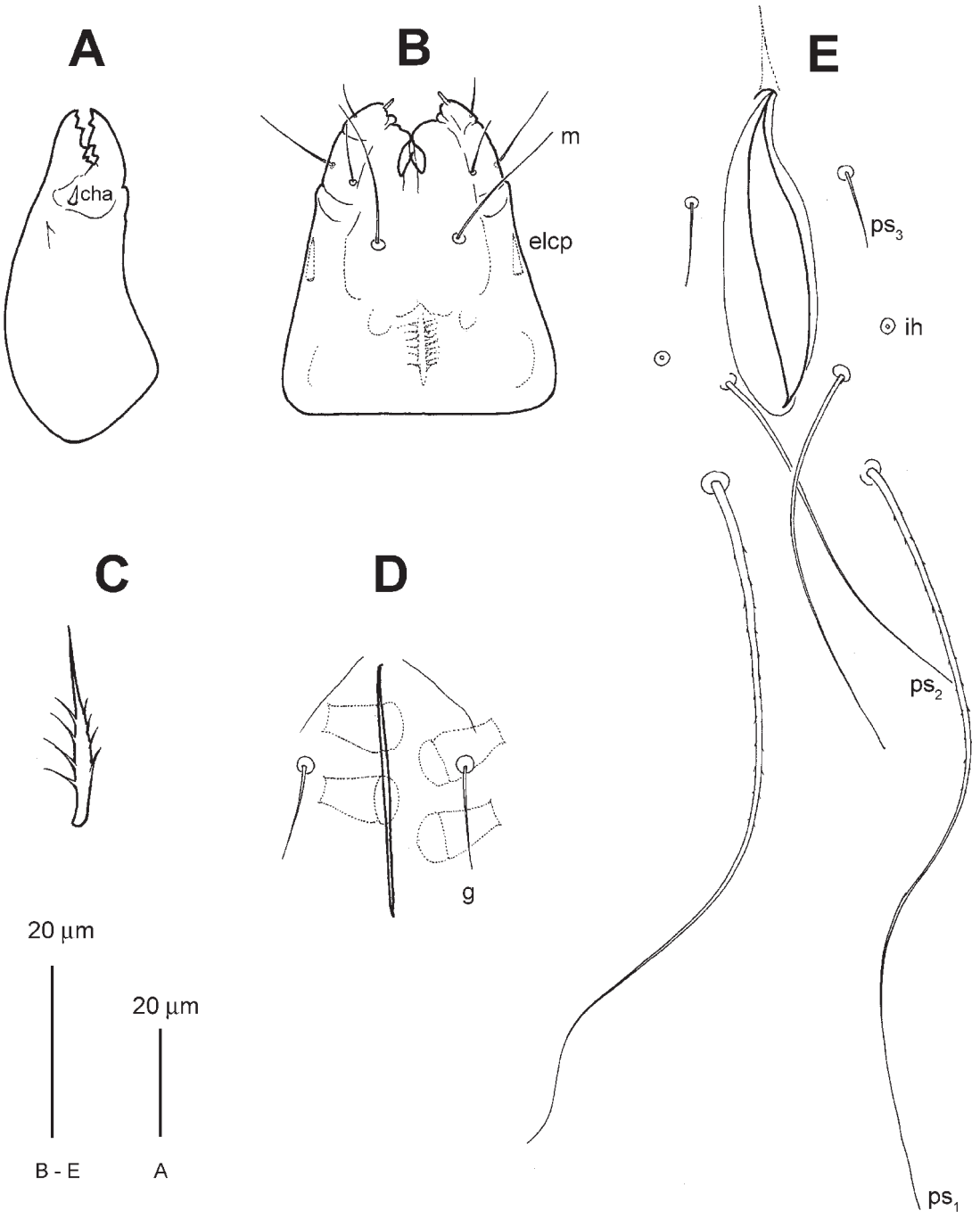


Fig. 13. *Tyrophagus communis* **sp. n.** (tritonymph). A, ventral view of chelicera; B, ventral view of subcapitulum; C, supracoxal seta; D, genital opening; E, anus.

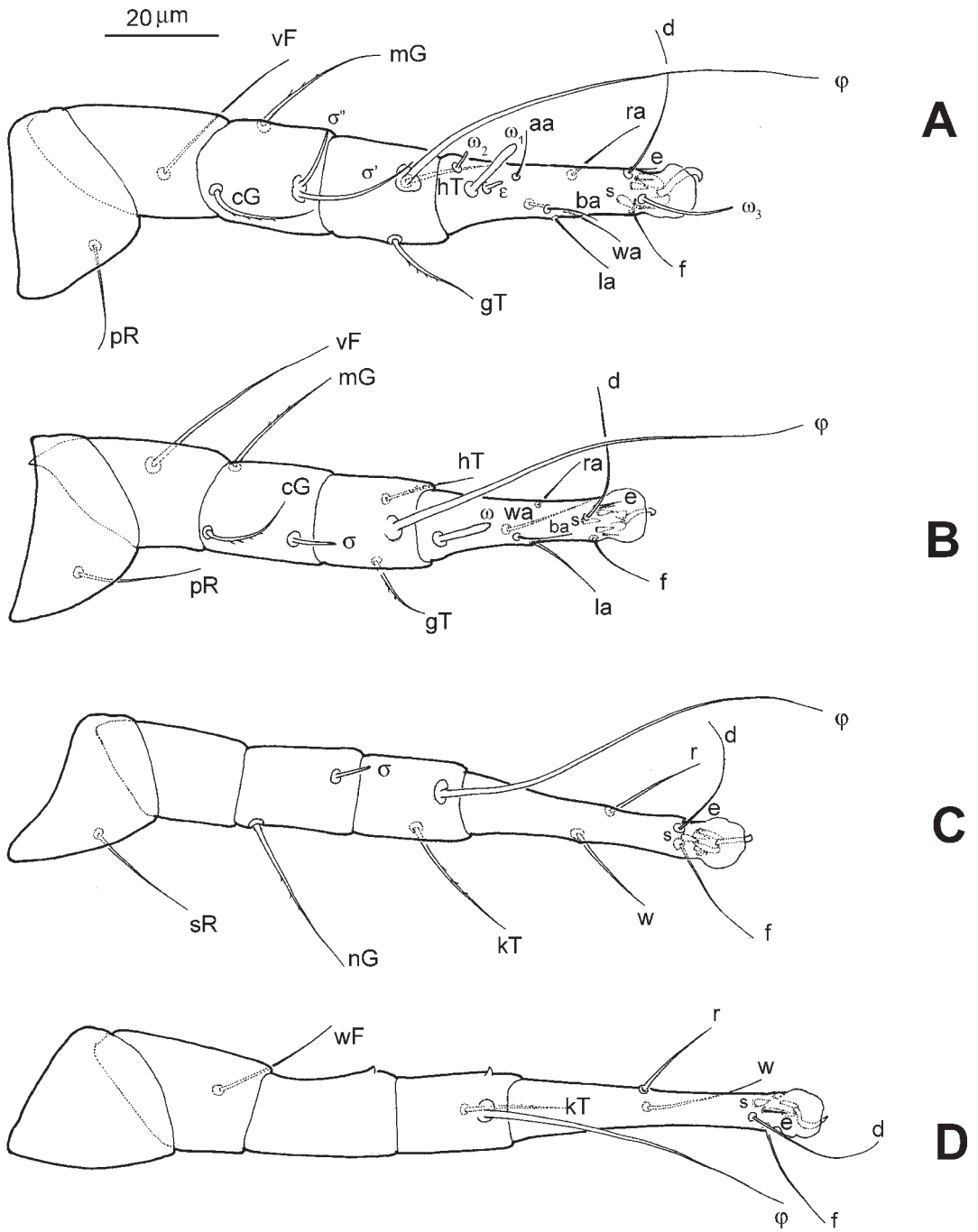


Fig. 14. *Tyrophagus communis* **sp. n.** (tritonymph). A, leg I; B, leg II; C, leg III; D, leg IV.

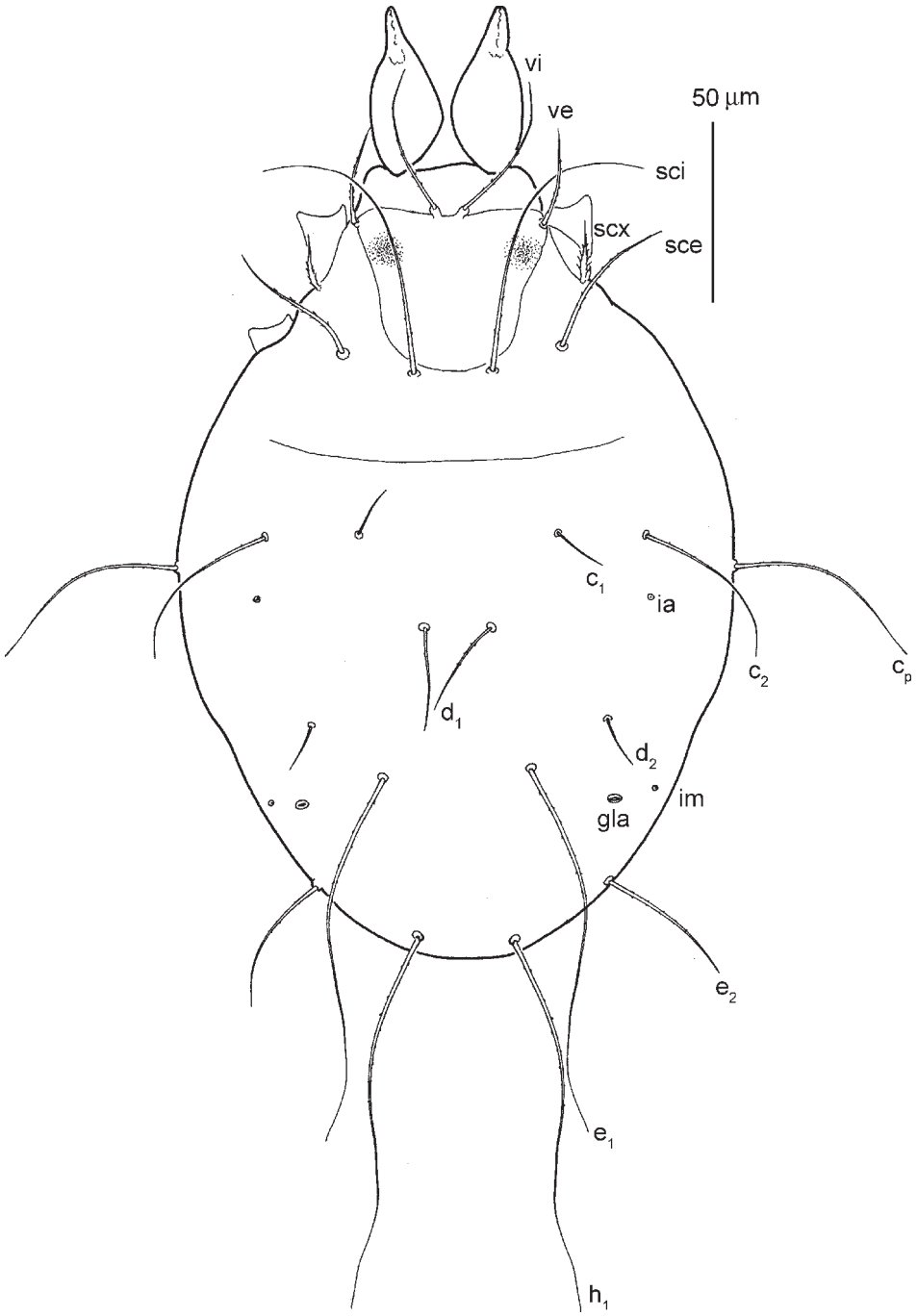


Fig. 15. *Tyrophagus communis* **sp. n.** (protonymph). Dorsal view of idiosoma.

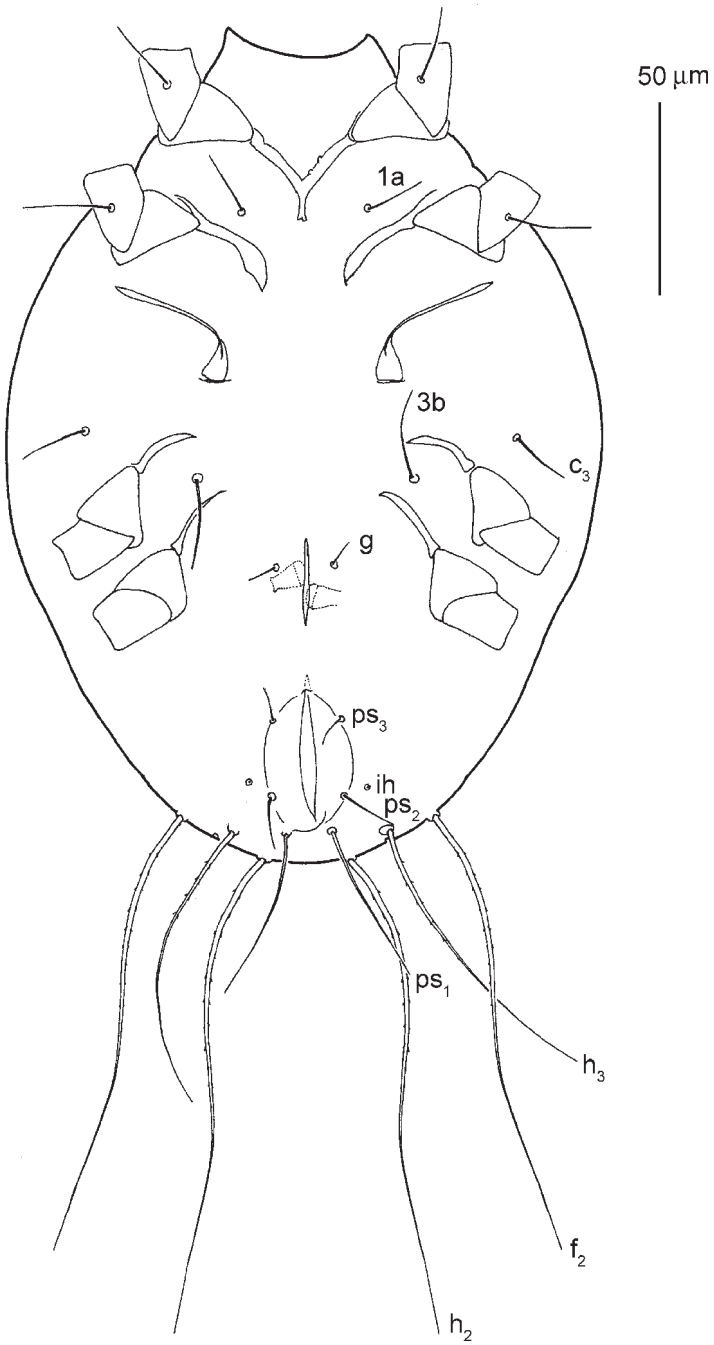


Fig. 16. *Tyrophagus communis* **sp. n.** (protonymph). Ventral view of idiosoma.

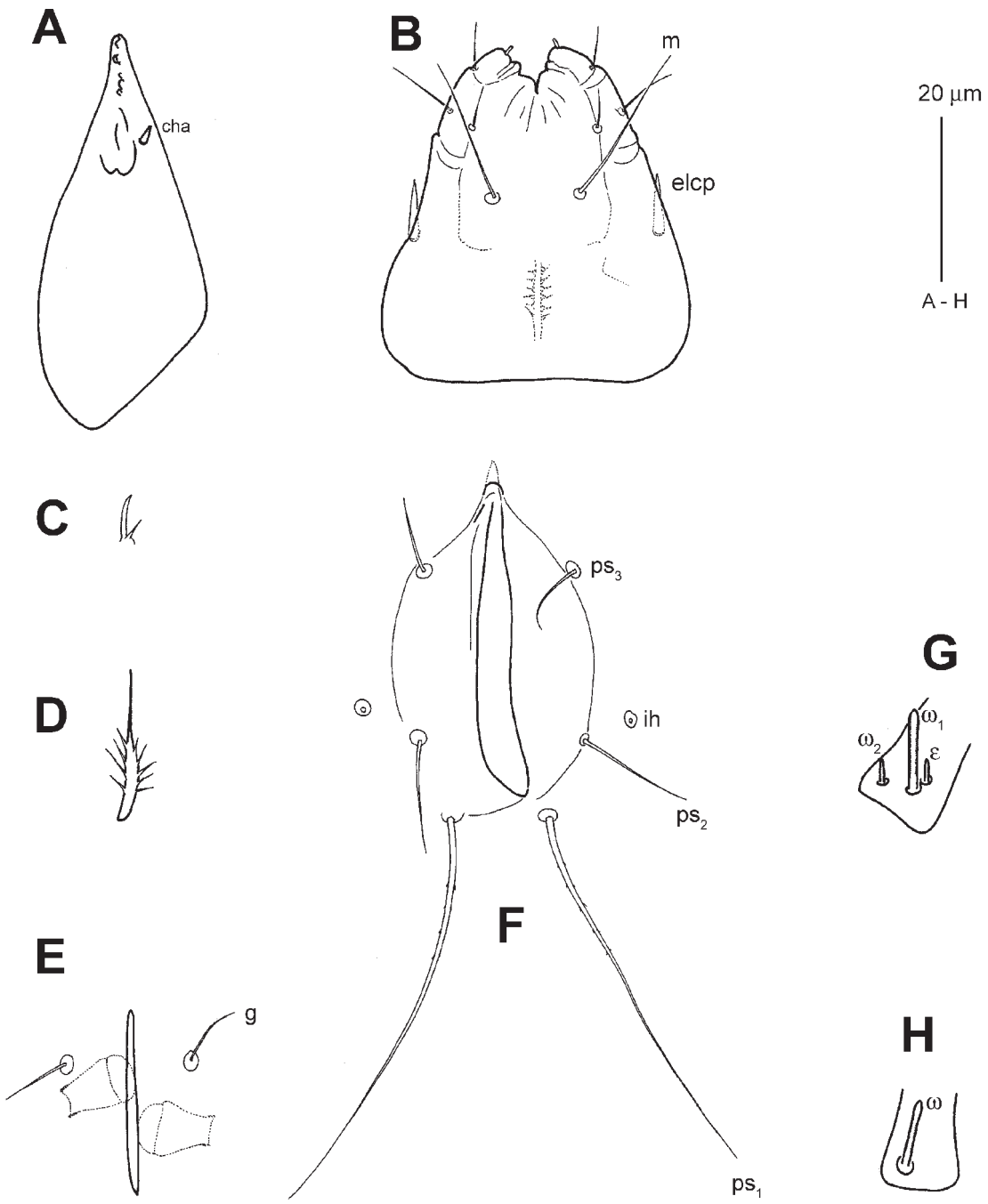


Fig. 17. *Tyrophagus communis* **sp. n.** (protonymph). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, genital opening; F, anus; G, solenidia and famulus of tarsus I; H, solenidion of tarsus II.

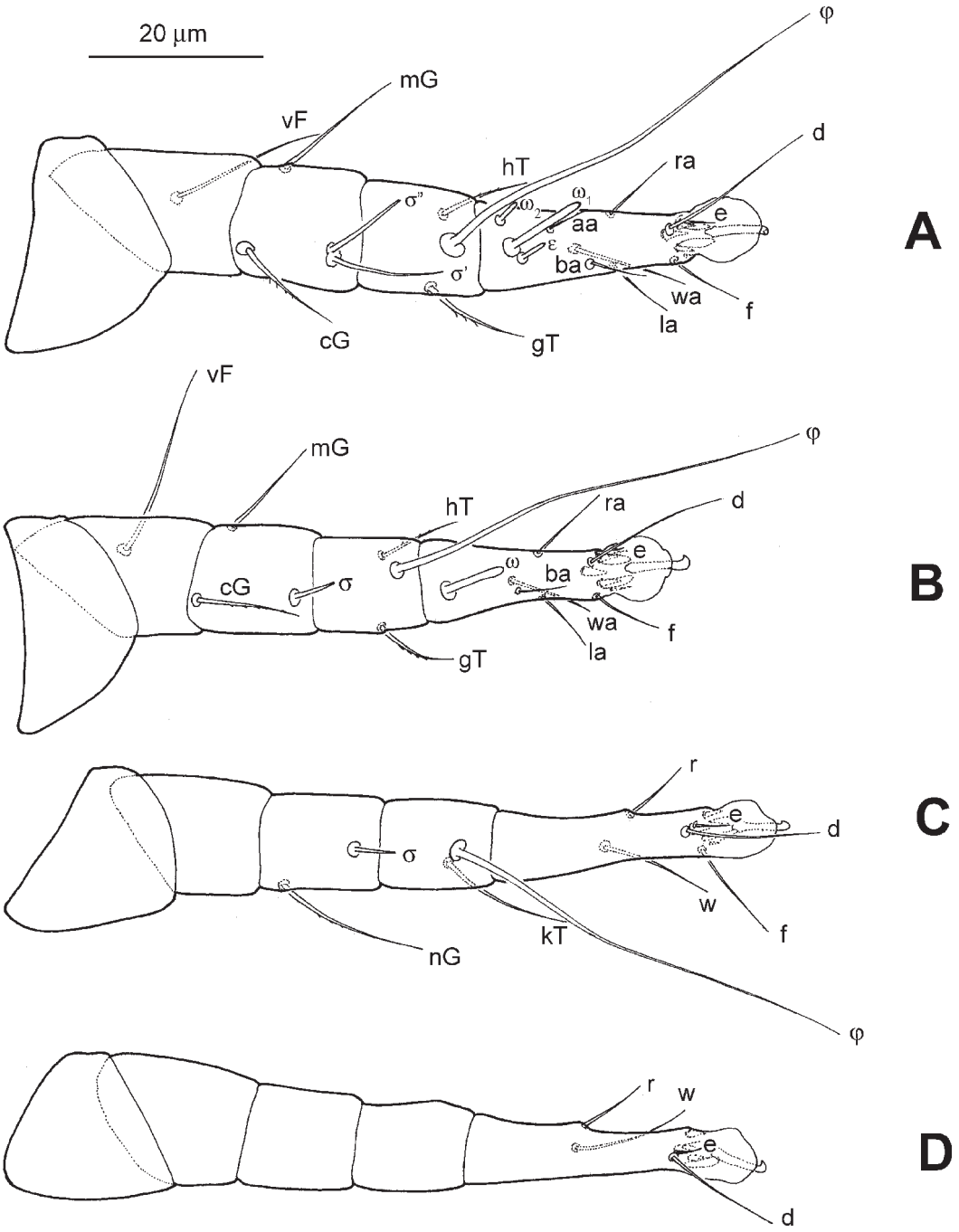


Fig. 18. *Tyrophagus communis* **sp. n.** (protonymph). A, leg I; B, leg II; C, leg III; D, leg IV.

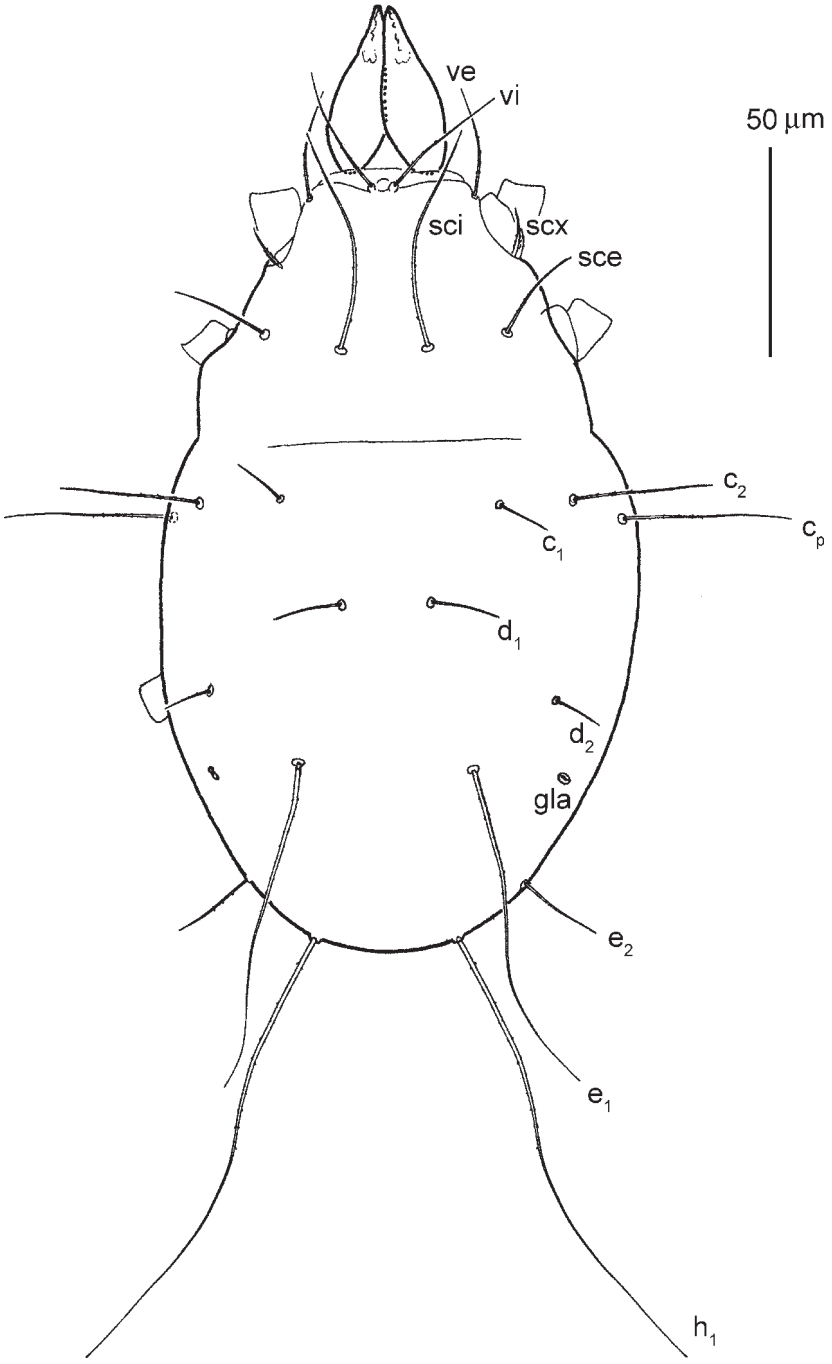


Fig. 19. *Tyrophagus communis* **sp. n.** (larva). Dorsal view of idiosoma.

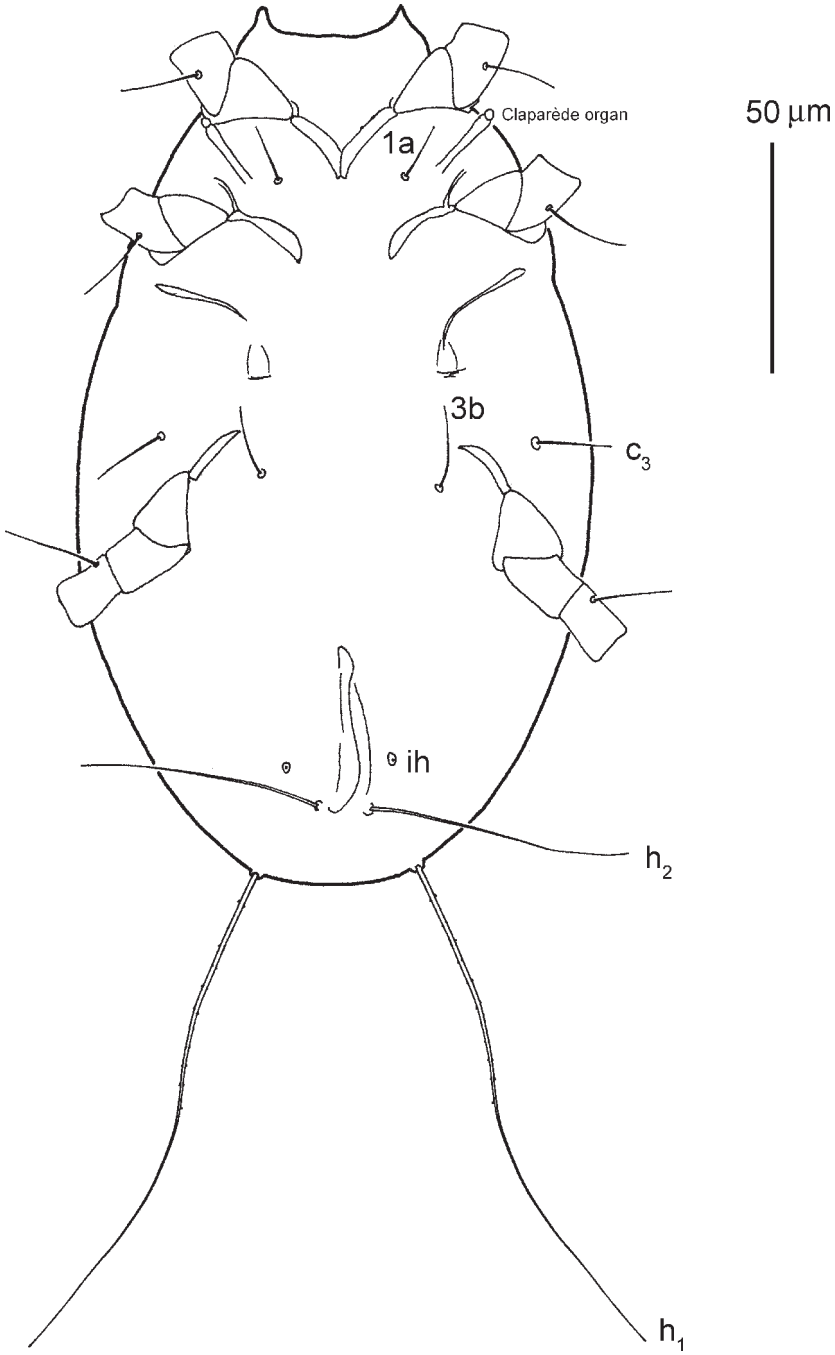


Fig. 20. *Tyrophagus communis* **sp. n.** (larva). Ventral view of idiosoma.

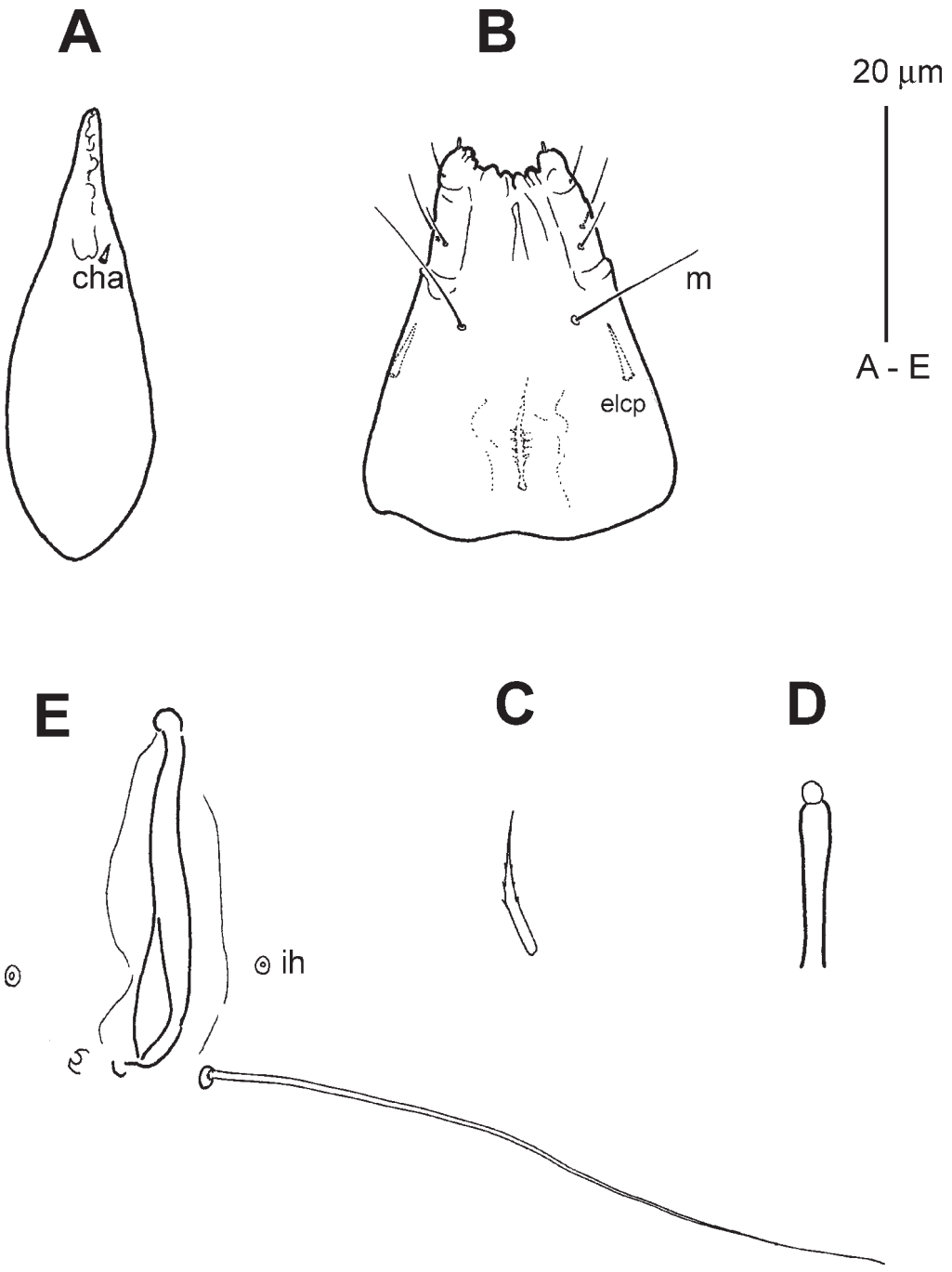


Fig. 21. *Tyrophagus communis* **sp. n.** (larva). A, ventral view of chelicera; B, ventral view of subcapitulum; C, supracoxal seta; D, Claparède organ; E, anus.

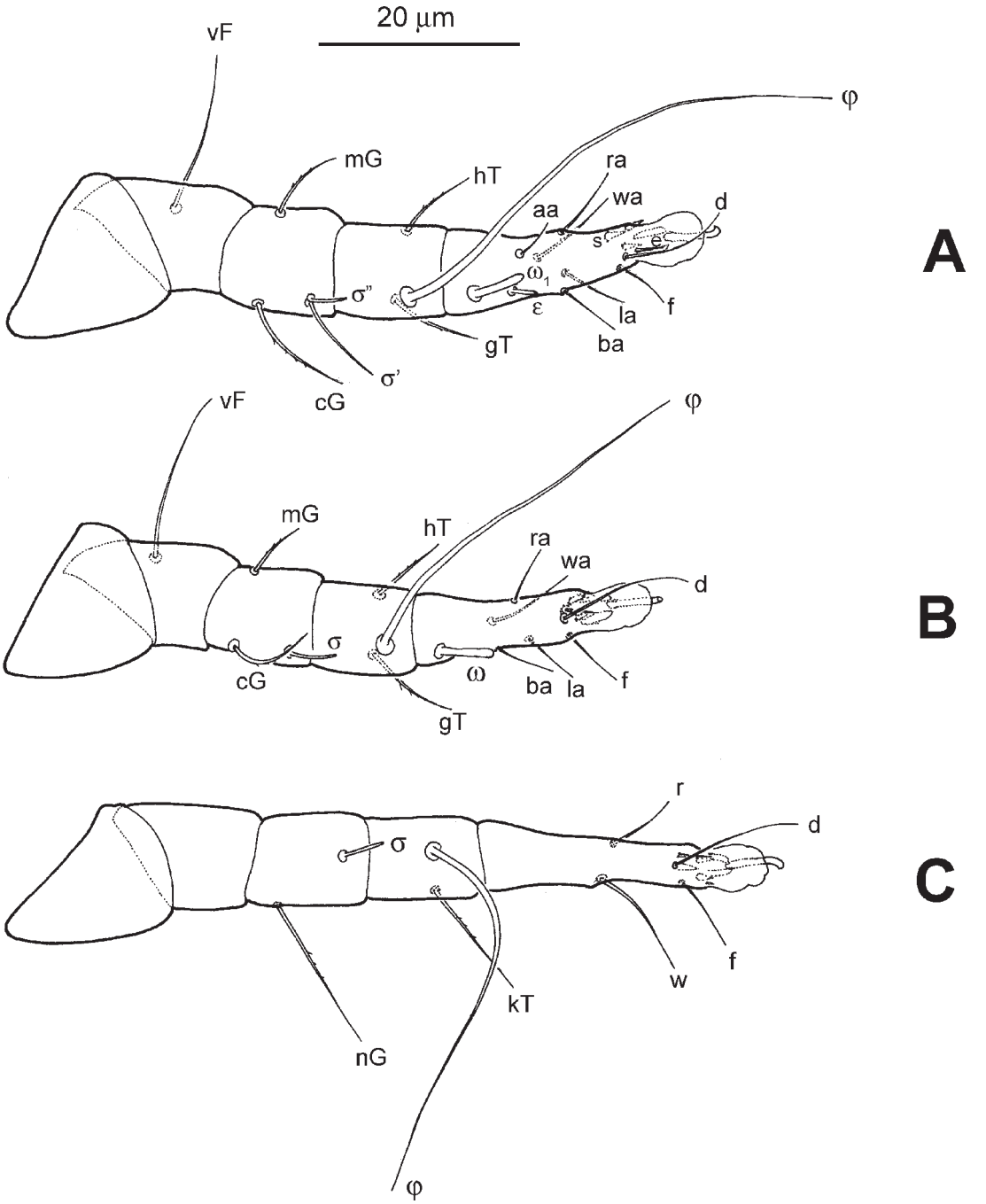


Fig. 22. *Tyrophagus communis* **sp. n.** (larva). A, leg I; B, leg II; C, leg III.

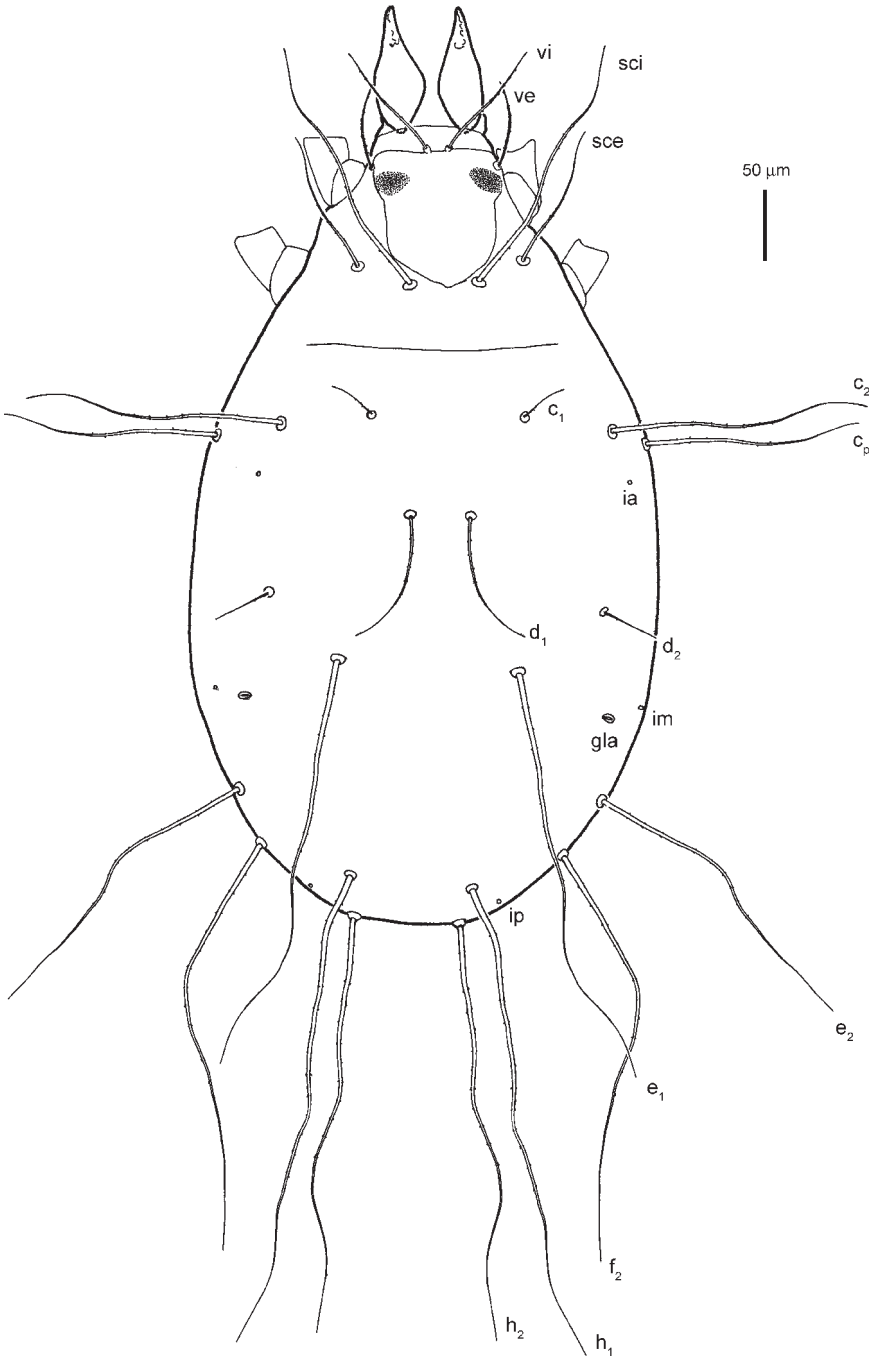


Fig. 23. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (female). Dorsal view of idiosoma.

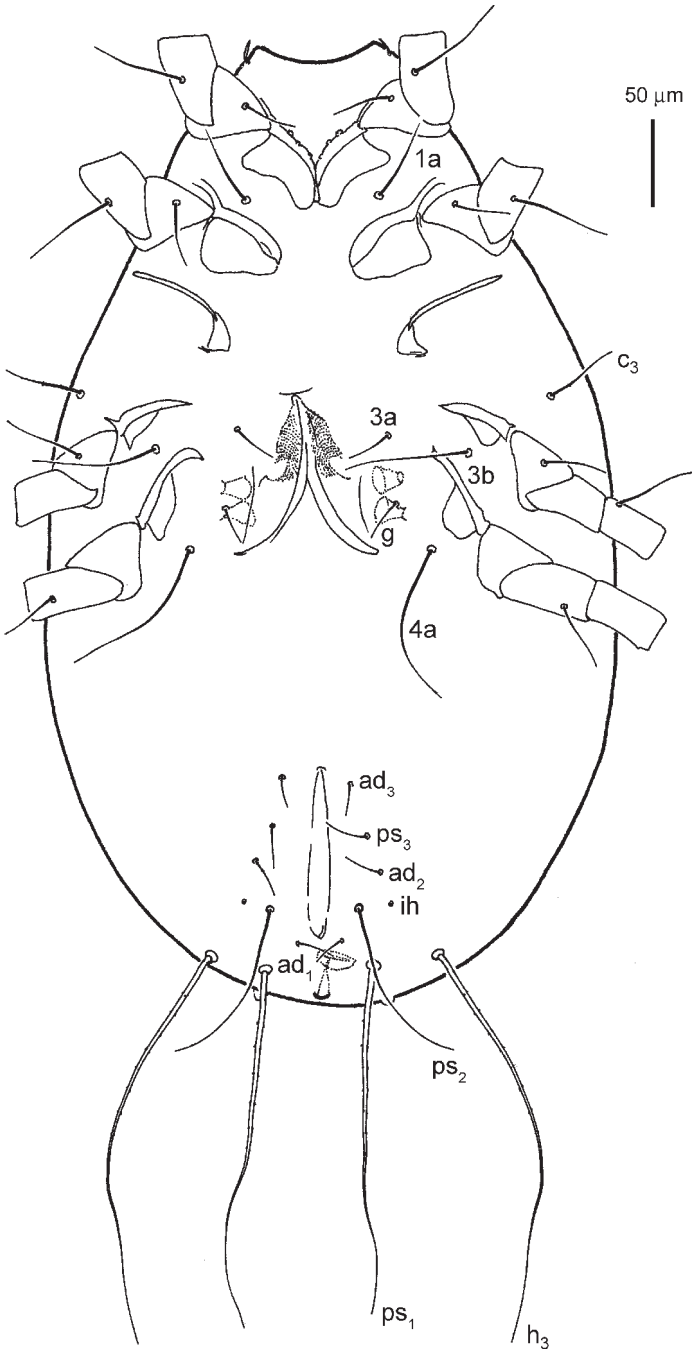


Fig. 24. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (female). Ventral view of idiosoma.

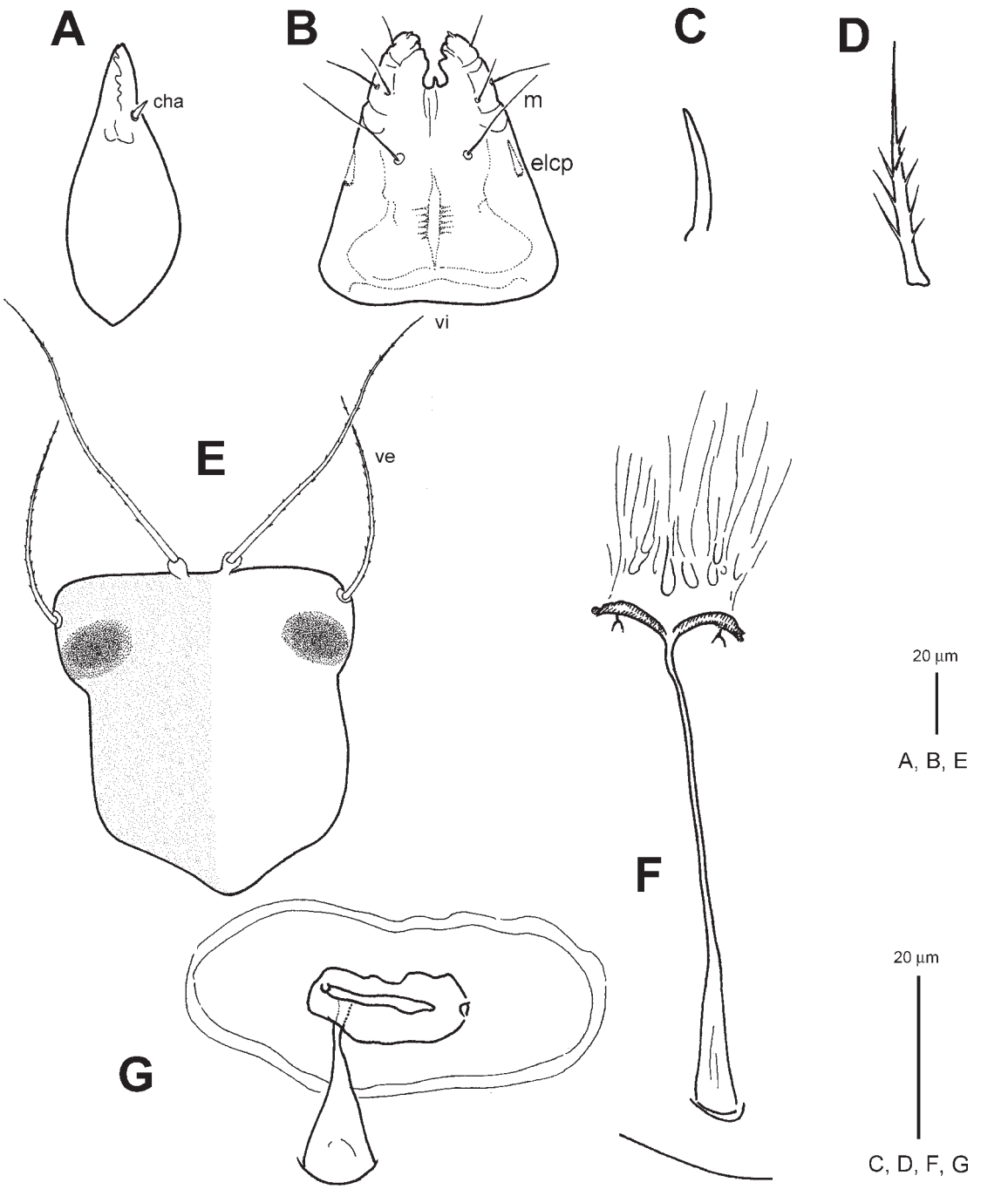


Fig. 25. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, prodorsal shield; F, copulatory opening and spermatheca; G, copulatory opening and folded spermatheca.

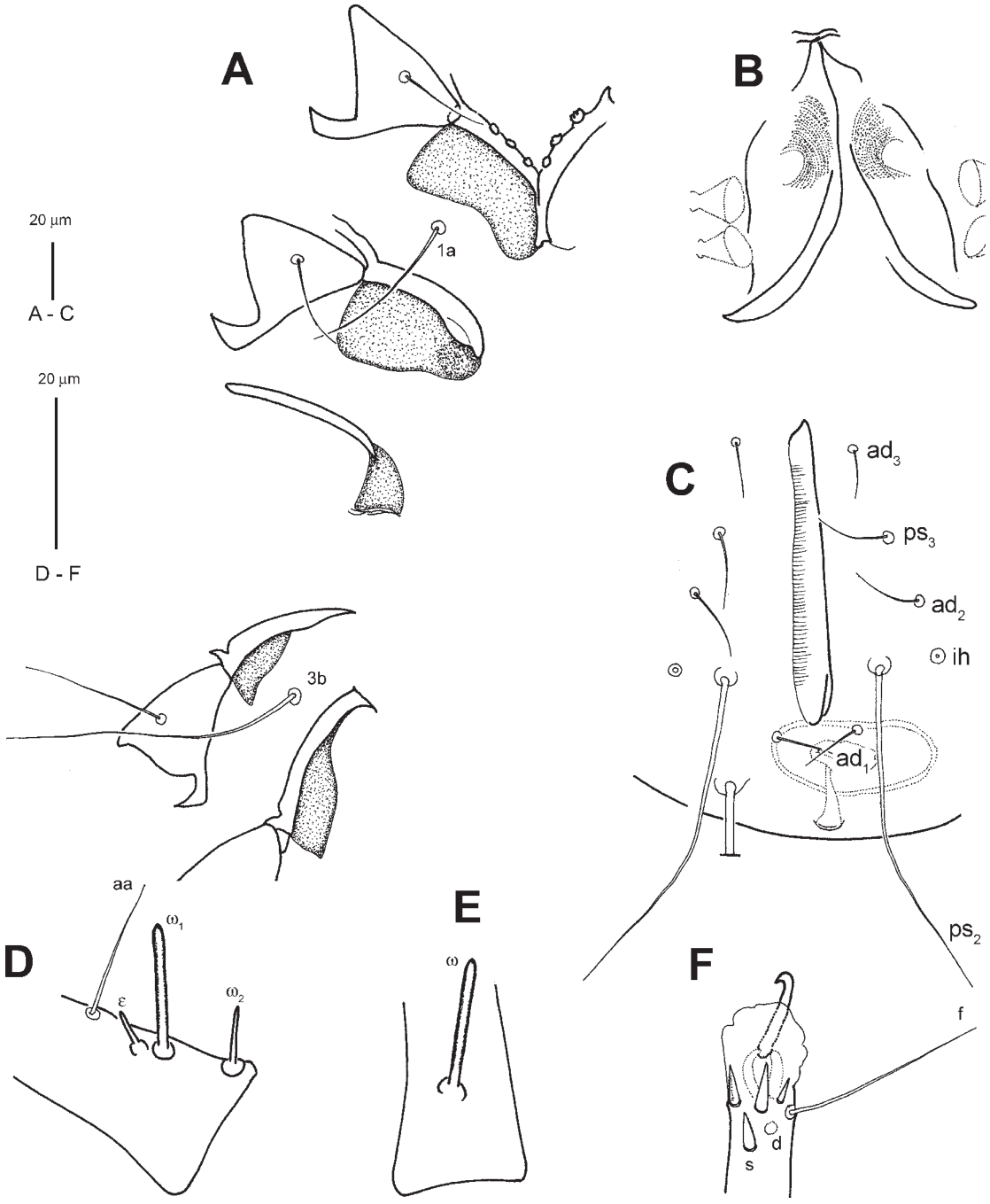


Fig. 26. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (female). A, coxae I–IV; B, genital opening; C, anus; D, solenidia, famulus, and seta of tarsus I; E, solenidion of tarsus II; F, ventral view of distal part of tarsus IV.

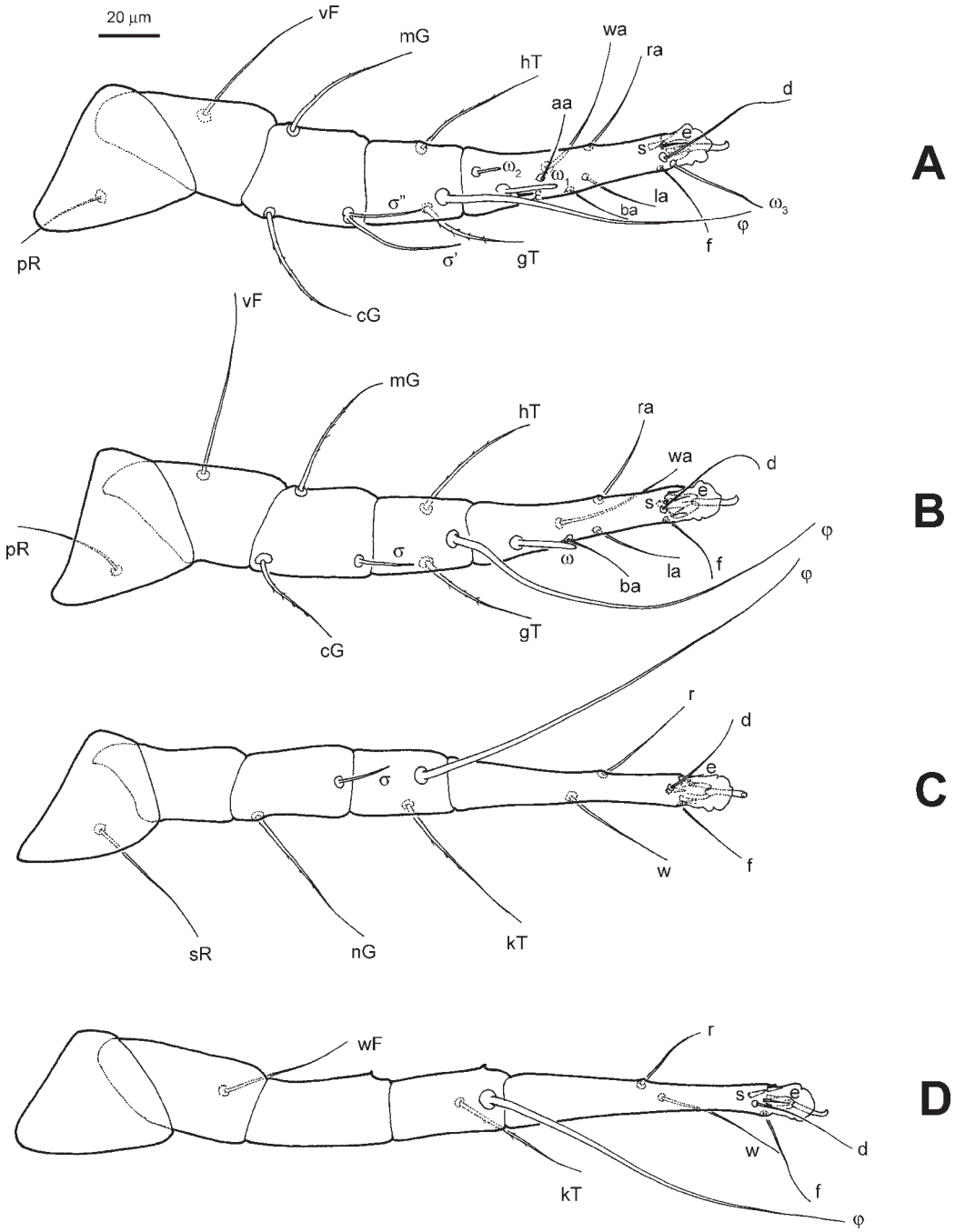


Fig. 27. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (female). A, leg I; B, leg II; C, leg III; D, leg IV.

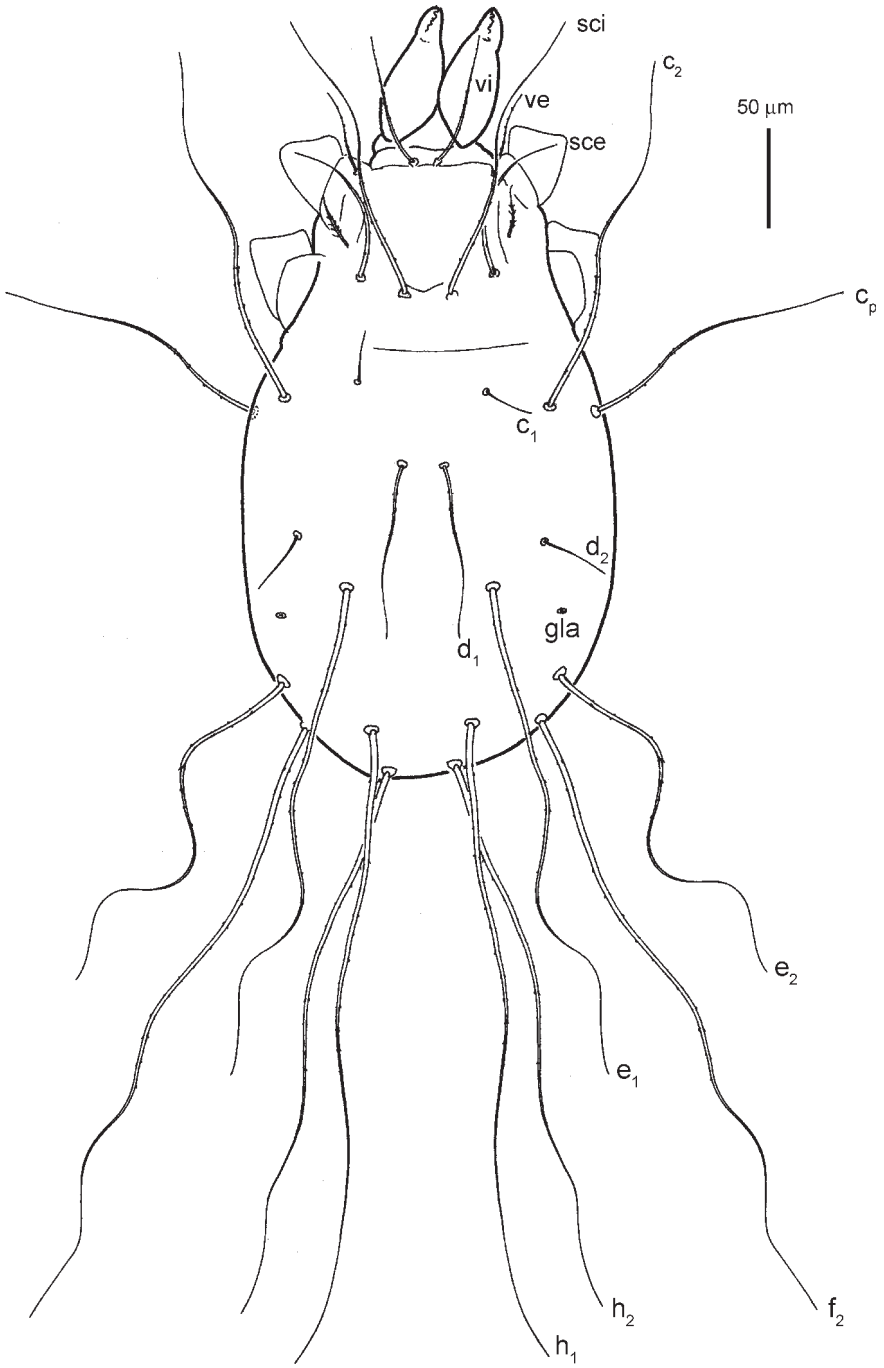


Fig. 28. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (male). Dorsal view of idiosoma.

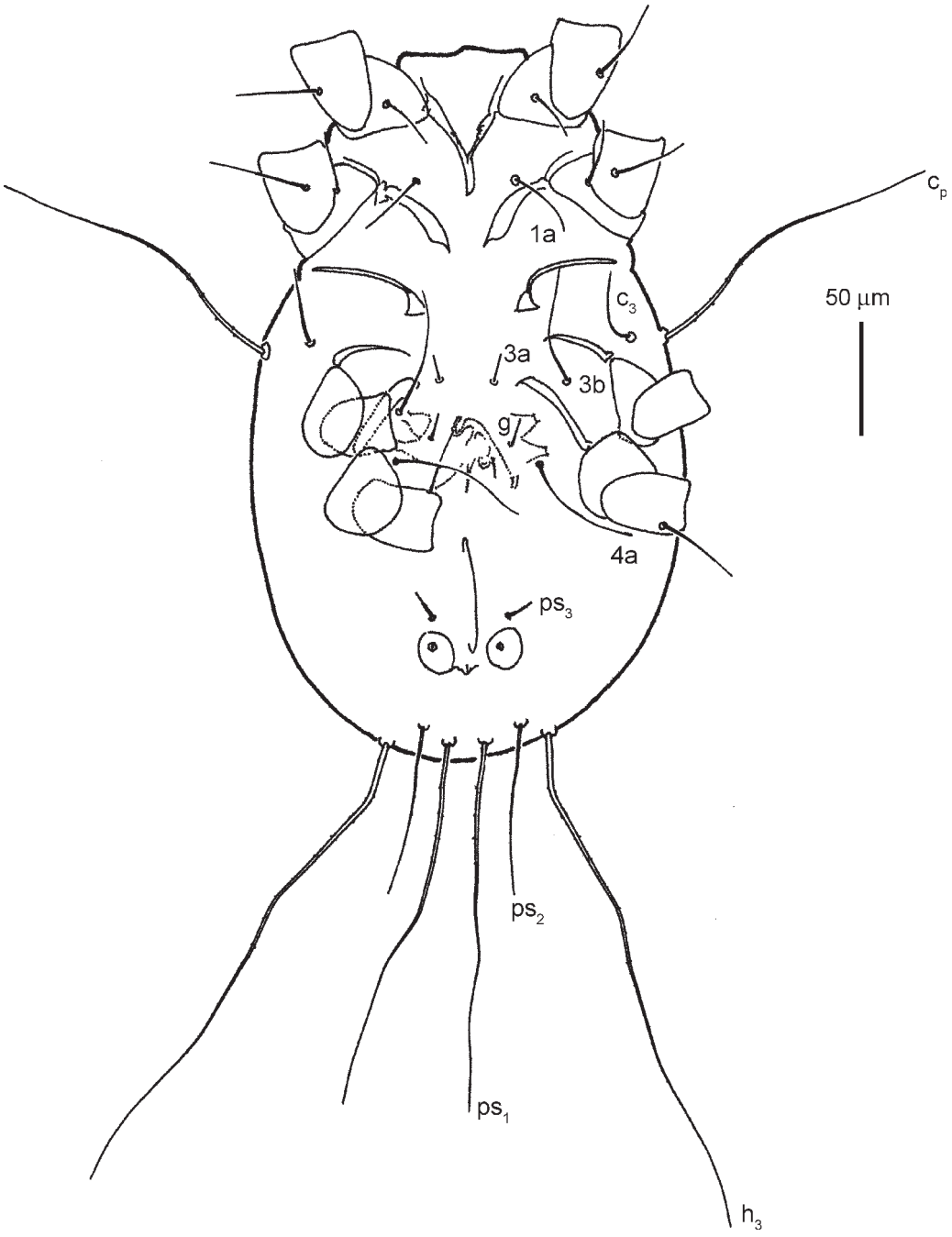


Fig. 29. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (male). Ventral view of idiosoma.

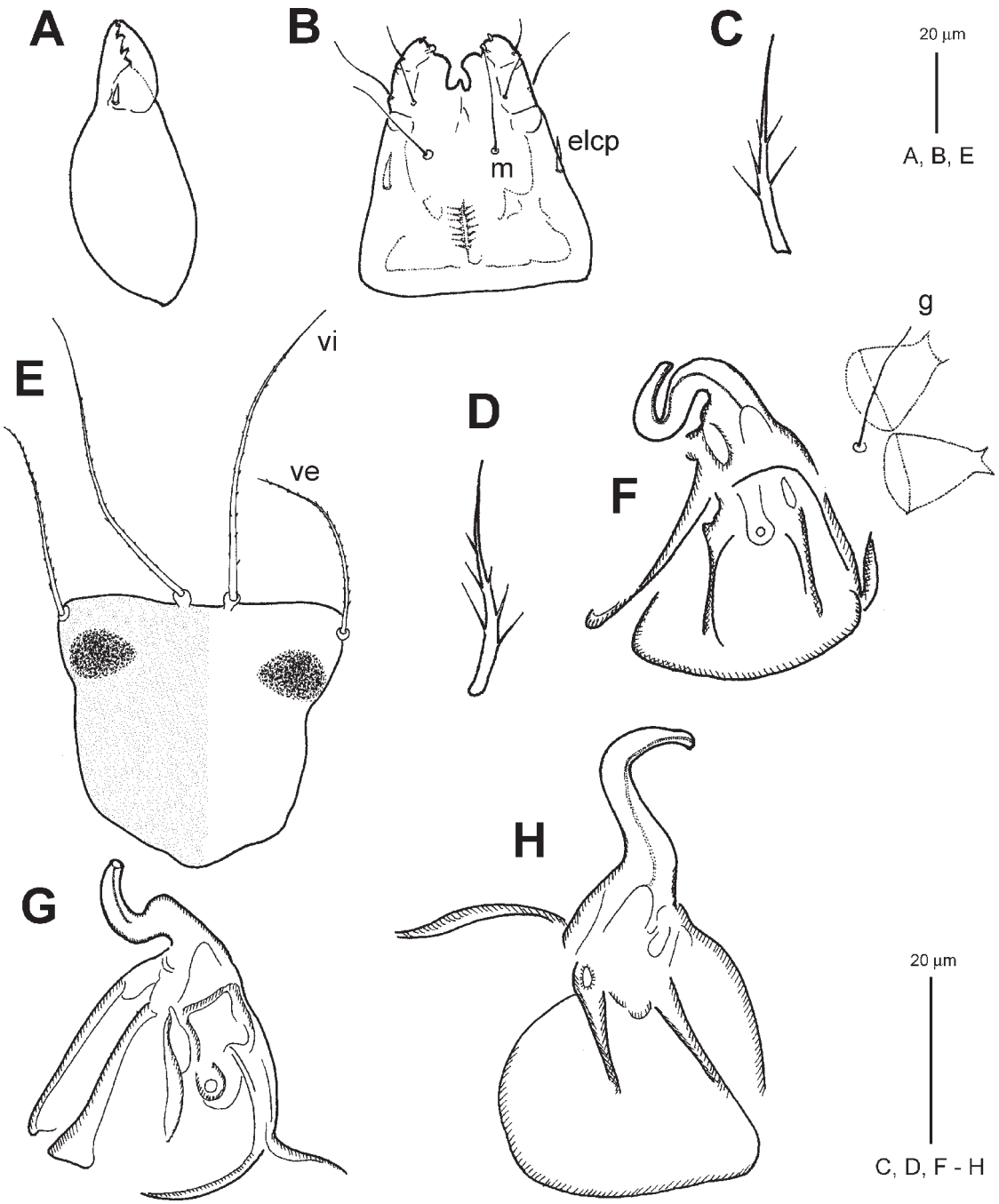


Fig. 30. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, supracoxal seta; D, supracoxal seta; E, prodorsal shield; F, aedeagus and genital papillae; G, aedeagus; H, aedeagus.

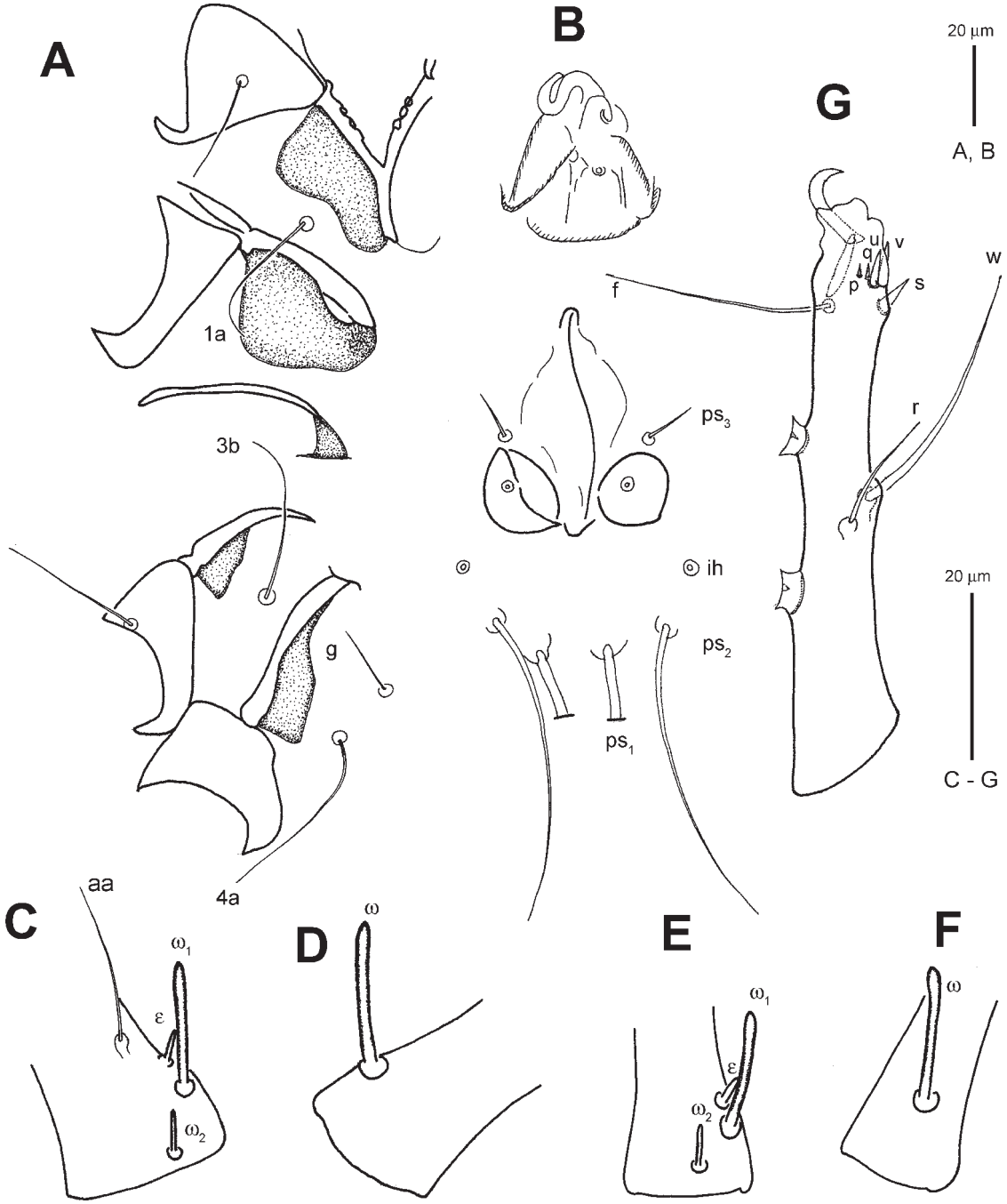


Fig. 31. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (male). A, coxae I–IV; B, aedeagus and anus; C, solenidia, famulus, and seta of tarsus I; D, solenidion of tarsus II; E, solenidia and famulus of tarsus I; F, solenidion of tarsus II; G, tarsus IV.

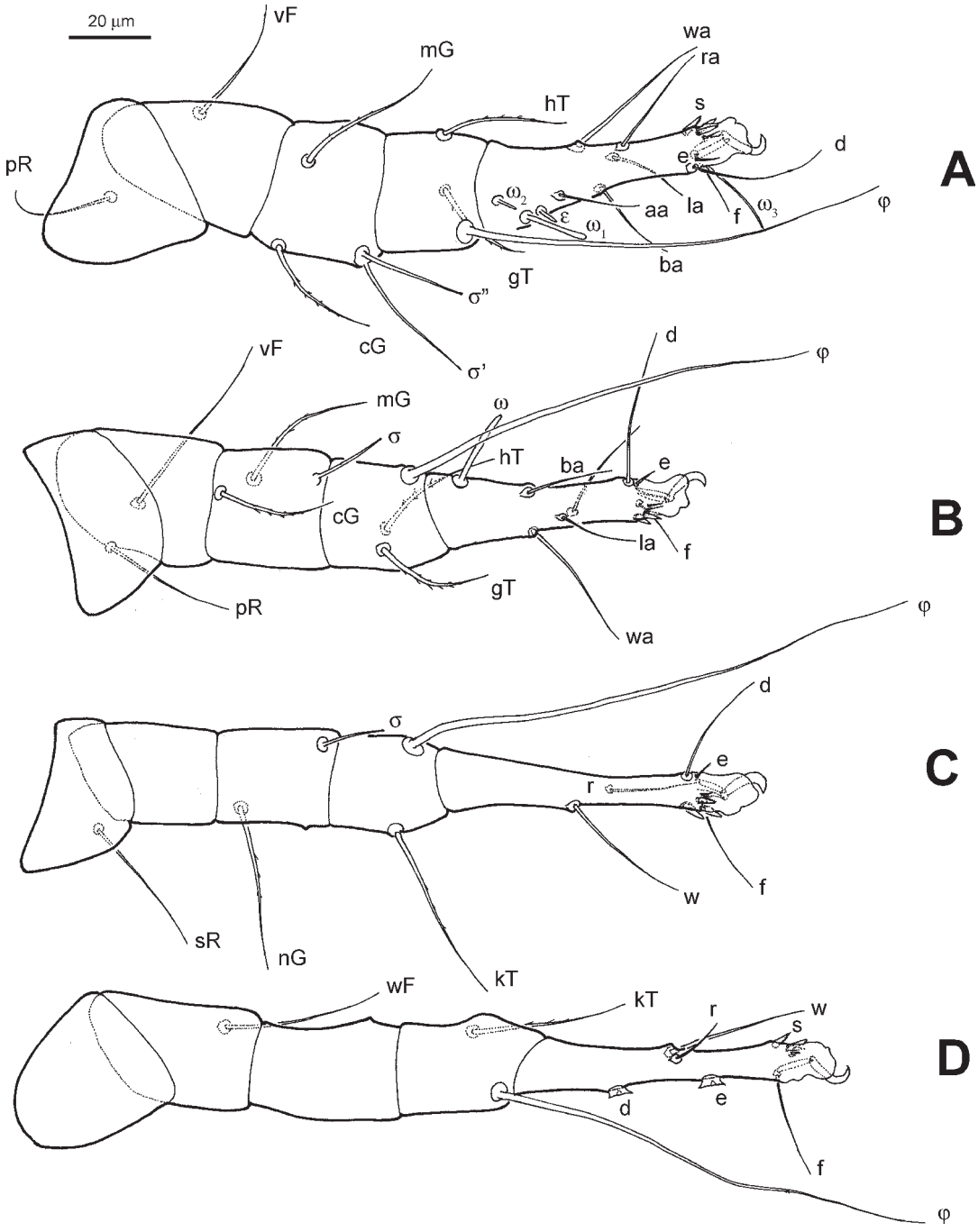


Fig. 32. *Tyrophagus curvipenis* Fain & Fauvel, 1993 (male). A, leg I; B, leg II; C, leg III; D, leg IV.

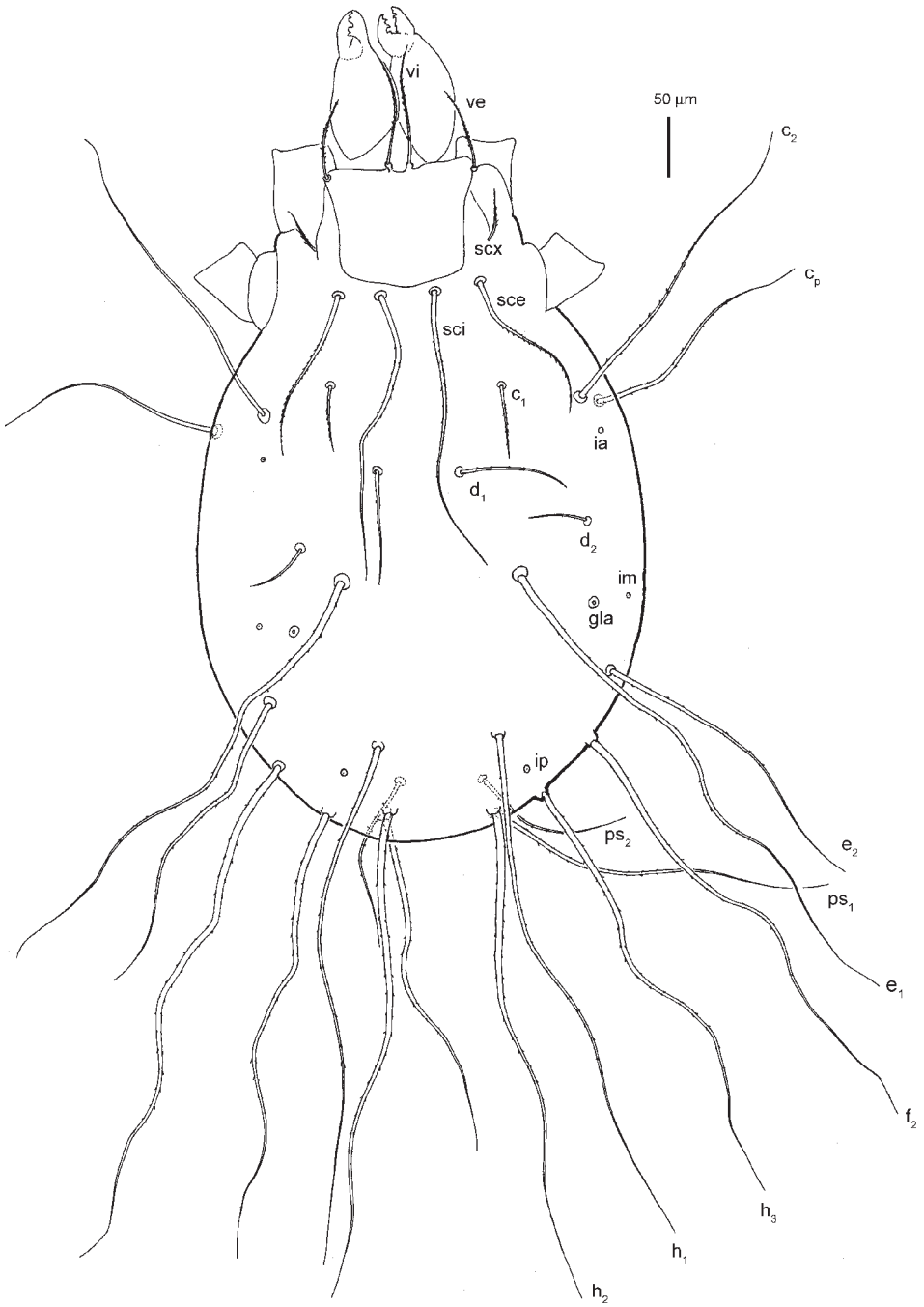


Fig. 33. *Tyrophagus longior* (Gervais, 1844) (female). Dorsal view of idiosoma.

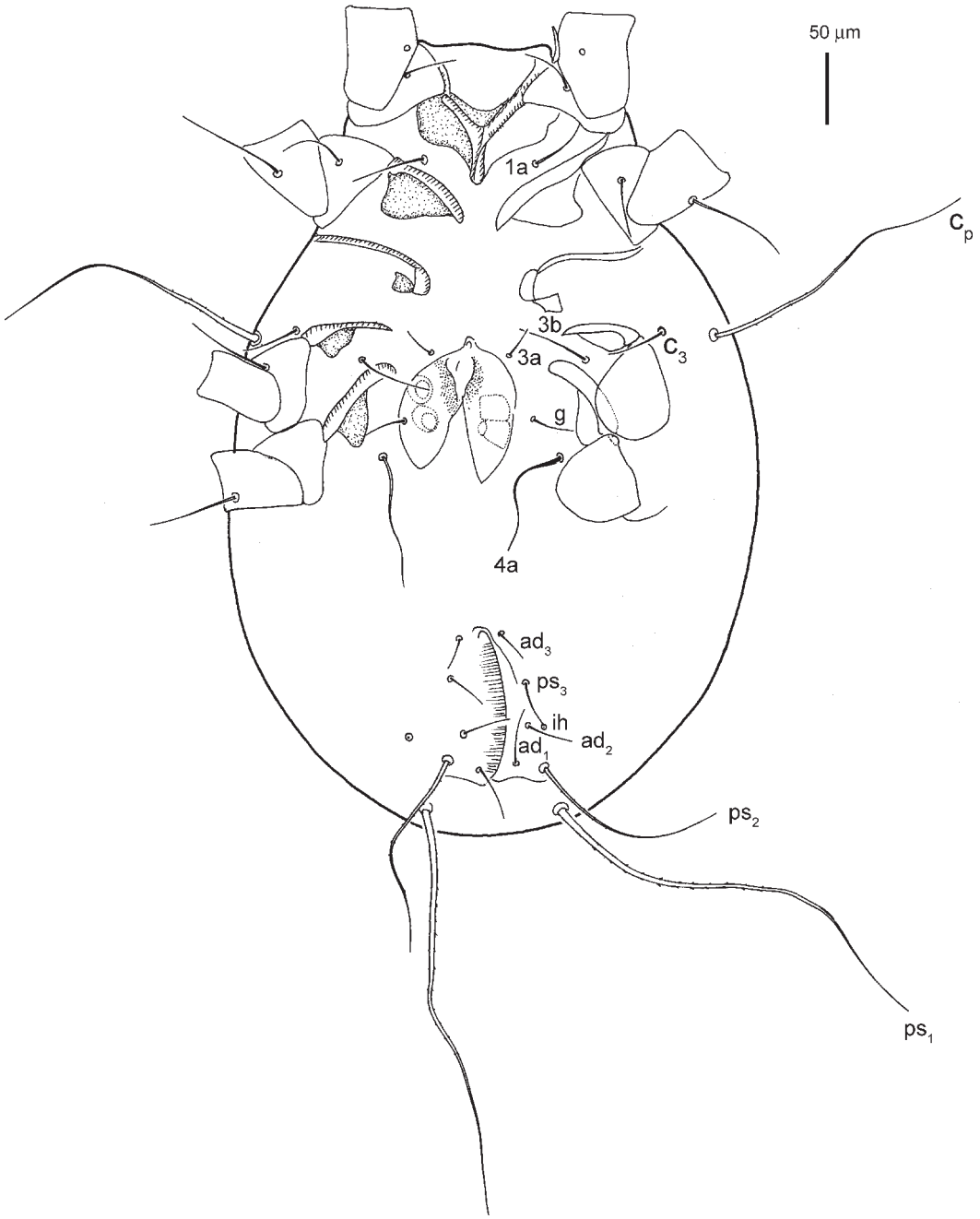


Fig. 34. *Tyrophagus longior* (Gervais, 1844) (female). Ventral view of idiosoma.

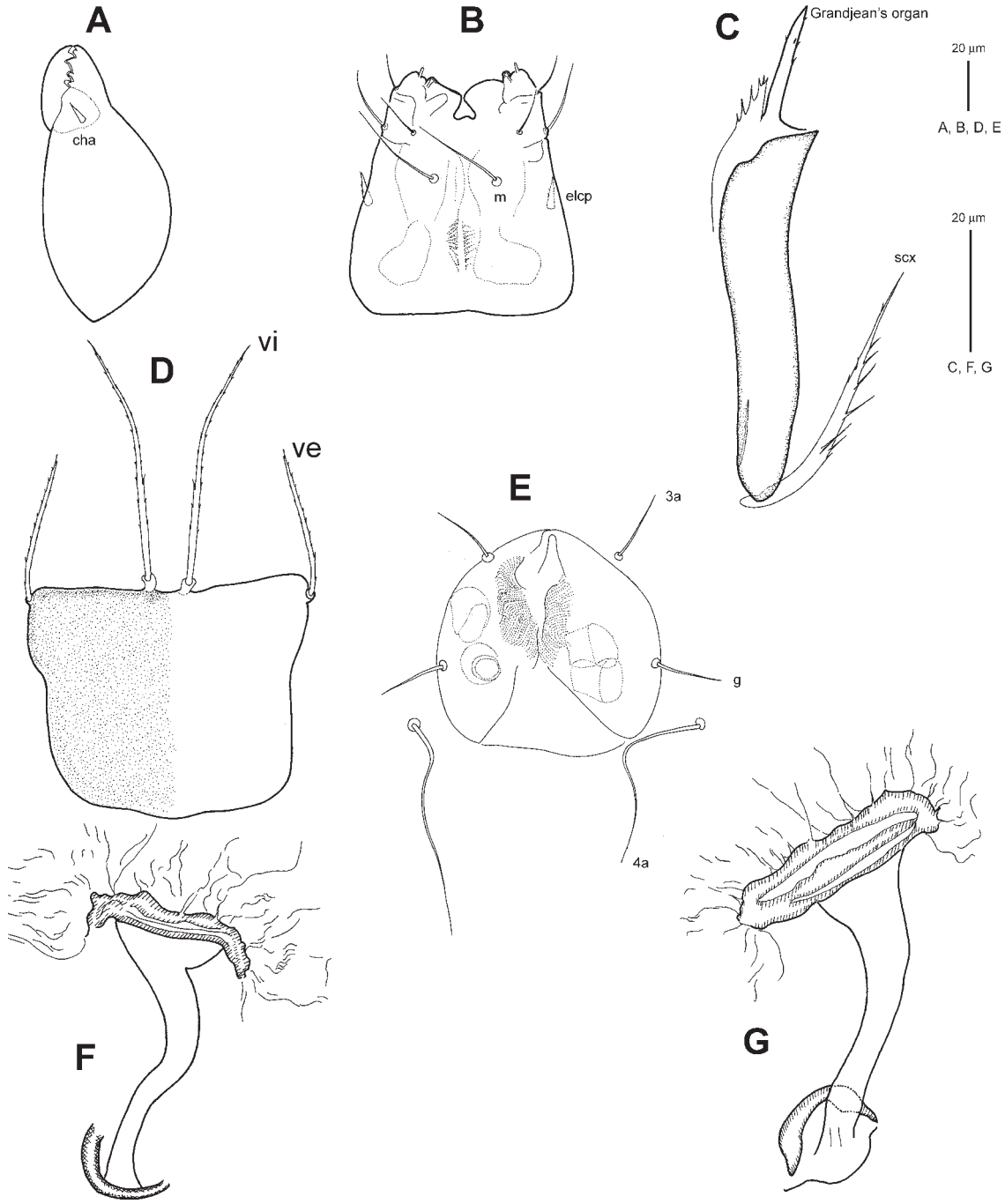


Fig. 35. *Tyrophagus longior* (Gervais, 1844) (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, lateral sclerite and supracoxal seta; D, prodorsal shield; E, genital opening; F, copulatory opening and spermatheca; G, copulatory opening and spermatheca.

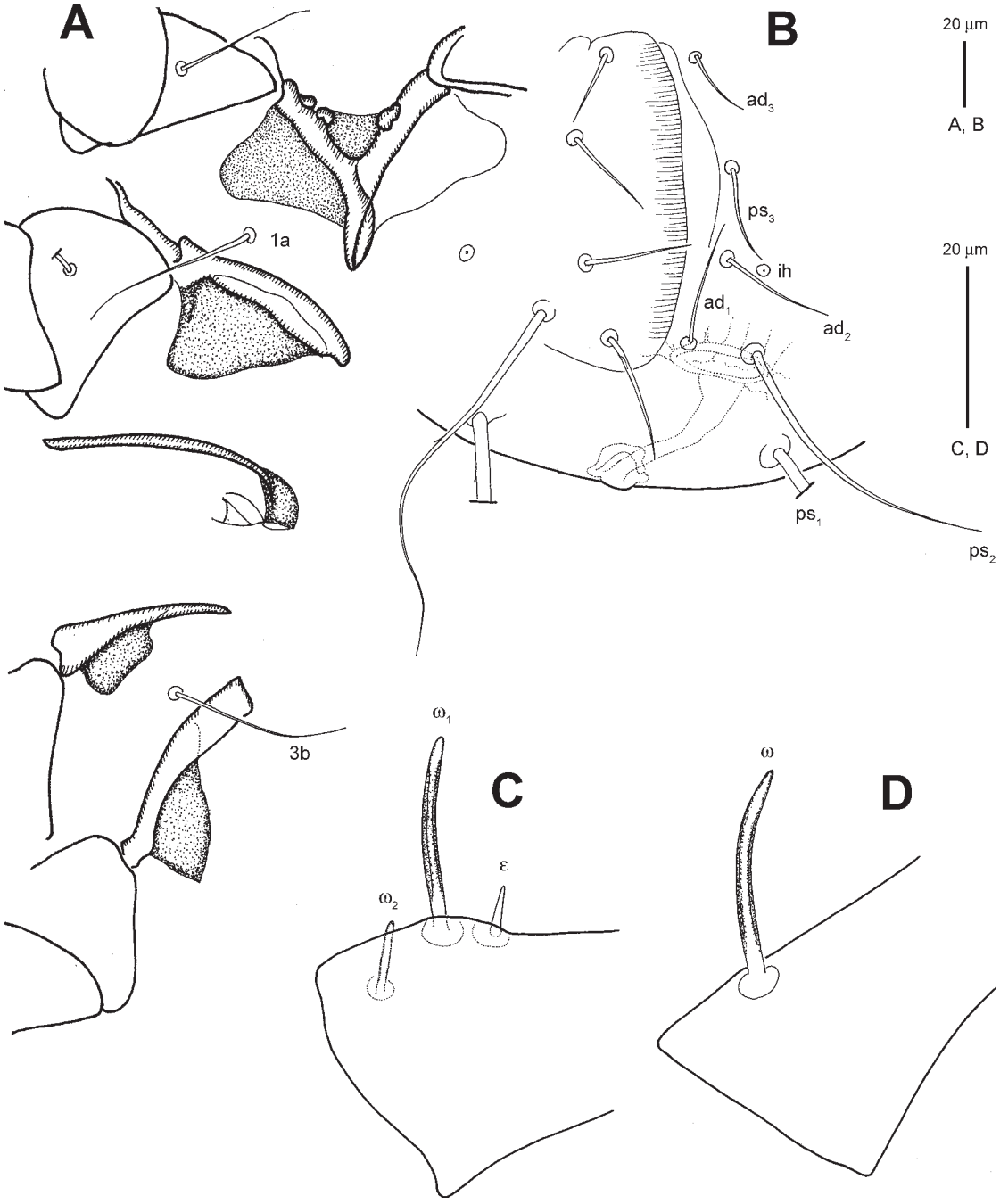


Fig. 36. *Tyrophagus longior* (Gervais, 1844) (female). A, coxae I–IV; B, anus; C, solenidia and famulus of tarsus I; D, solenidion of tarsus II.

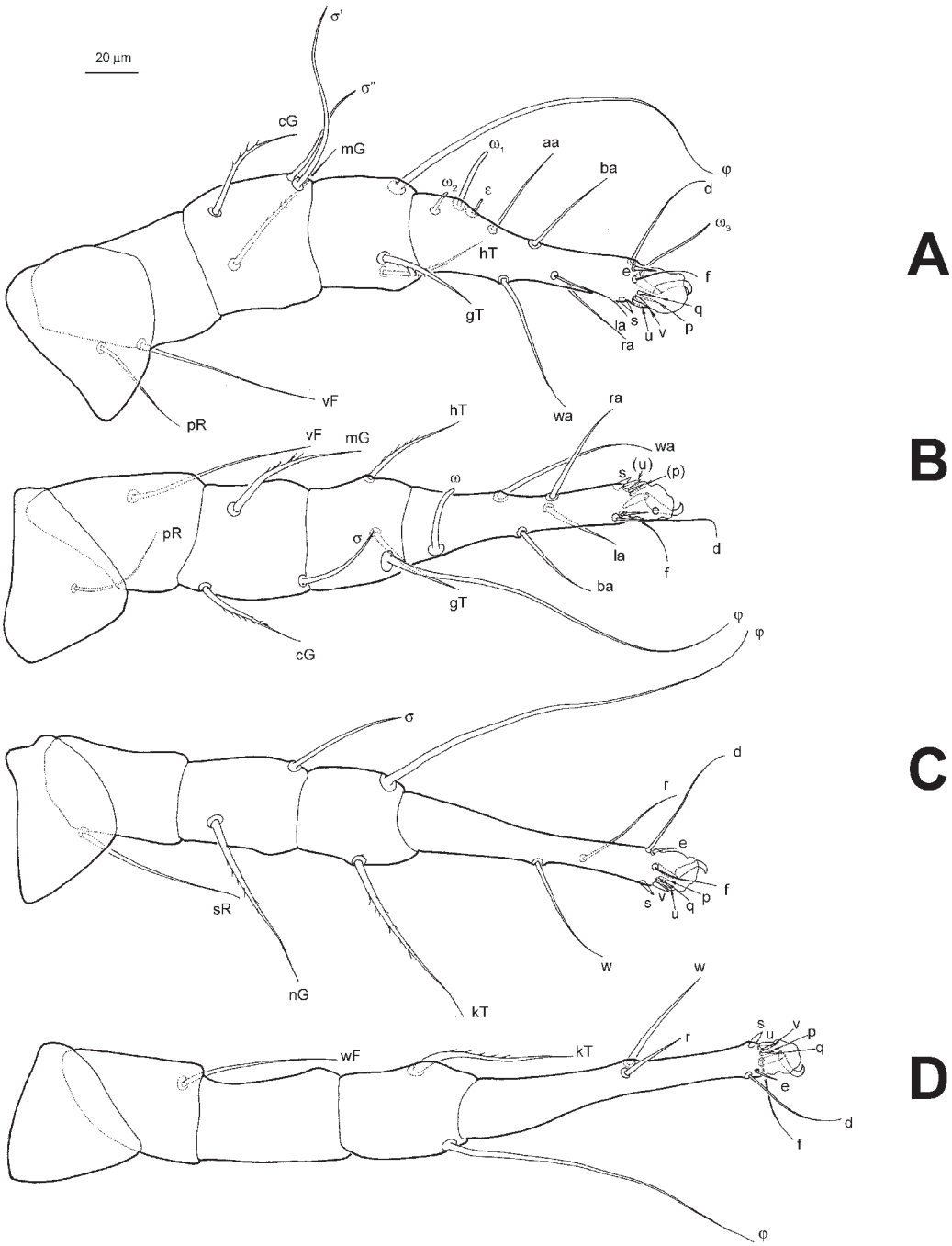


Fig. 37. *Tyrophagus longior* (Gervais, 1844) (female). A, leg I; B, leg II; C, leg III; D, leg IV.

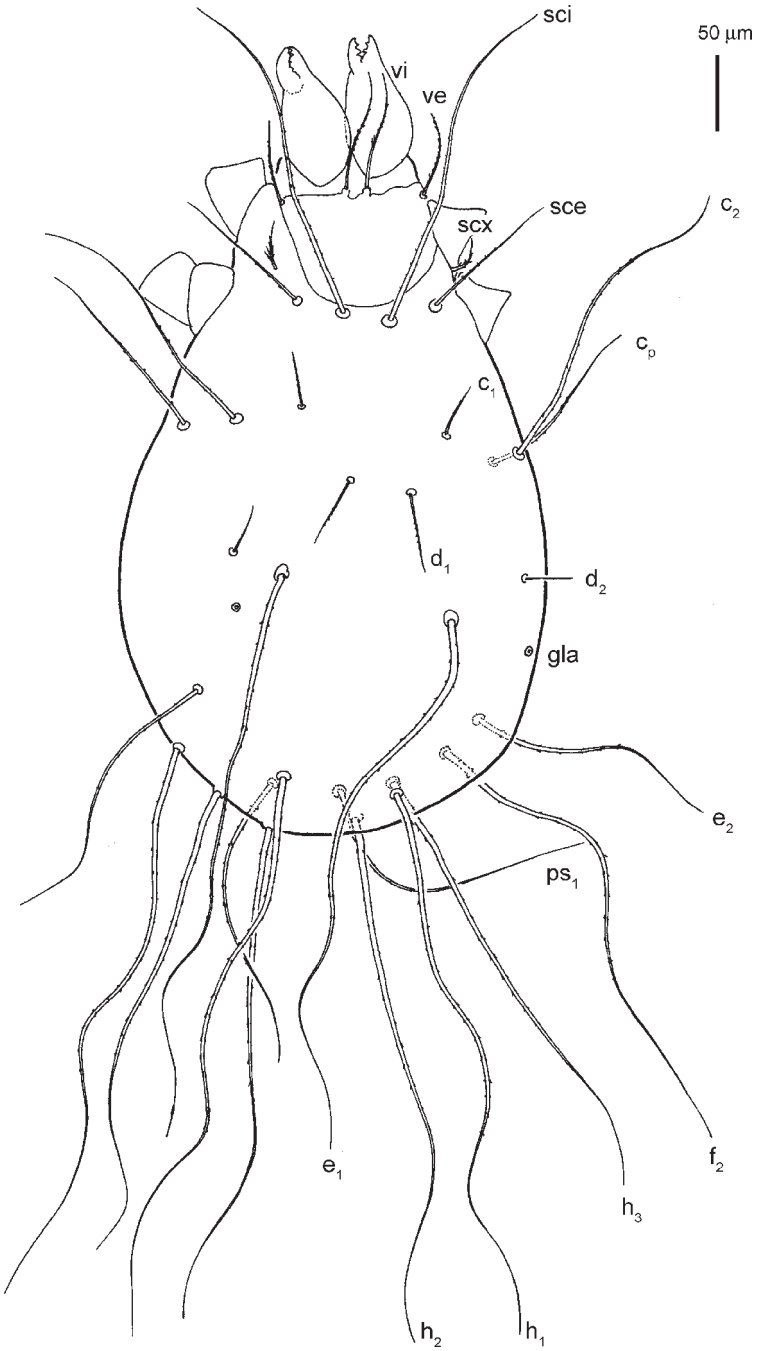


Fig. 38. *Tyrophagus longior* (Gervais, 1844) (male). Dorsal view of idiosoma.

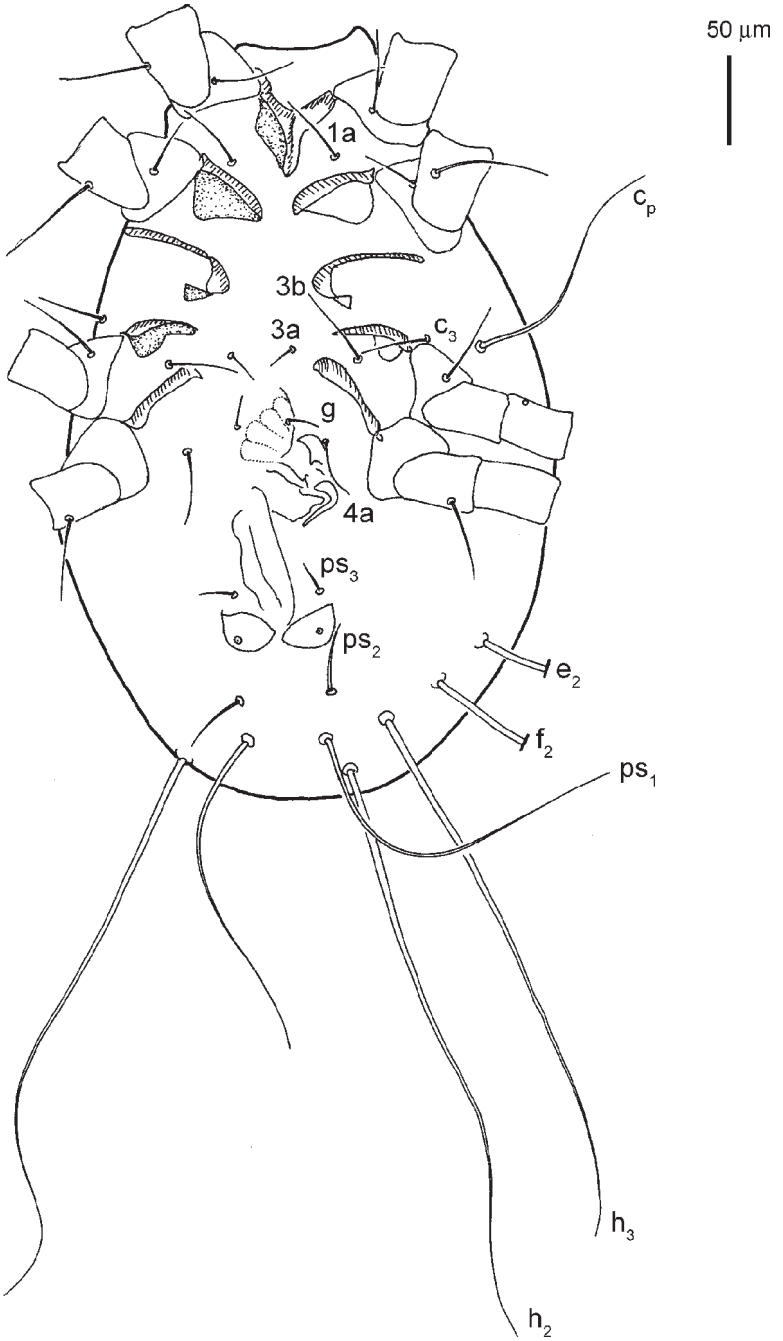


Fig. 39. *Tyrophagus longior* (Gervais, 1844) (male). Ventral view of idiosoma.

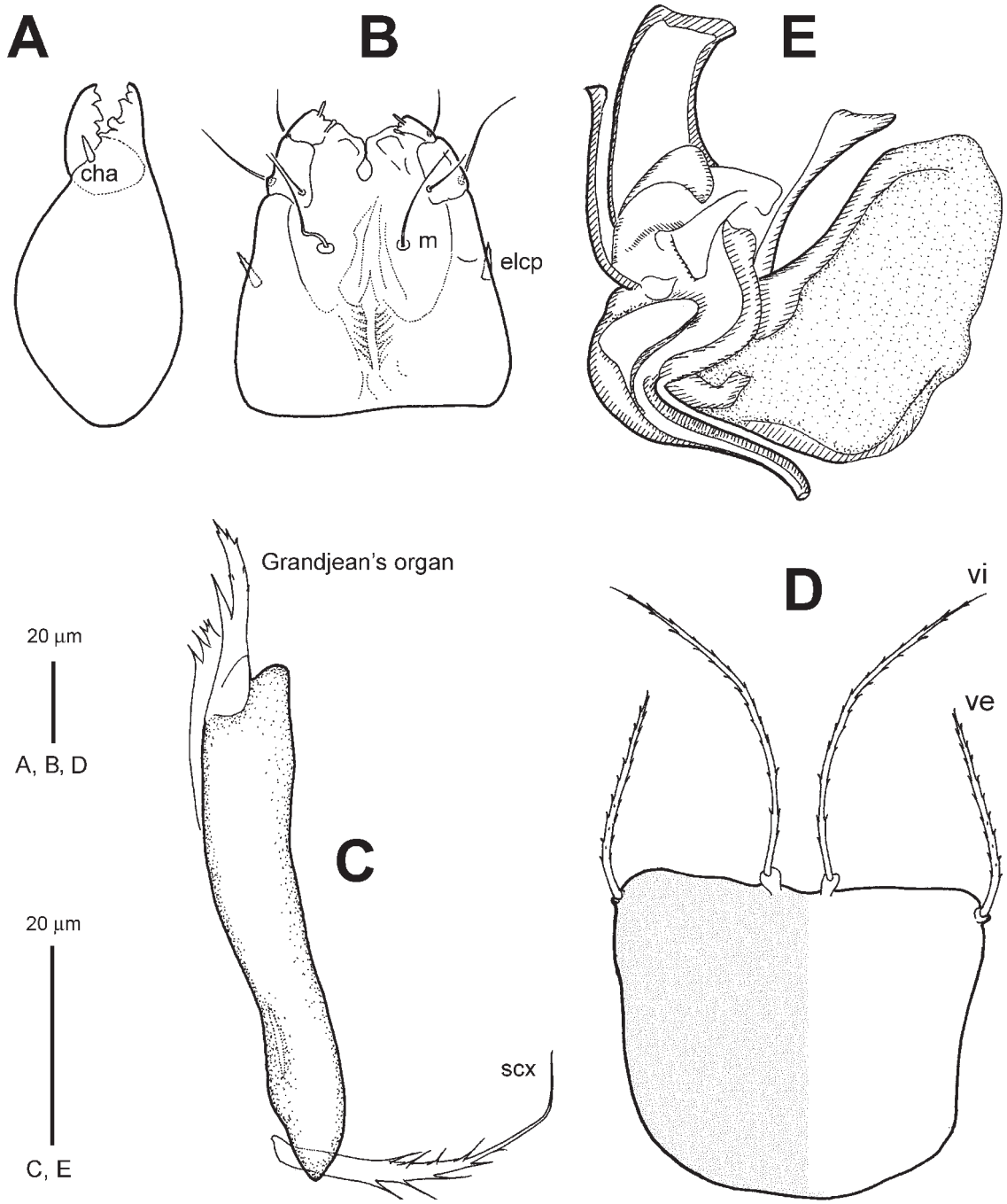


Fig. 40. *Tyrophagus longior* (Gervais, 1844) (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, lateral sclerite and supracoxal seta; D, prodorsal shield; E, lateral view of aedeagus.

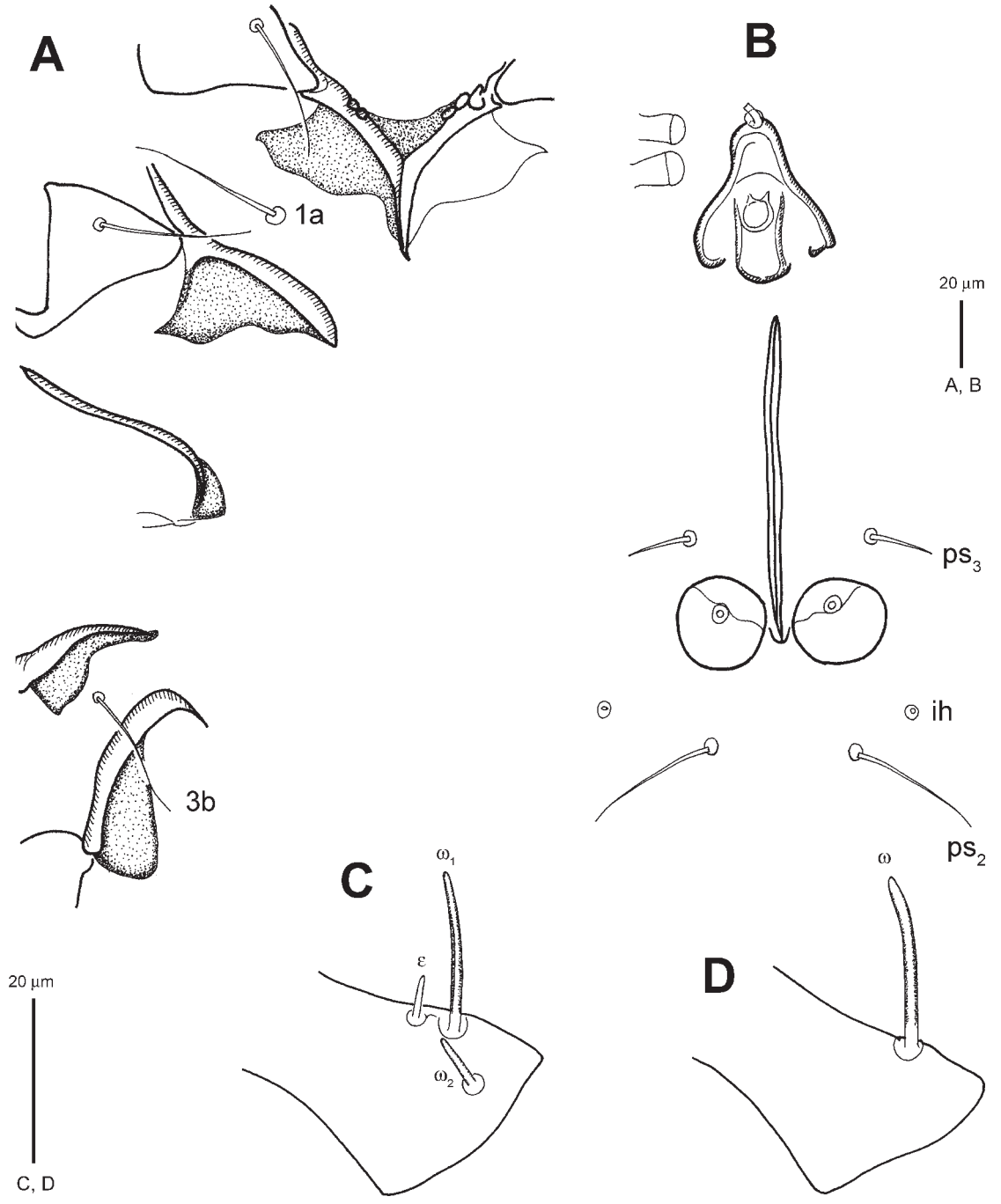


Fig. 41. *Tyrophagus longior* (Gervais, 1844) (male). A, coxae I–IV; B, genital opening and anus; C, solenidia and famulus of tarsus I; D, solenidion of tarsus II.

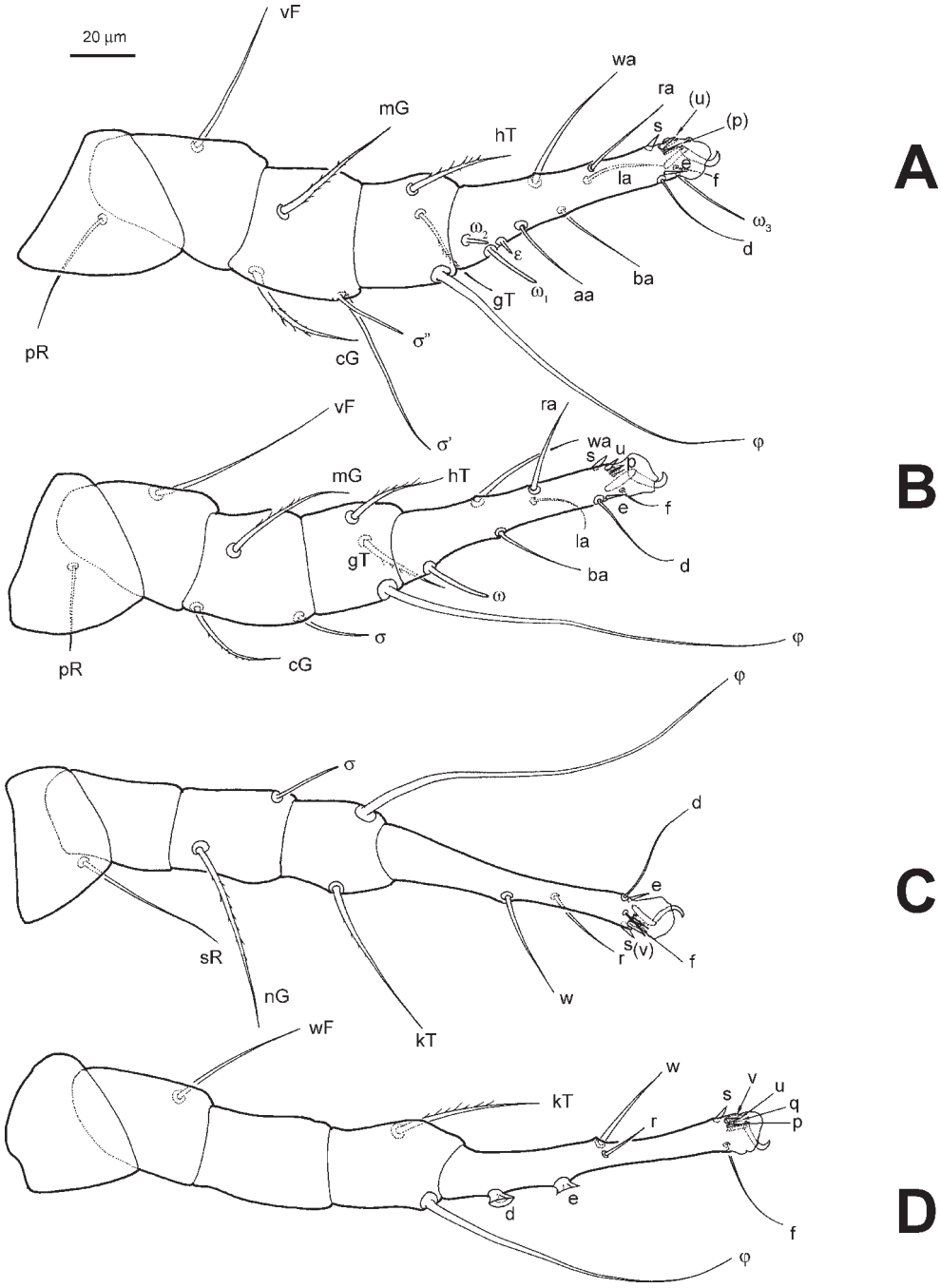


Fig. 42. *Tyrophagus longior* (Gervais, 1844) (male). A, leg I; B, leg II; C, leg III; D, leg IV.

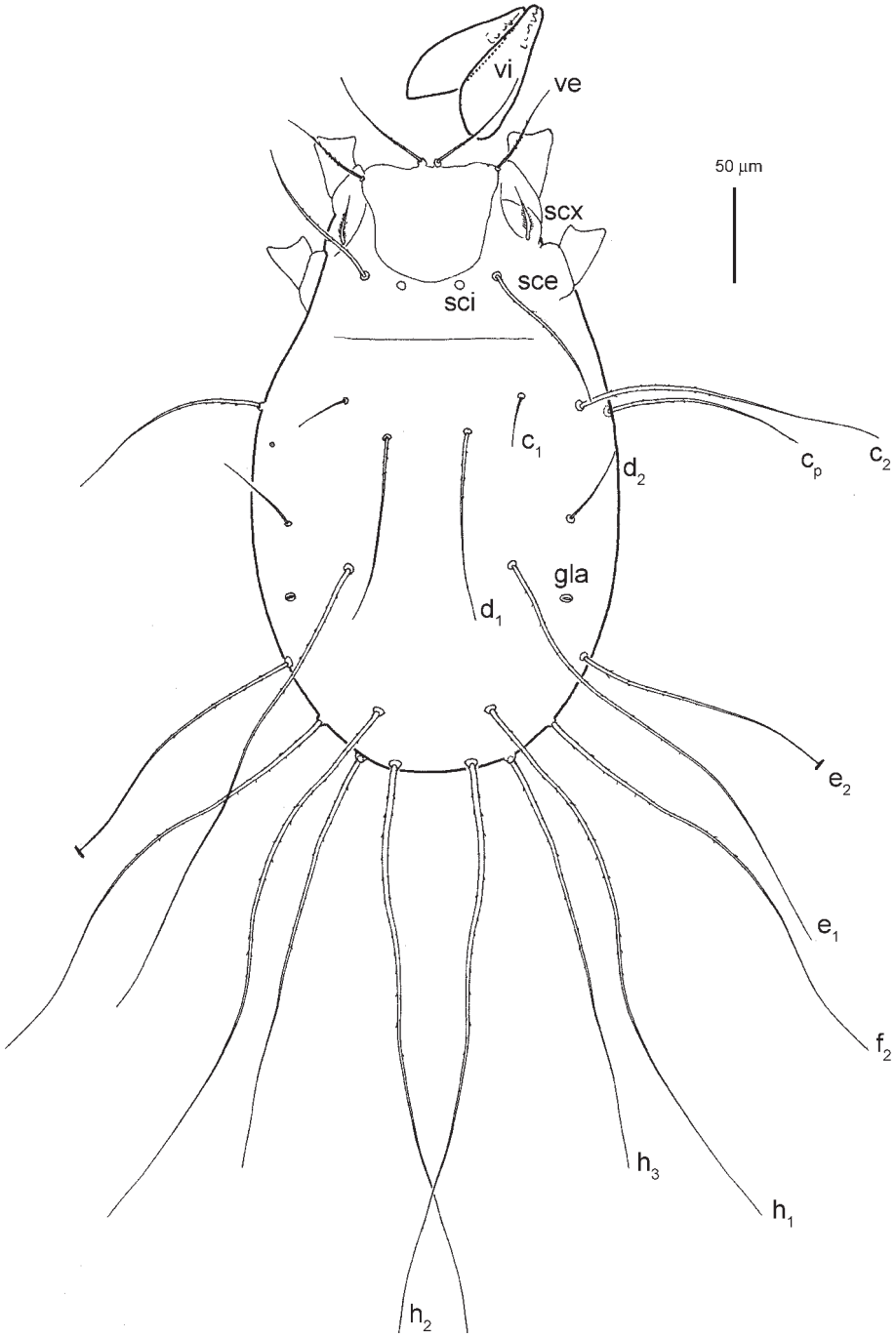


Fig. 43. *Tyrophagus macfarlanei* **sp. n.** (female). Dorsal view of idiosoma.

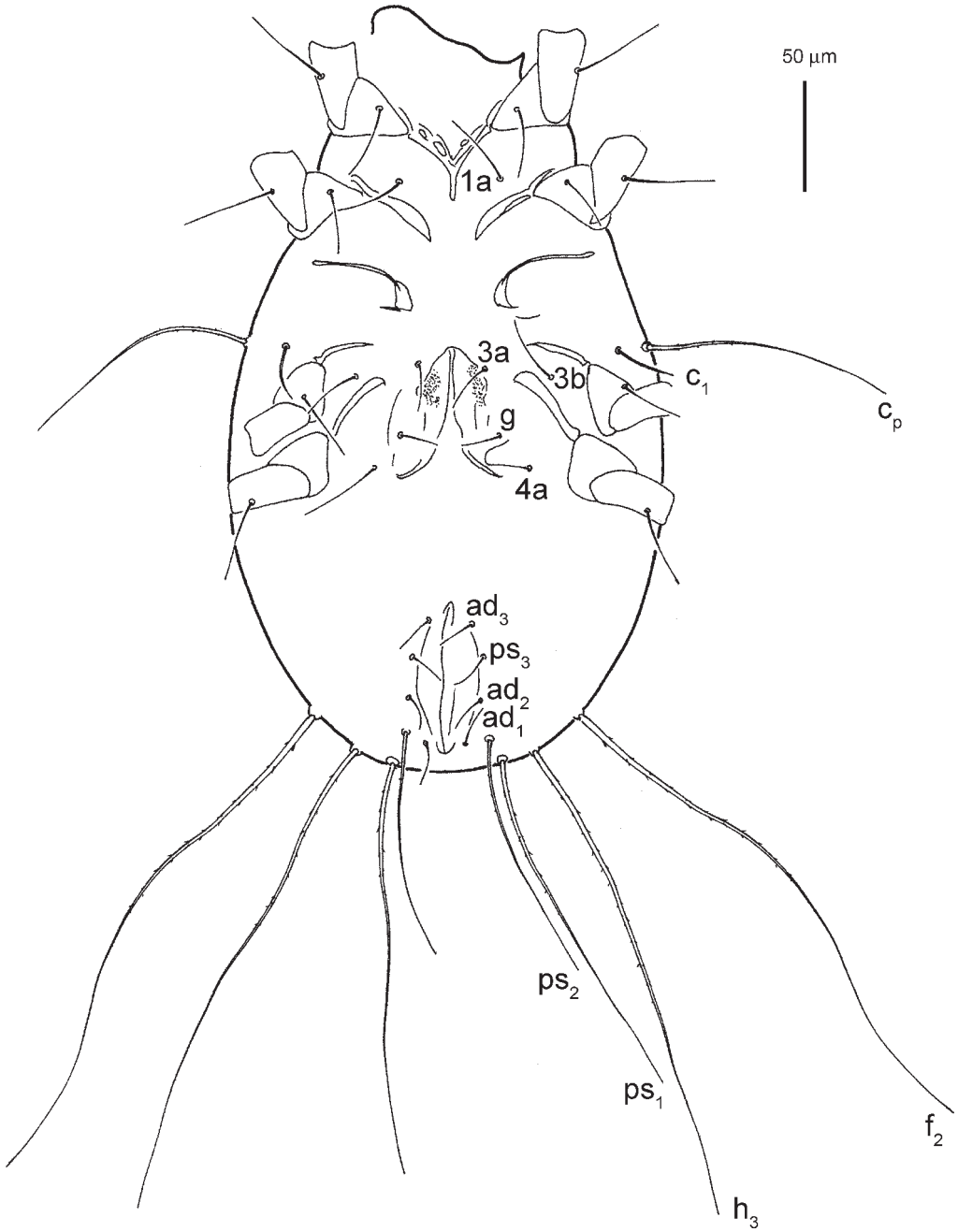


Fig. 44. *Tyrophagus macfarlanei* **sp. n.** (female). Ventral view of idiosoma.

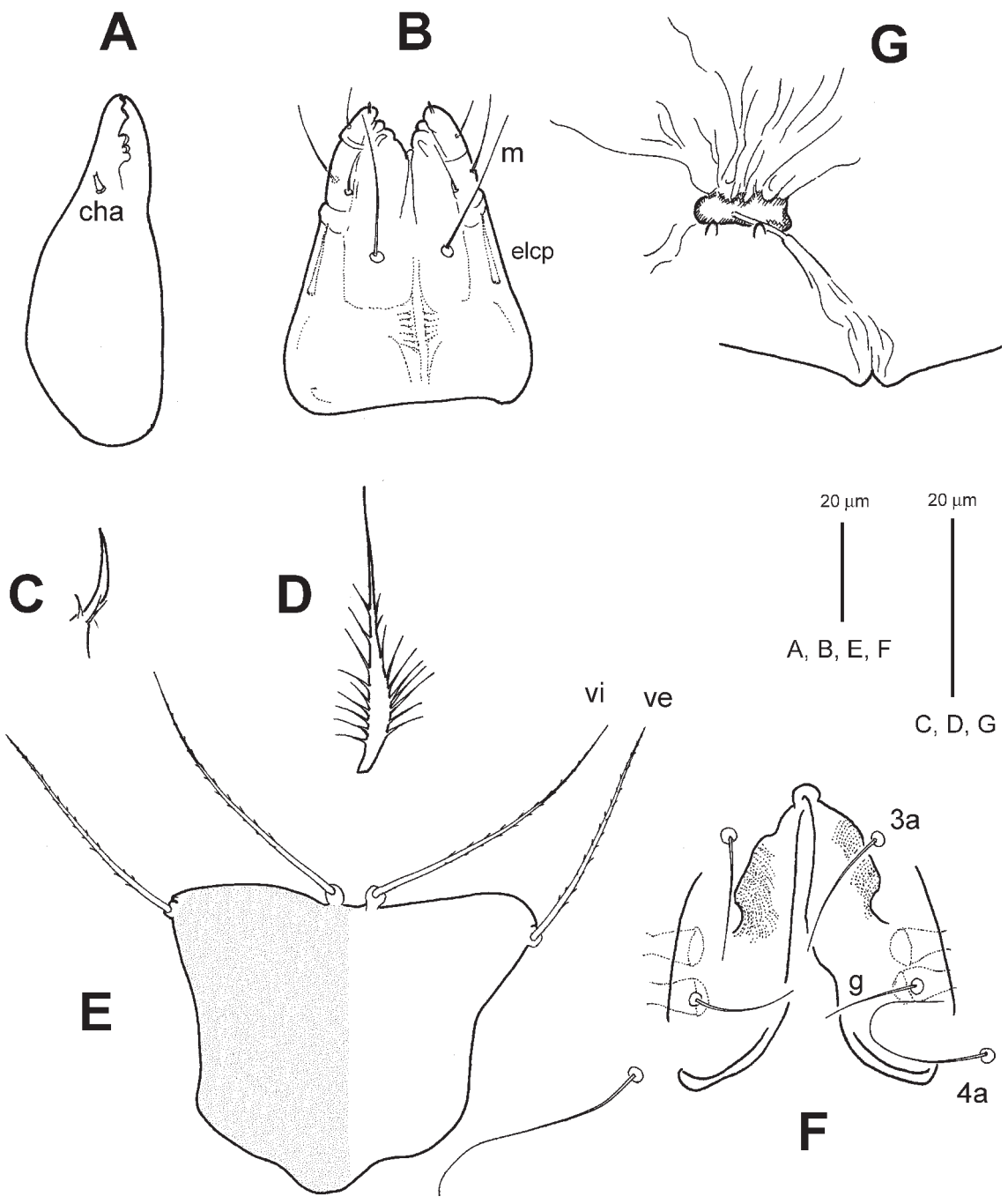


Fig. 45. *Tyrophagus macfarlanei* **sp. n.** (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, prodorsal shield; F, genital opening; G, copulatory opening and spermatheca.

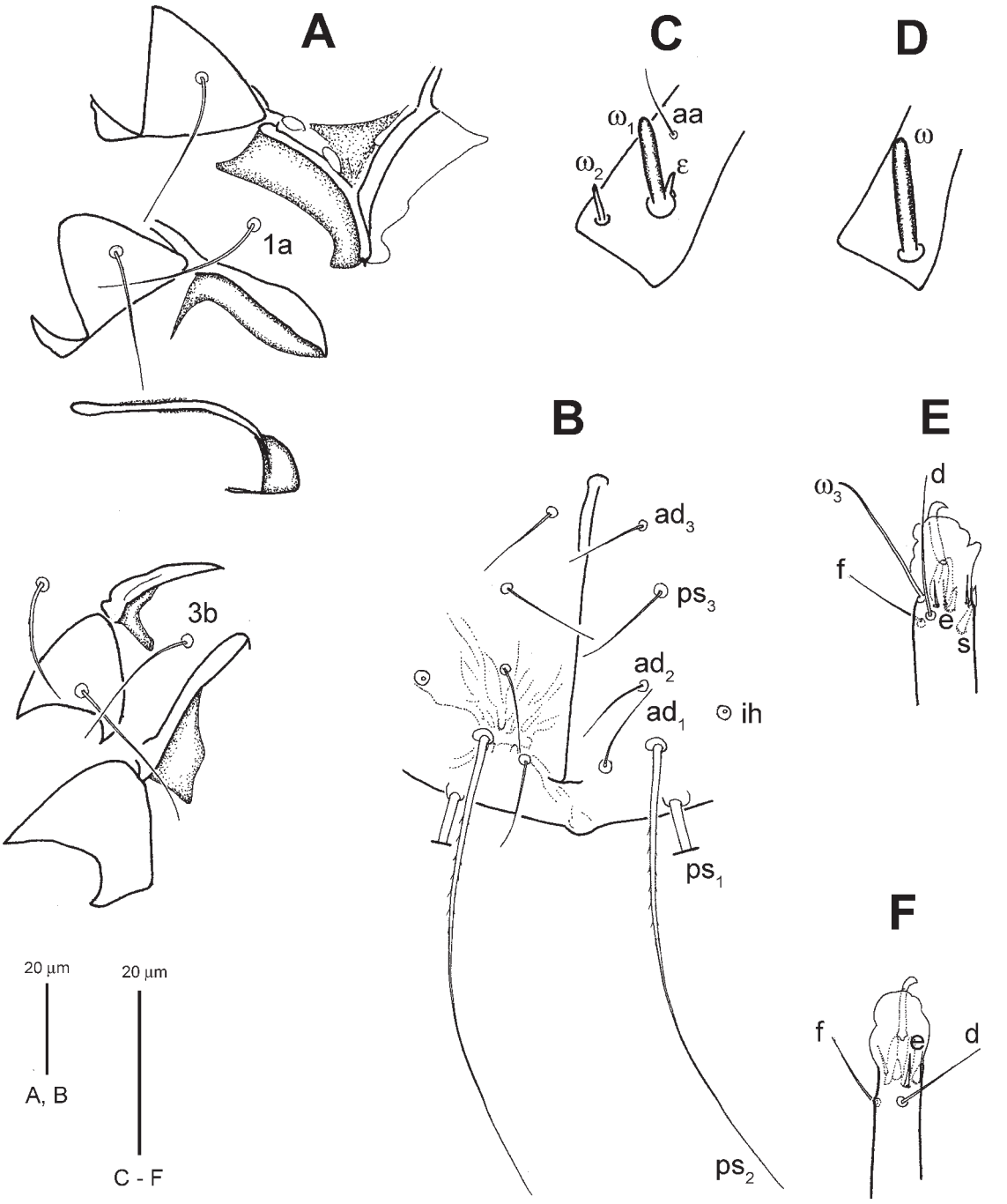


Fig. 46. *Tyrophagus macfarlanei* **sp. n.** (female). A, coxae I–IV; B, anus; C, solenidia, famulus, and seta of tarsus I; D, solenidion of tarsus II; E, distal part of tarsus I; F, distal part of tarsus II.

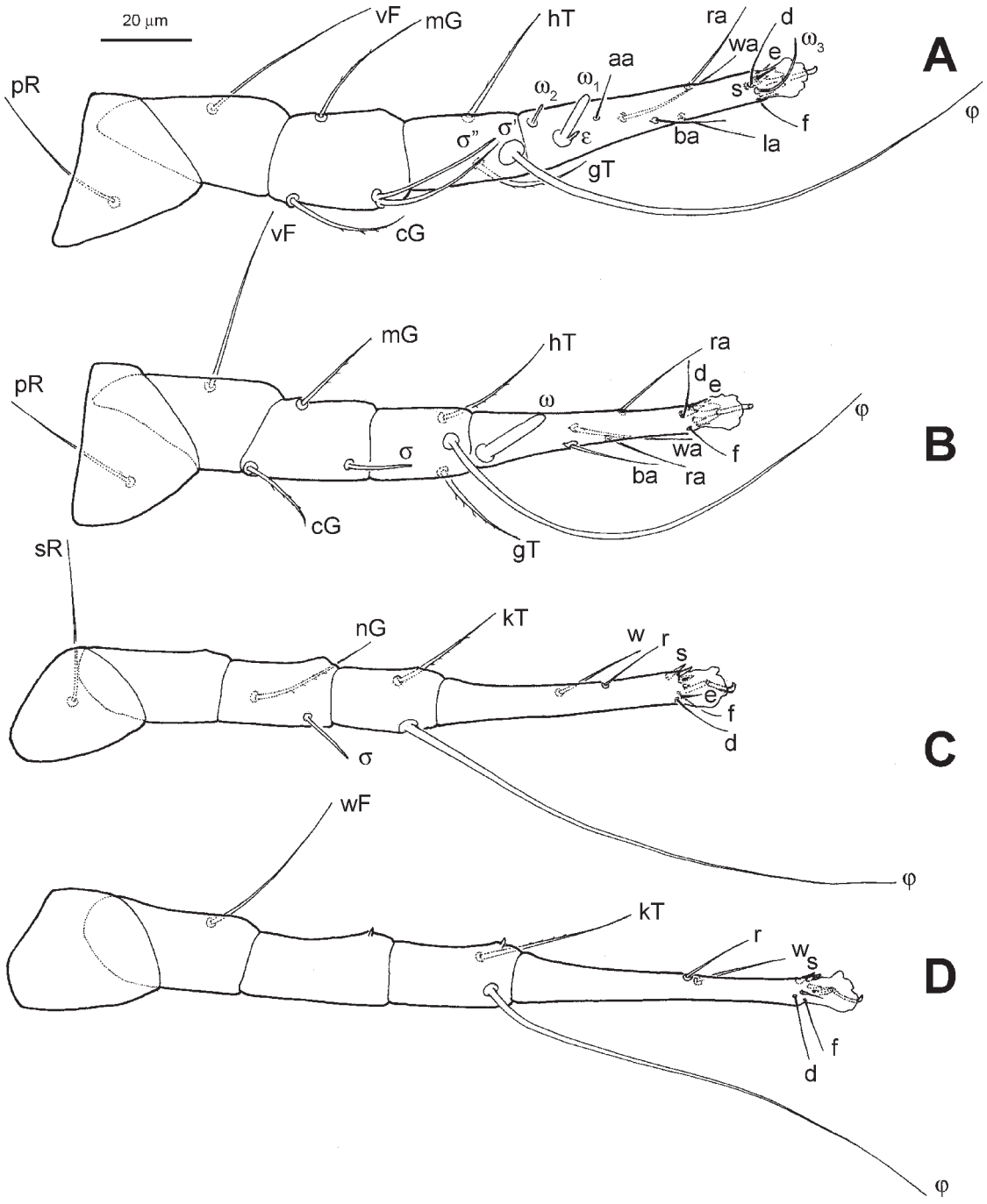


Fig. 47. *Tyrophagus macfarlanei* **sp. n.** (female). A, leg I; B, leg II; C, leg III; D, leg IV.

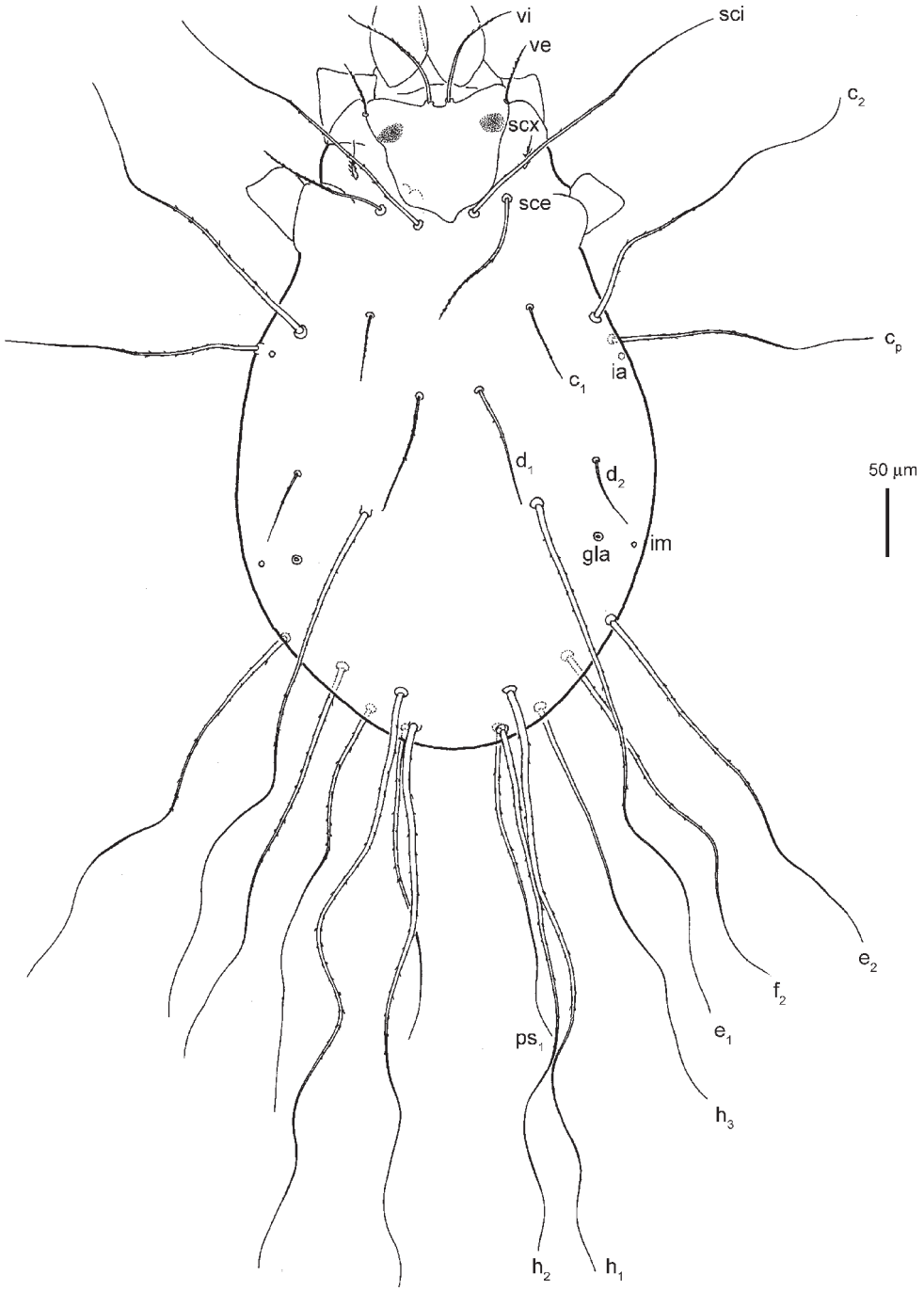


Fig. 48. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (female). Dorsal view of idiosoma.

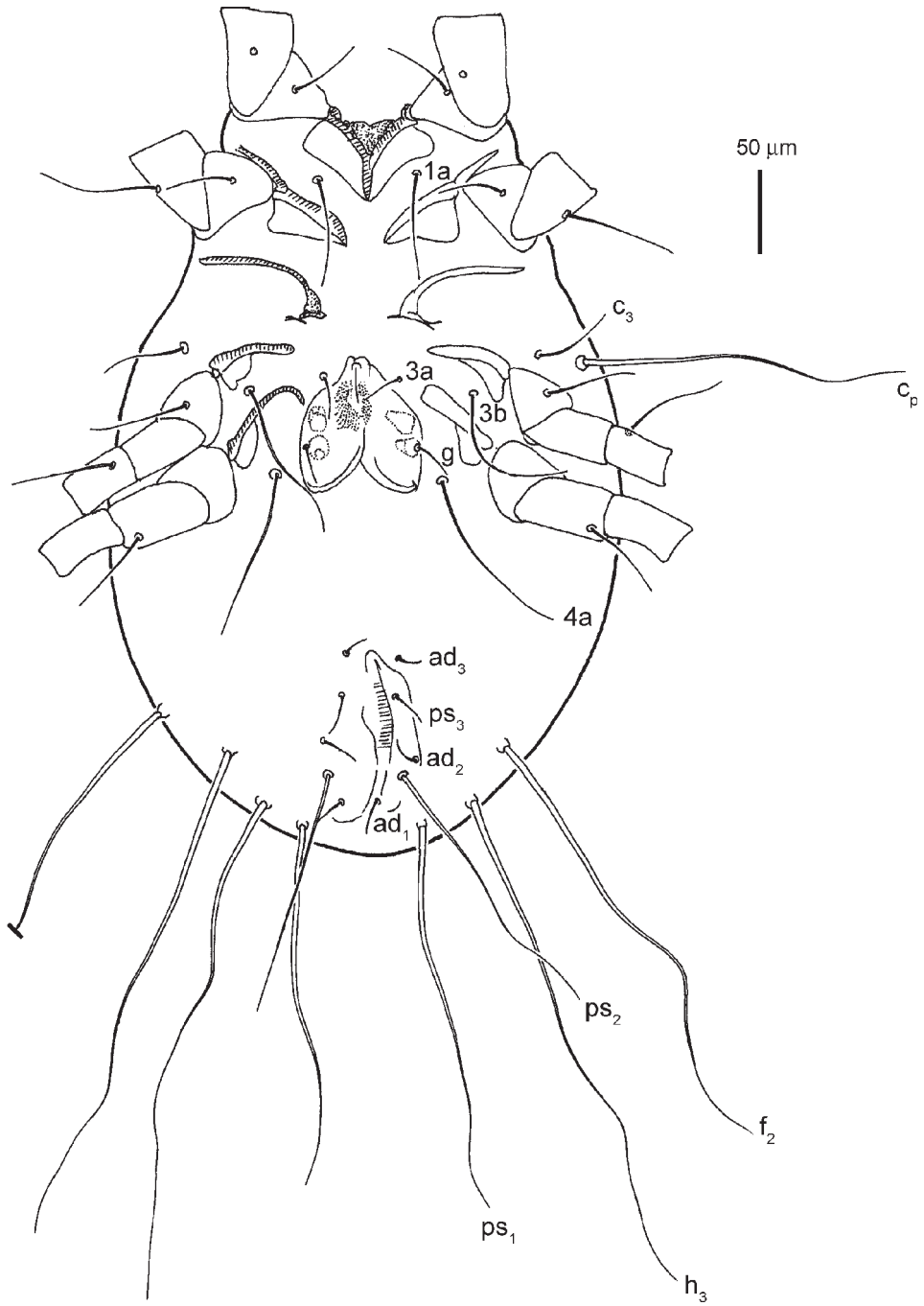


Fig. 49. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (female). Ventral view of idiosoma.

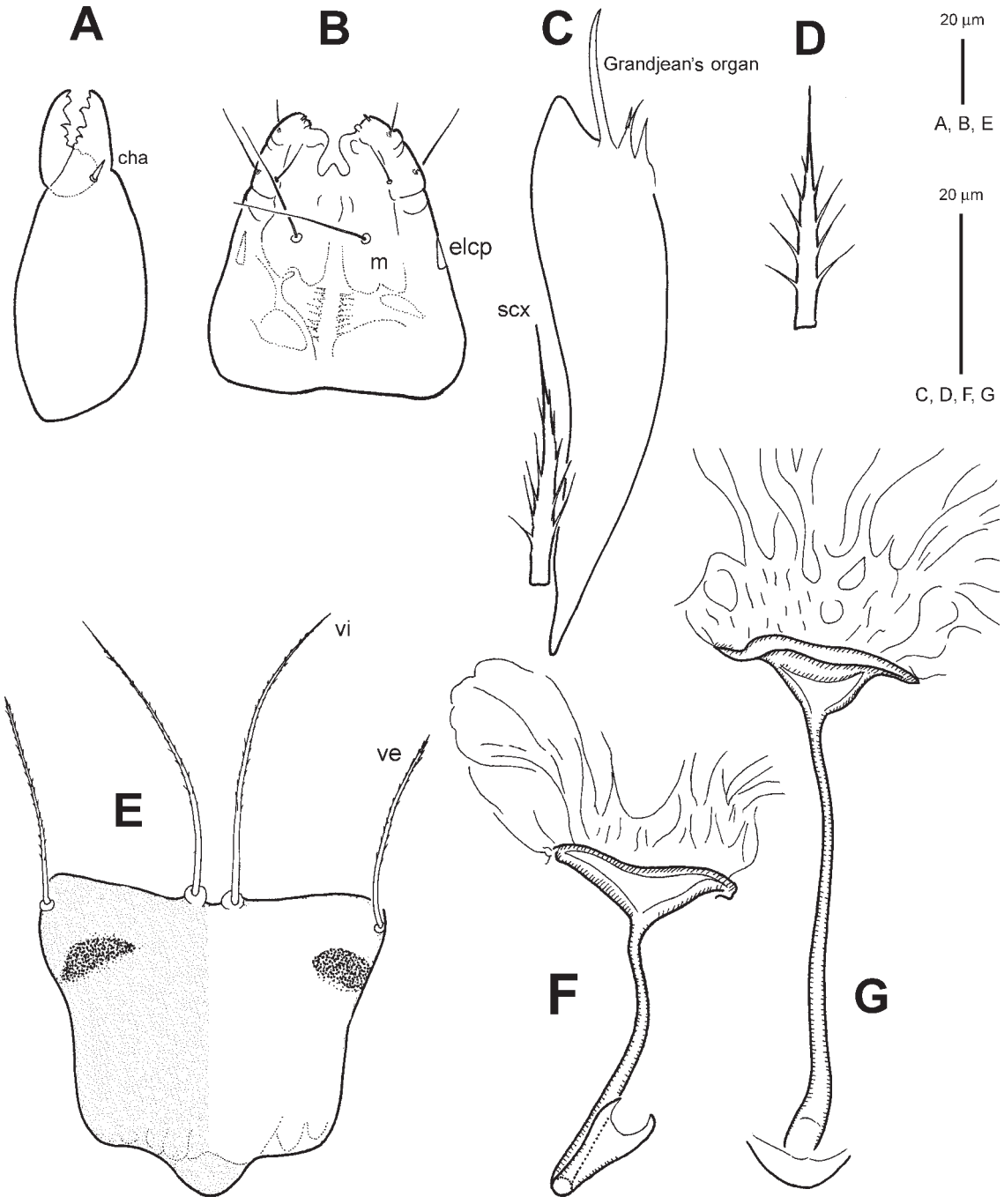


Fig. 50. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, lateral sclerite and supracoxal seta; D, supracoxal seta; E, prodorsal shield; F, copulatory opening and spermatheca; G, copulatory opening and spermatheca.

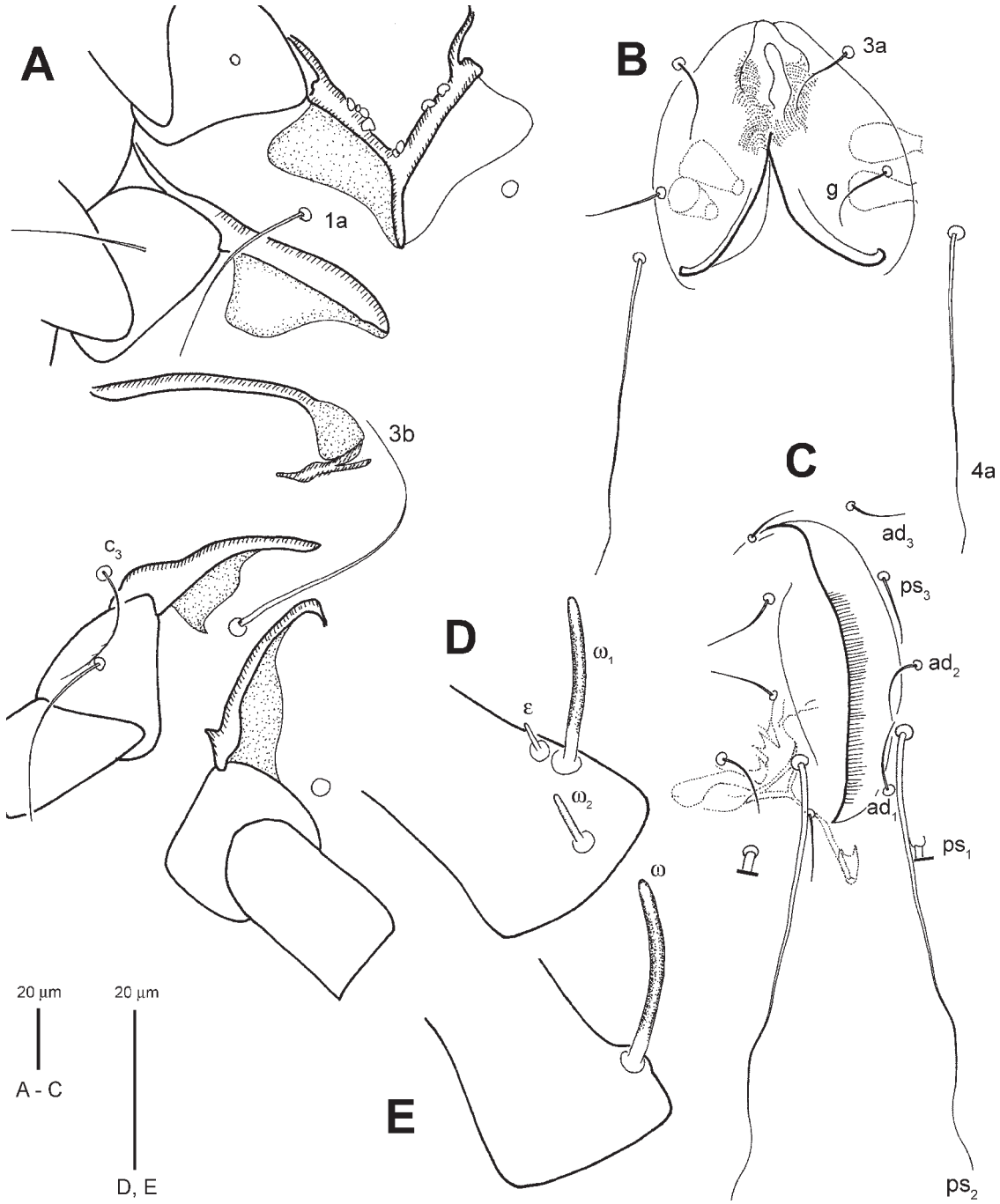


Fig. 51. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (female). A, coxae I–IV; B, genital opening; C, anus; D, solenidia and famulus of tarsus I; E, solenidion of tarsus II.

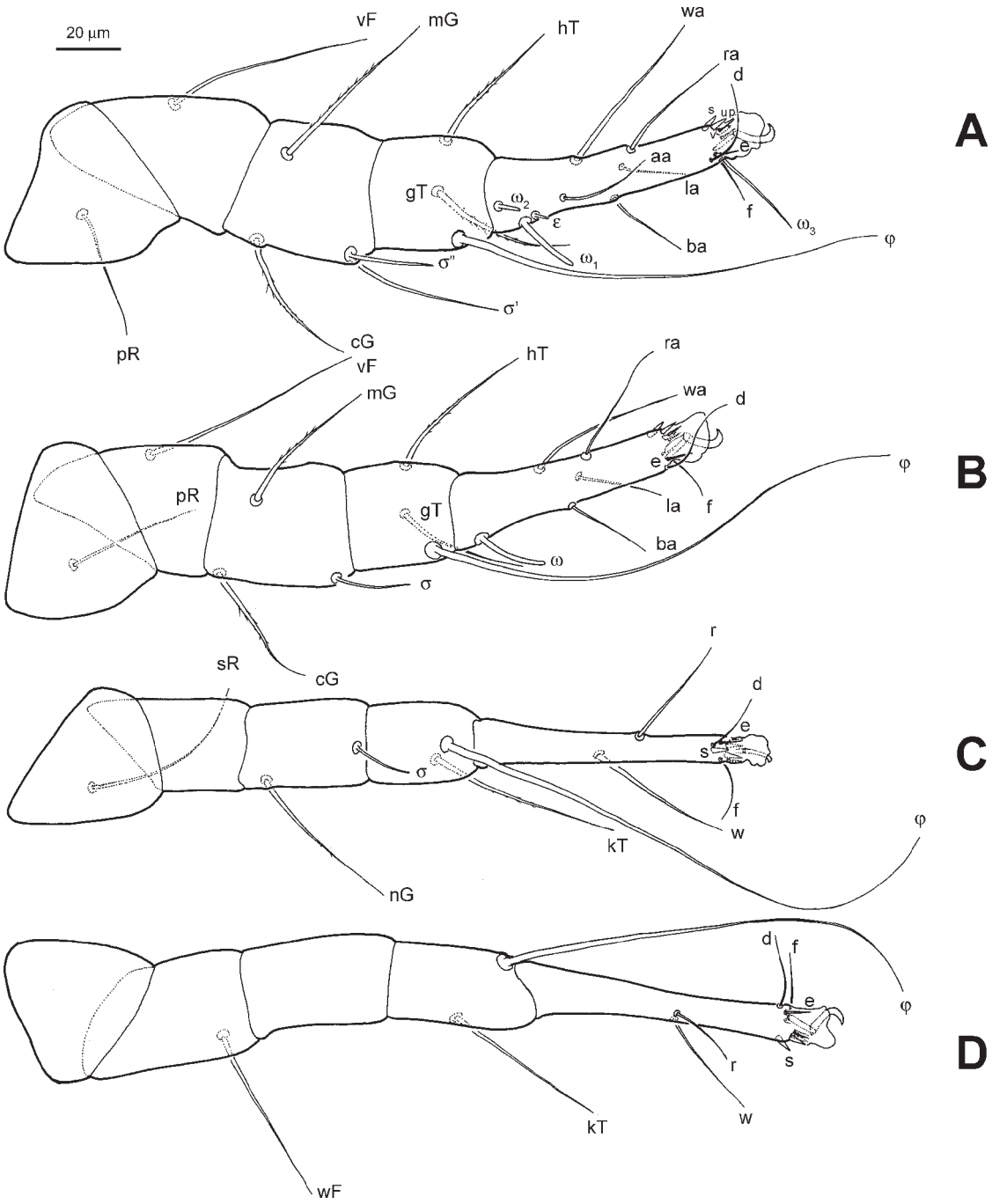


Fig. 52. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (female). A, leg I; B, leg II; C, leg III; D, leg IV.

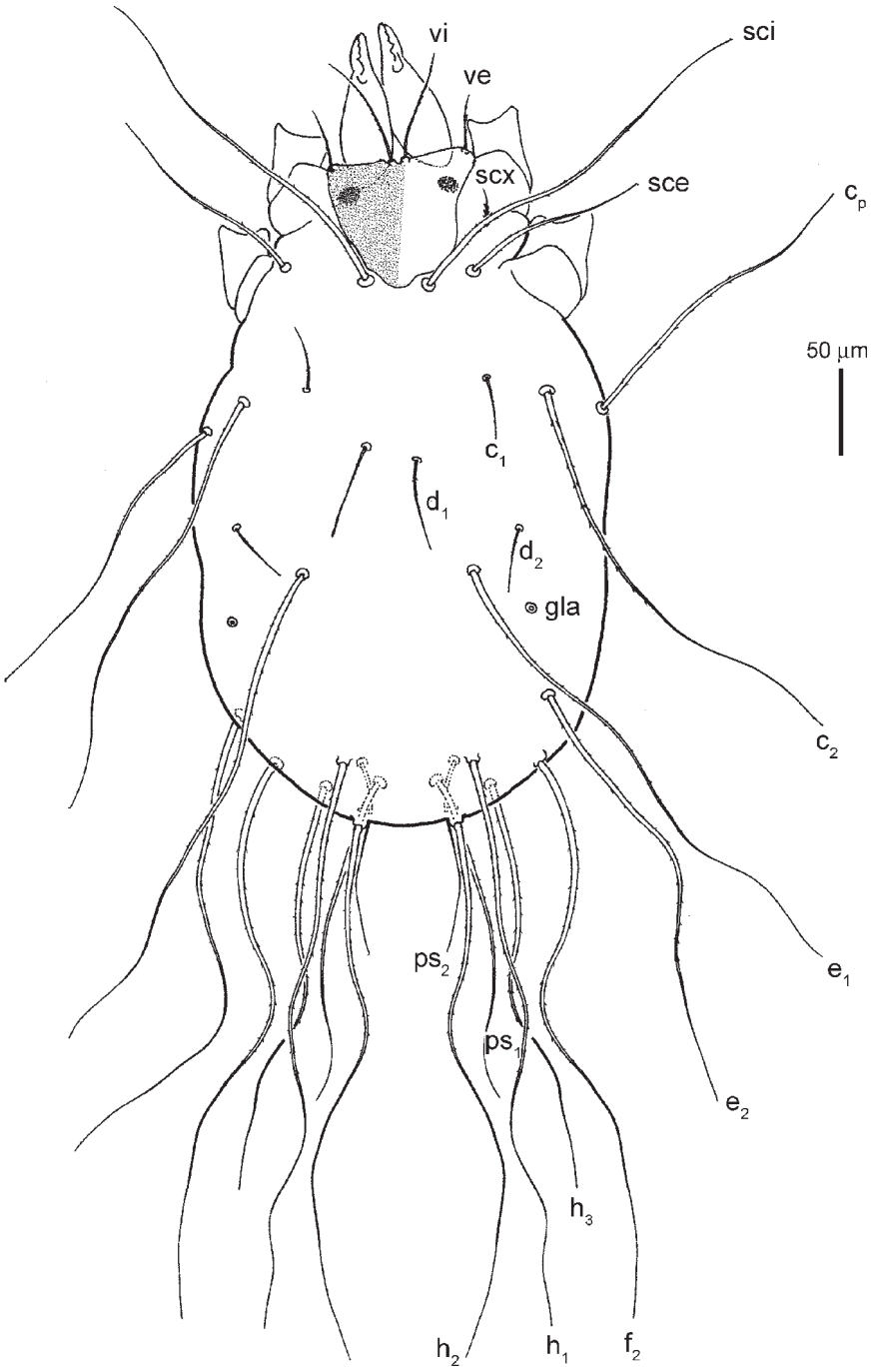


Fig. 53. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (male). Dorsal view of idiosoma.

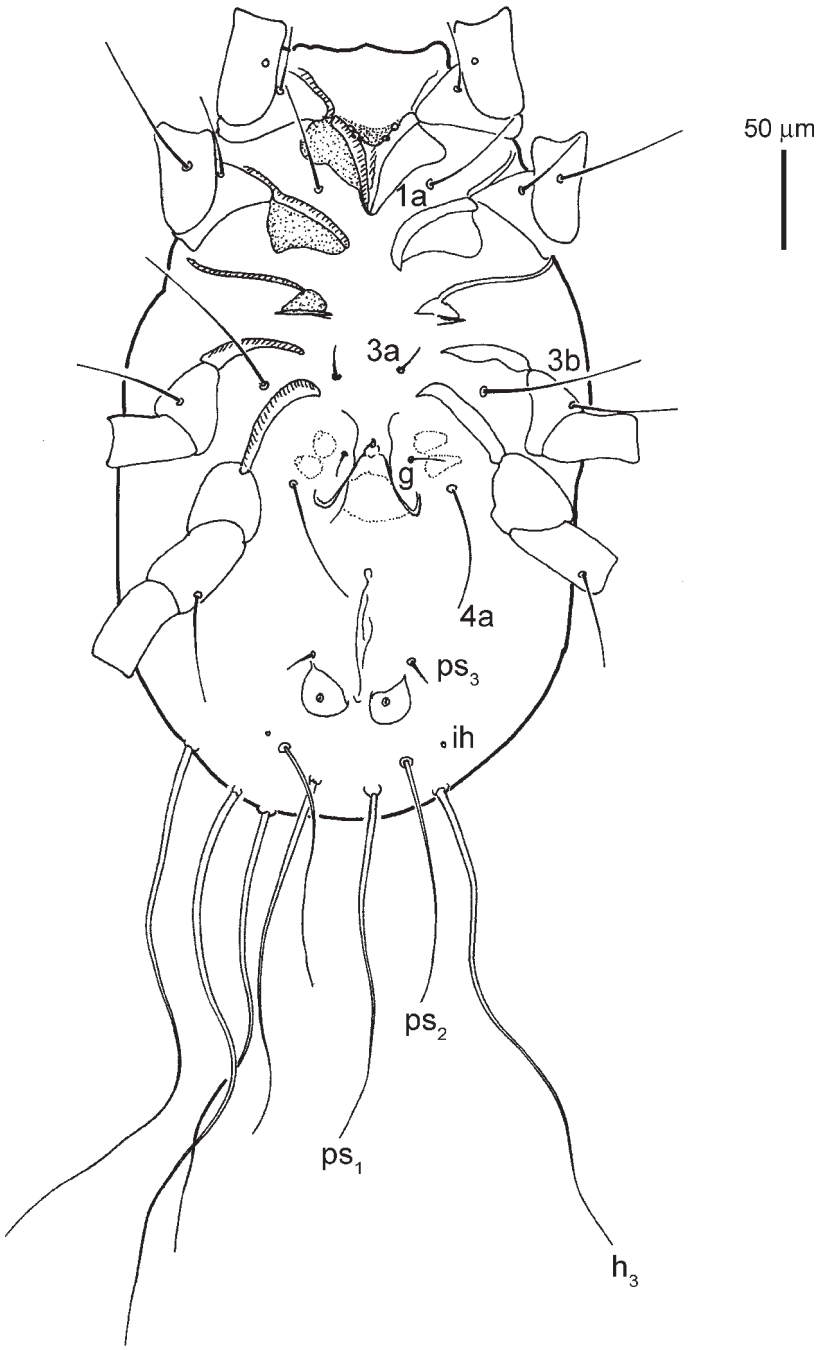


Fig. 54. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (male). Ventral view of idiosoma.

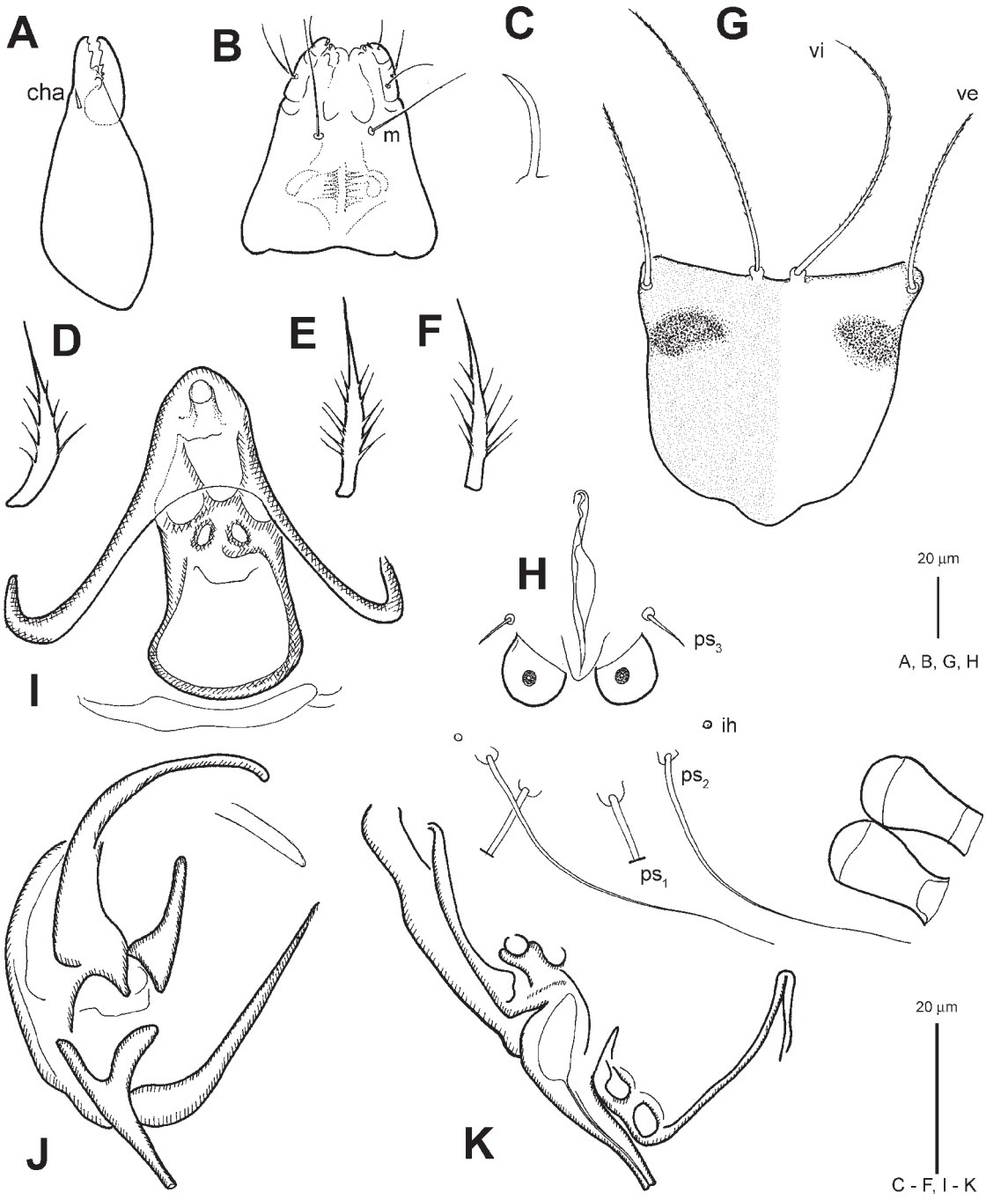


Fig. 55. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, supracoxal seta; F, supracoxal seta; G, prodorsal shield; H, anus; I, ventral view of aedeagus; J, lateral view of aedeagus; K, aedeagus and genital papillae.

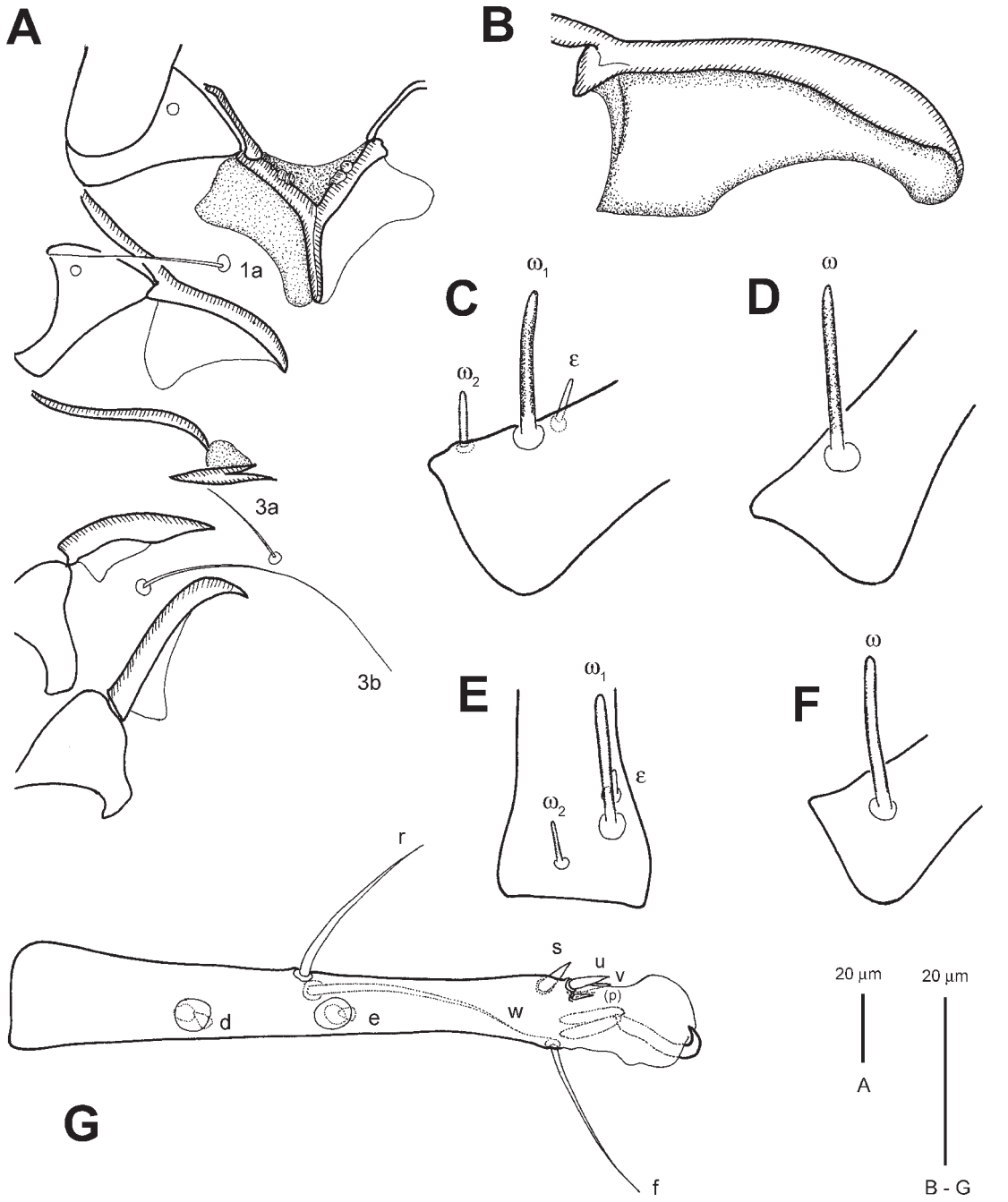


Fig. 56. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (male). A, coxae I–IV; B, coxa II; C, solenidia and famulus of tarsus I; D, solenidion of tarsus II; E, solenidia and famulus of tarsus I; F, solenidion of tarsus II; G, tarsus IV.

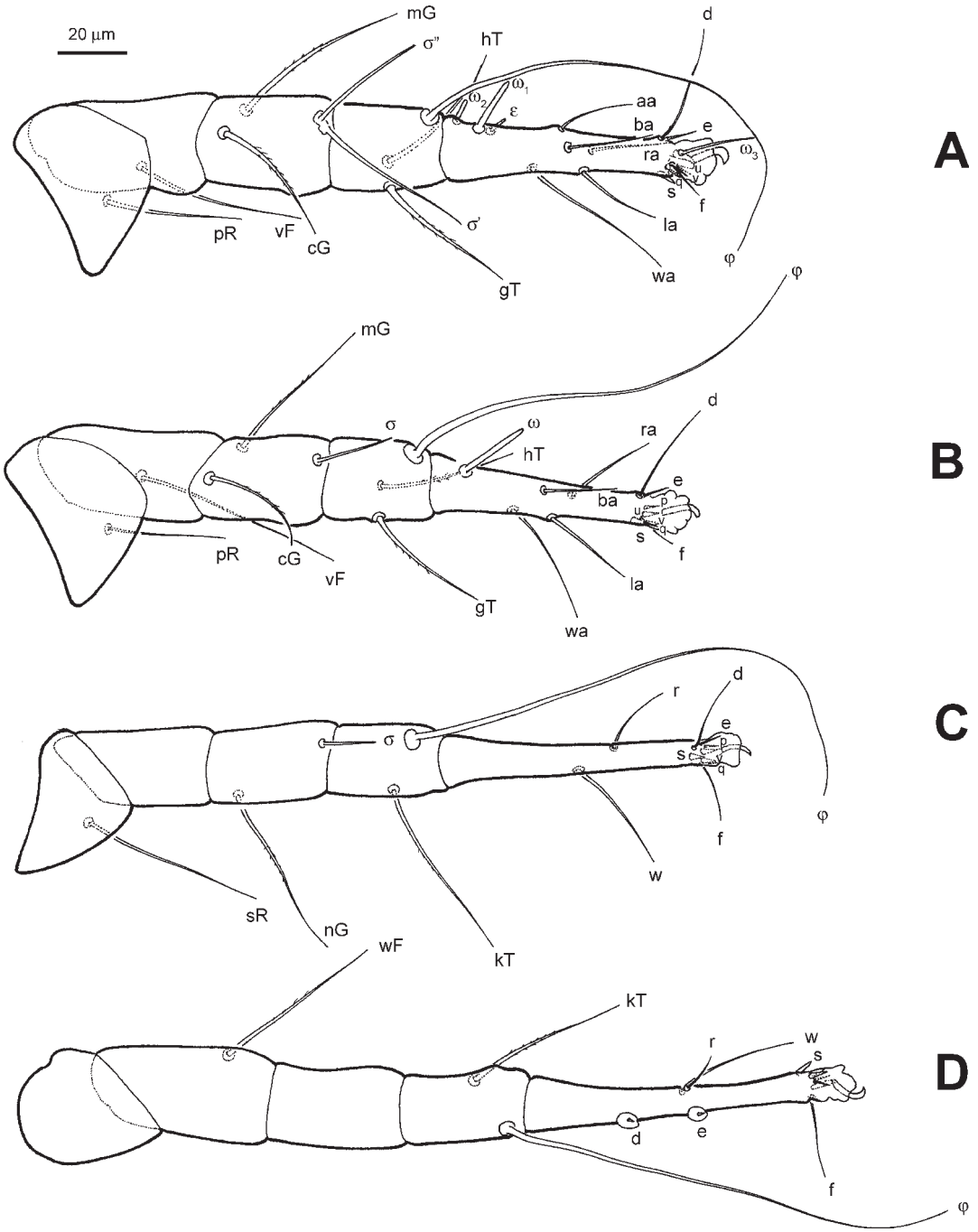


Fig. 57. *Tyrophagus neiswanderi* Johnson & Bruce, 1965 (male). A, leg I; B, leg II; C, leg III; D, leg IV.

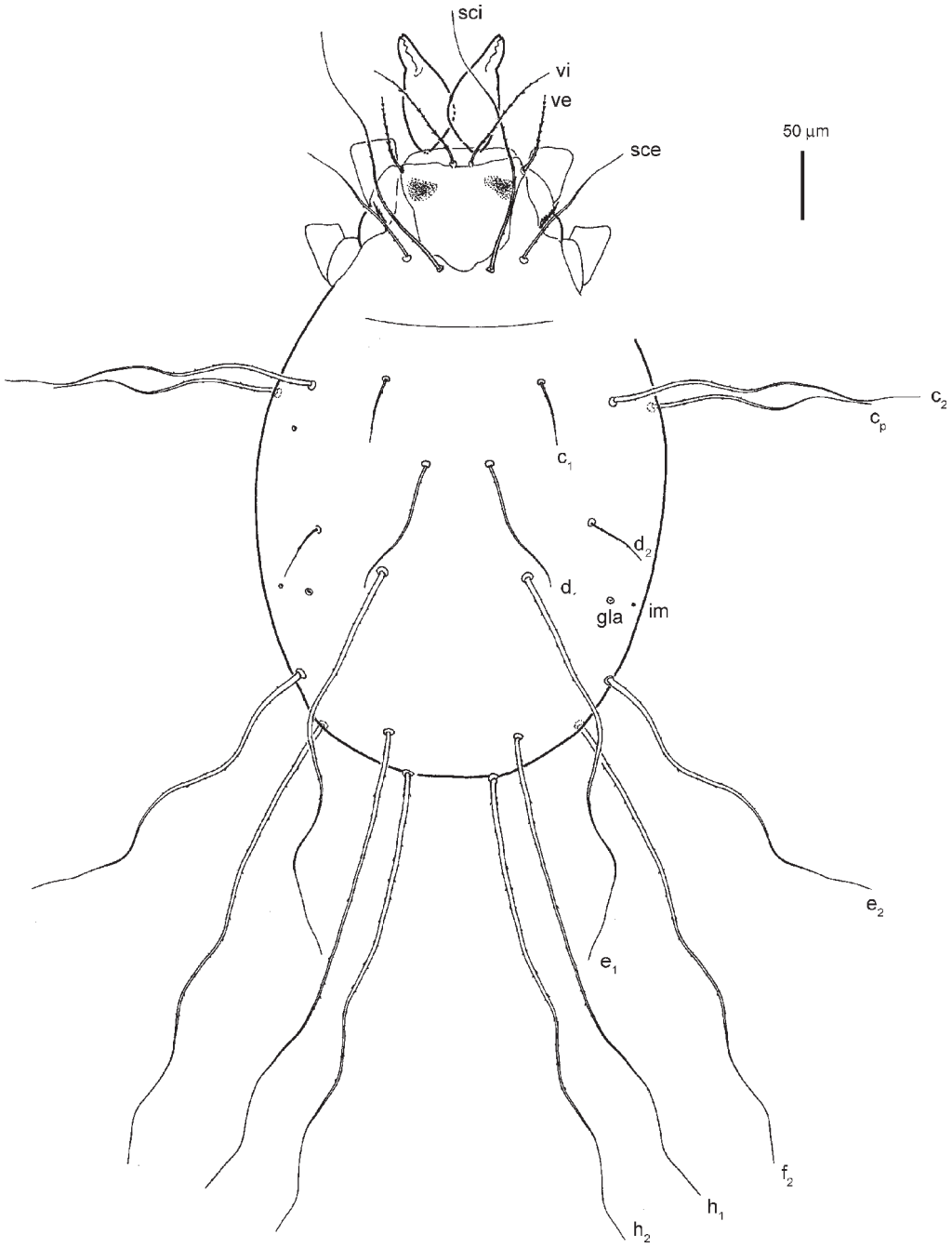


Fig. 58. *Tyrophagus putrescentiae* (Schrank, 1781) (female). Dorsal view of idiosoma.

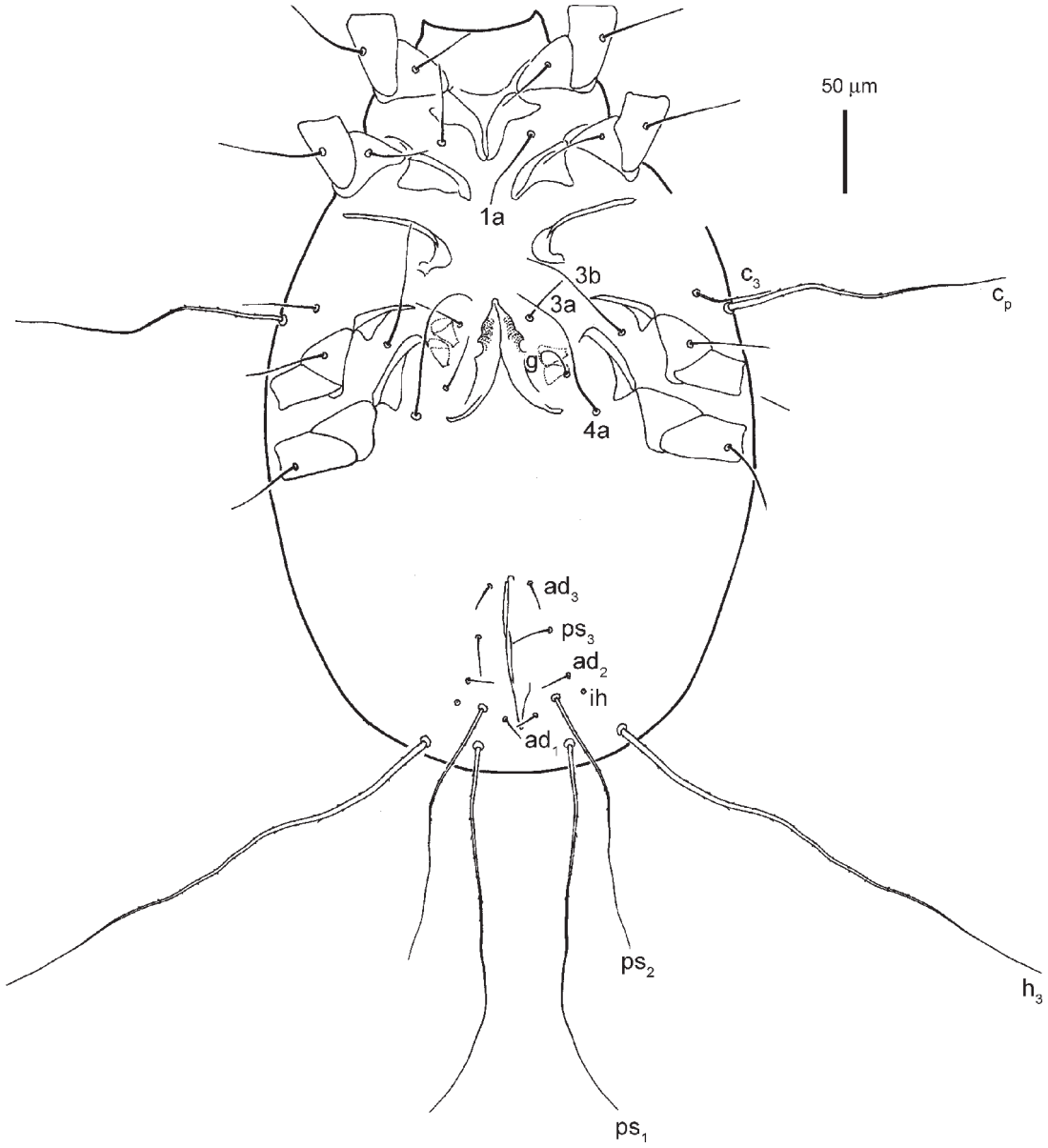


Fig. 59. *Tyrophagus putrescentiae* (Schrank, 1781) (female). Ventral view of idiosoma.

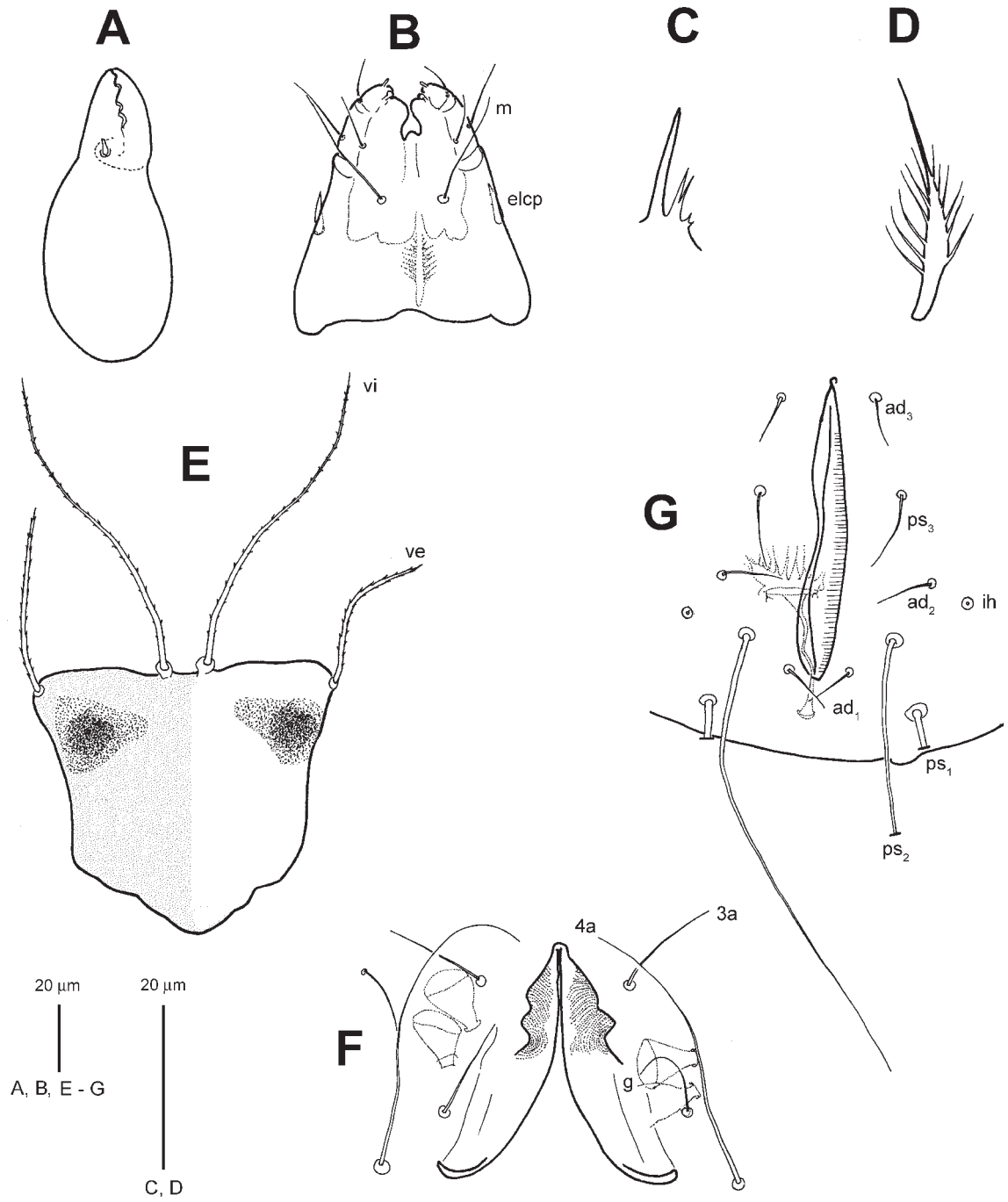


Fig. 60. *Tyrophagus putrescentiae* (Schrank, 1781) (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, prodorsal shield; F, genital opening; G, anus.

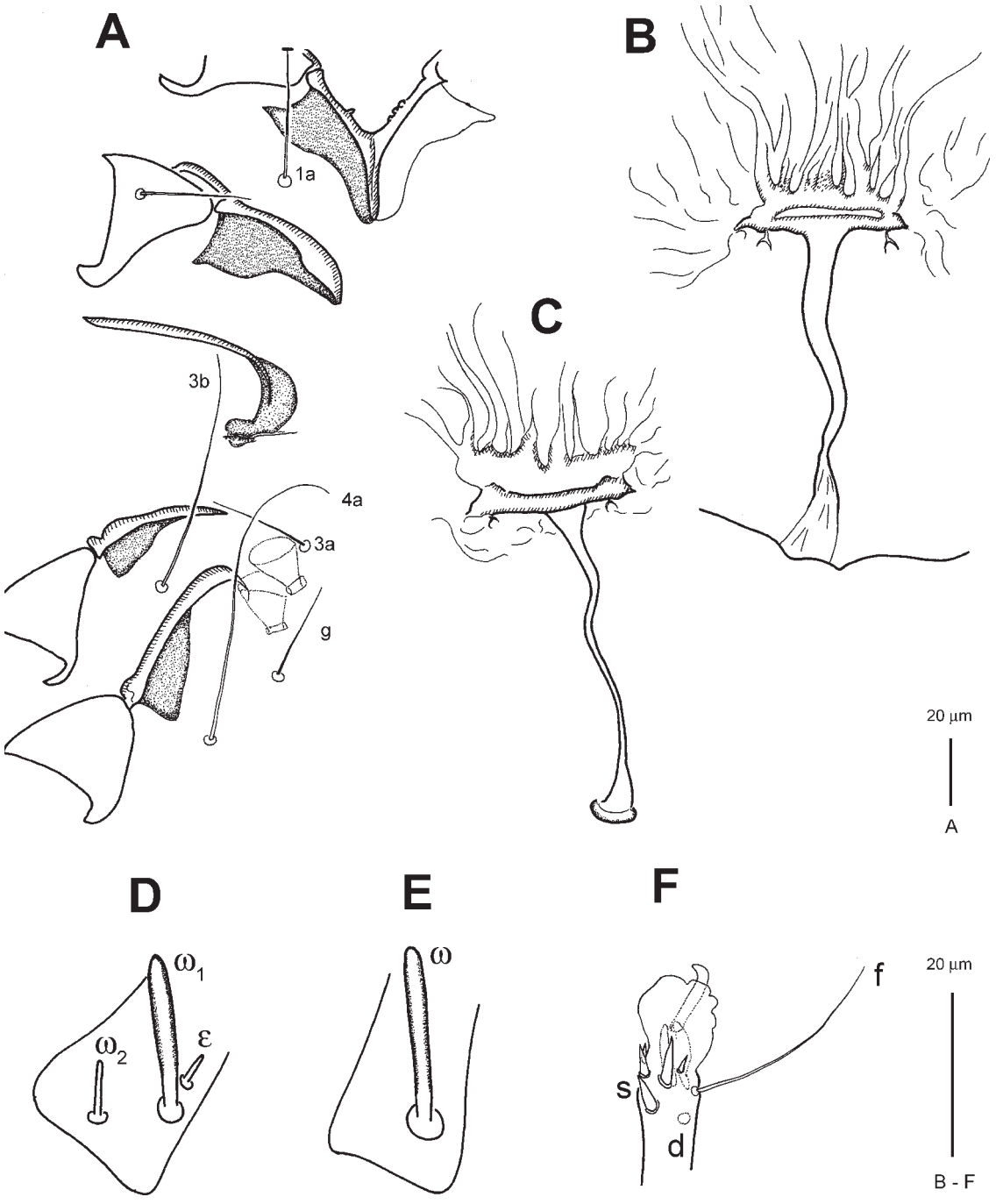


Fig. 61. *Tyrophagus putrescentiae* (Schrank, 1781) (female). A, coxae I–IV; B, copulatory opening and spermatheca; C, copulatory opening and spermatheca; D, solenidia and famulus of tarsus I; E, solenidion of tarsus II; F, ventral view of distal part of tarsus IV.

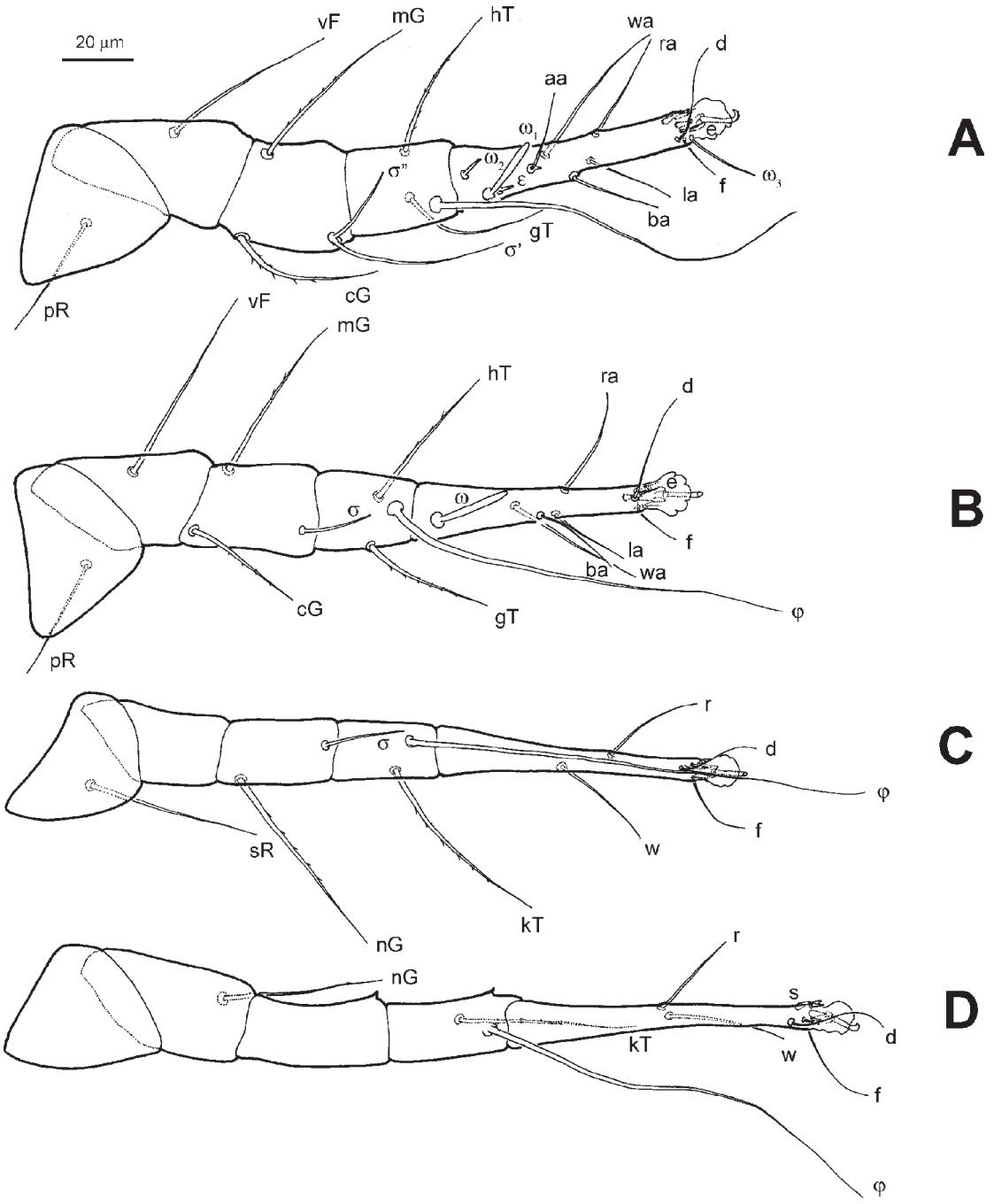


Fig. 62. *Tyrophagus putrescentiae* (Schrank, 1781) (female). A, leg I; B, leg II; C, leg III; D, leg IV.

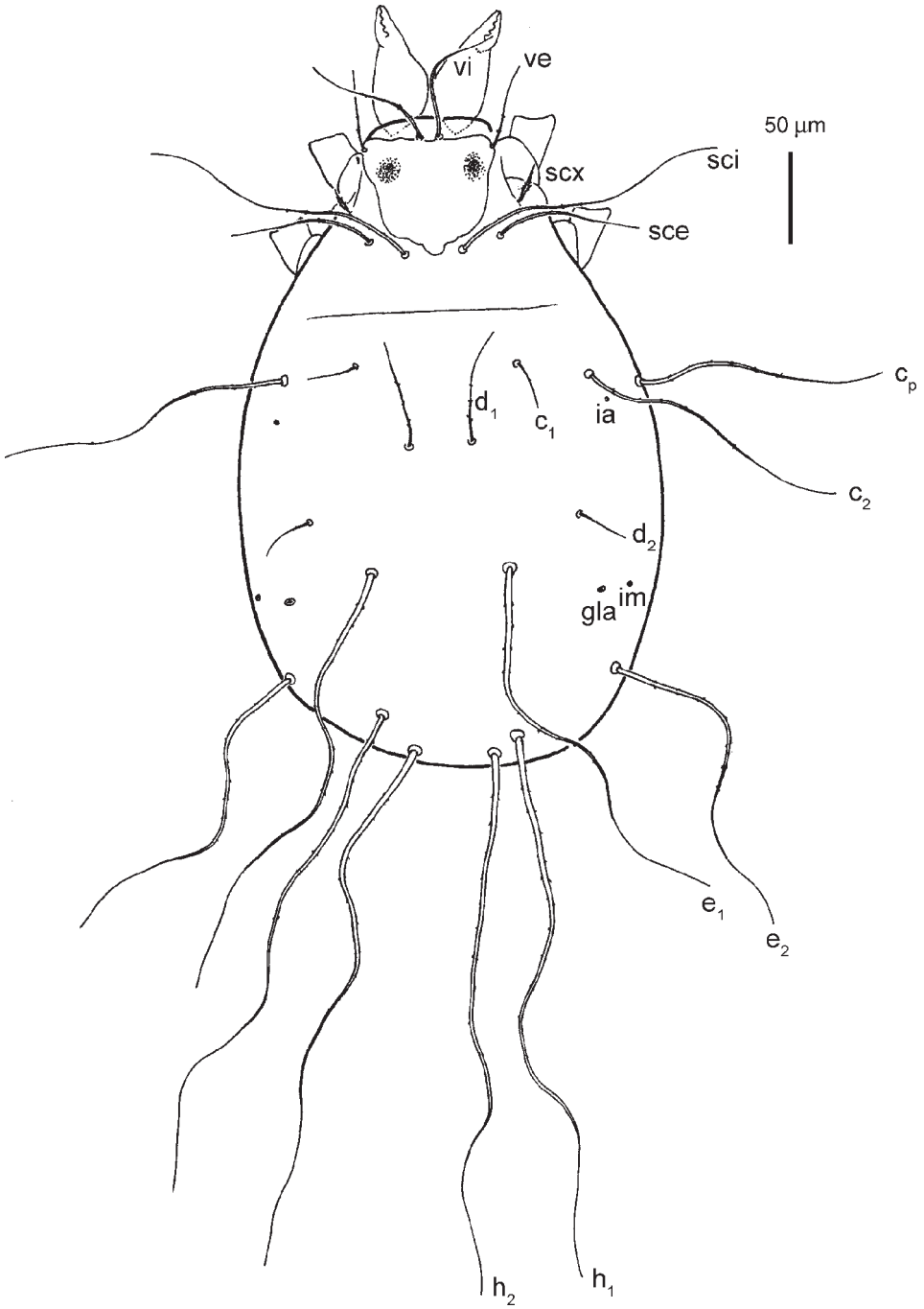


Fig. 63. *Tyrophagus putrescentiae* (Schrank, 1781) (male). Dorsal view of idiosoma.

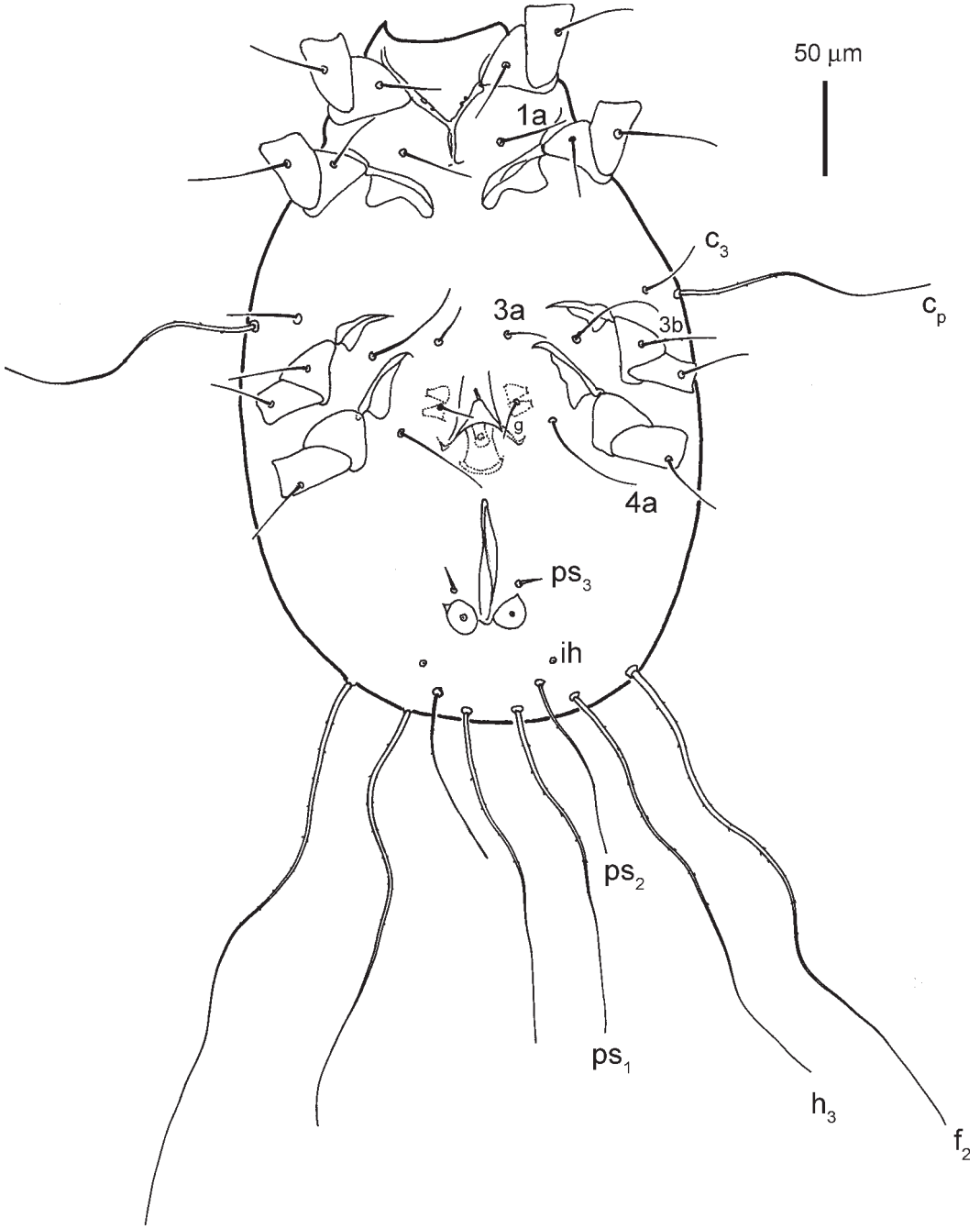


Fig. 64. *Tyrophagus putrescentiae* (Schrank, 1781) (male). Ventral view of idiosoma.

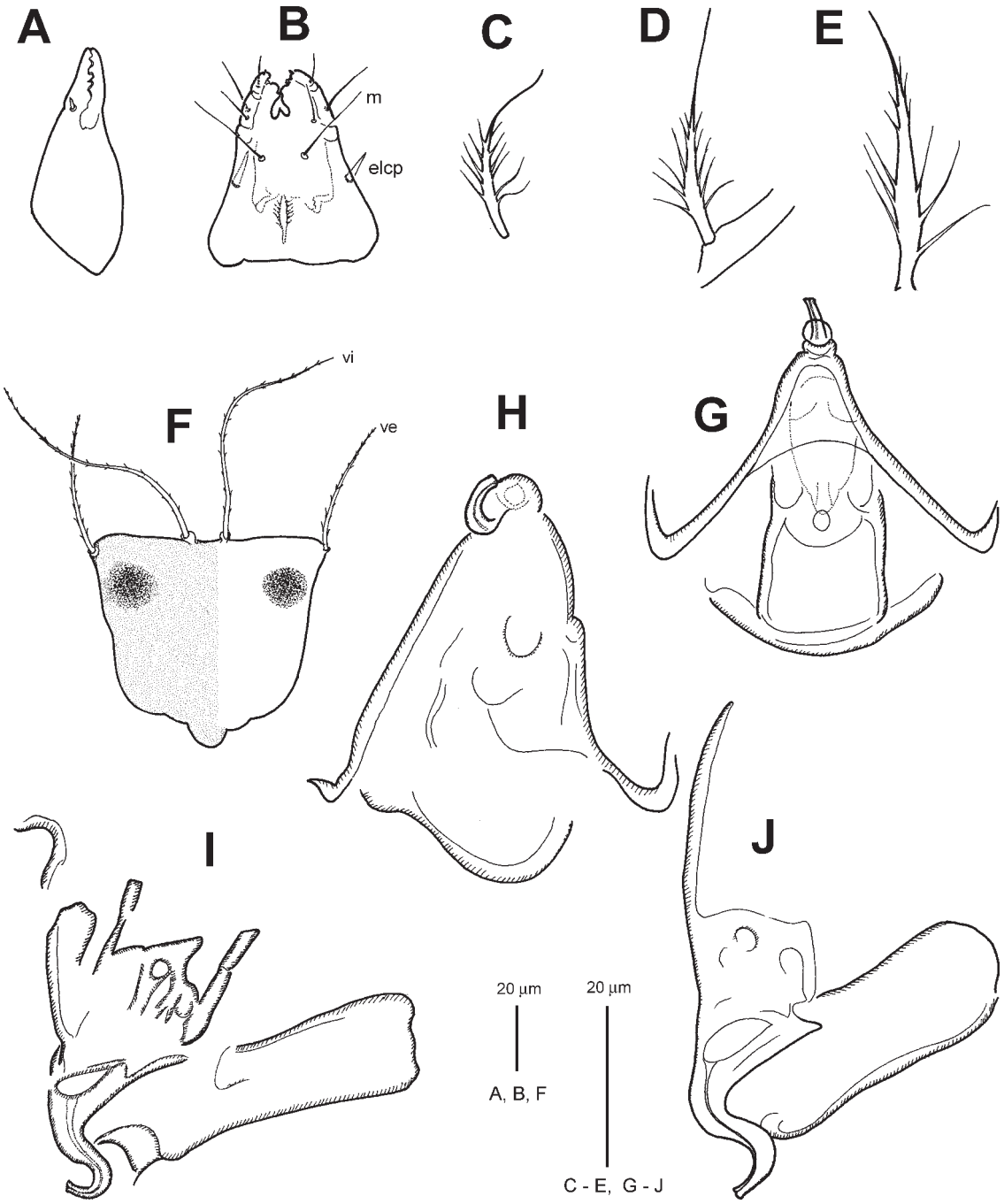


Fig. 65. *Tyrophagus putrescentiae* (Schrank, 1781) (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, supracoxal seta; D, supracoxal seta; E, supracoxal seta; F, prodorsal shield; G, ventral view of aedeagus; H, ventral view of aedeagus; I, lateral view of aedeagus; J, lateral view of aedeagus.

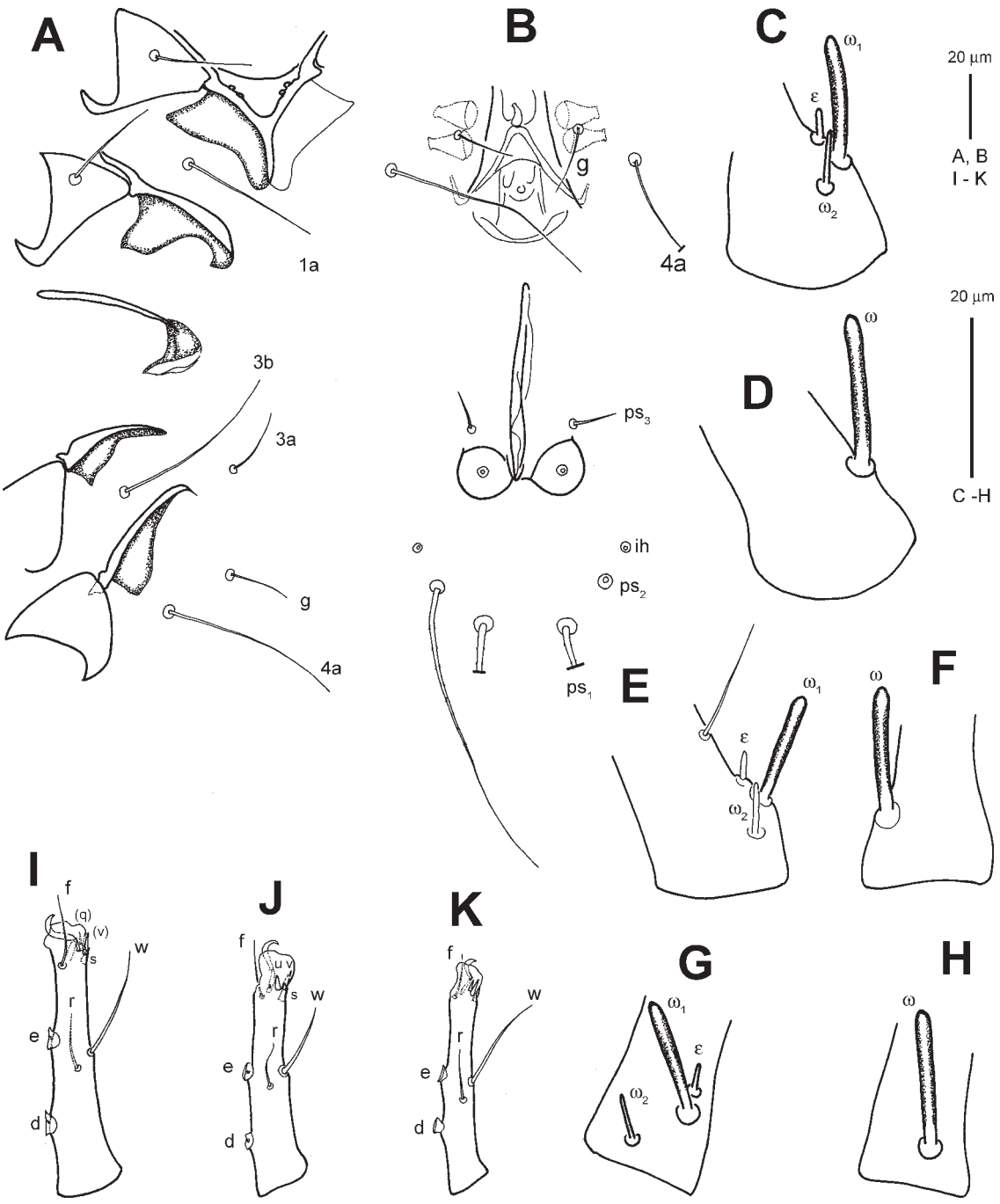


Fig. 66. *Tyrophagus putrescentiae* (Schrank, 1781) (male). A, coxae I–IV; B, genital opening and anus; C, solenidia and famulus of tarsus I; D, solenidion of tarsus II; E, solenidia, famulus, and seta of tarsus I; F, solenidion of tarsus II; G, solenidia and famulus of tarsus I; H, solenidion of tarsus II; I, lateral view of tarsus IV; J, lateral view of tarsus IV; K, lateral view of tarsus IV.

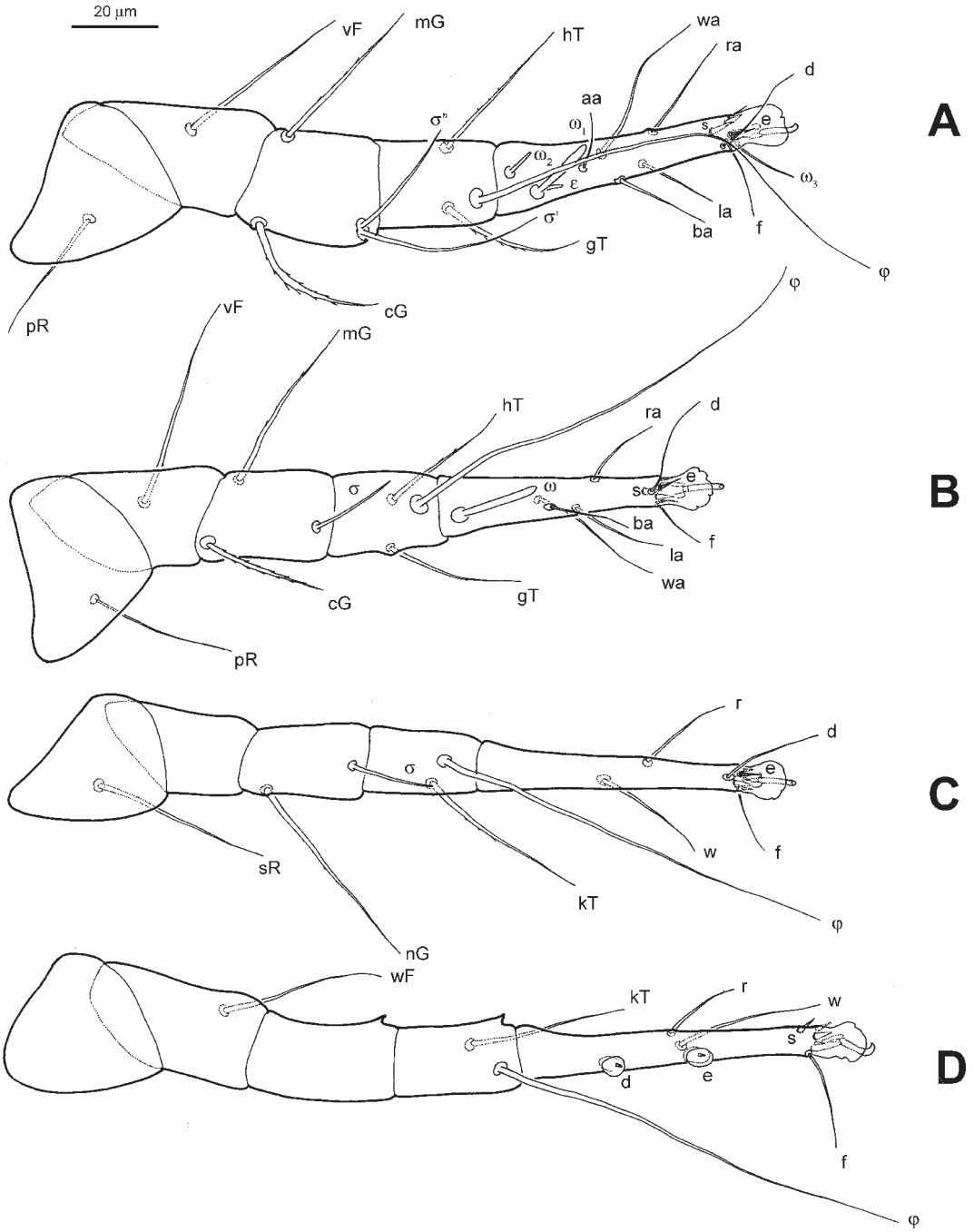


Fig. 67. *Tyrophagus putrescentiae* (Schrank, 1781) (male). A, leg I; B, leg II; C, leg III; D, leg IV.

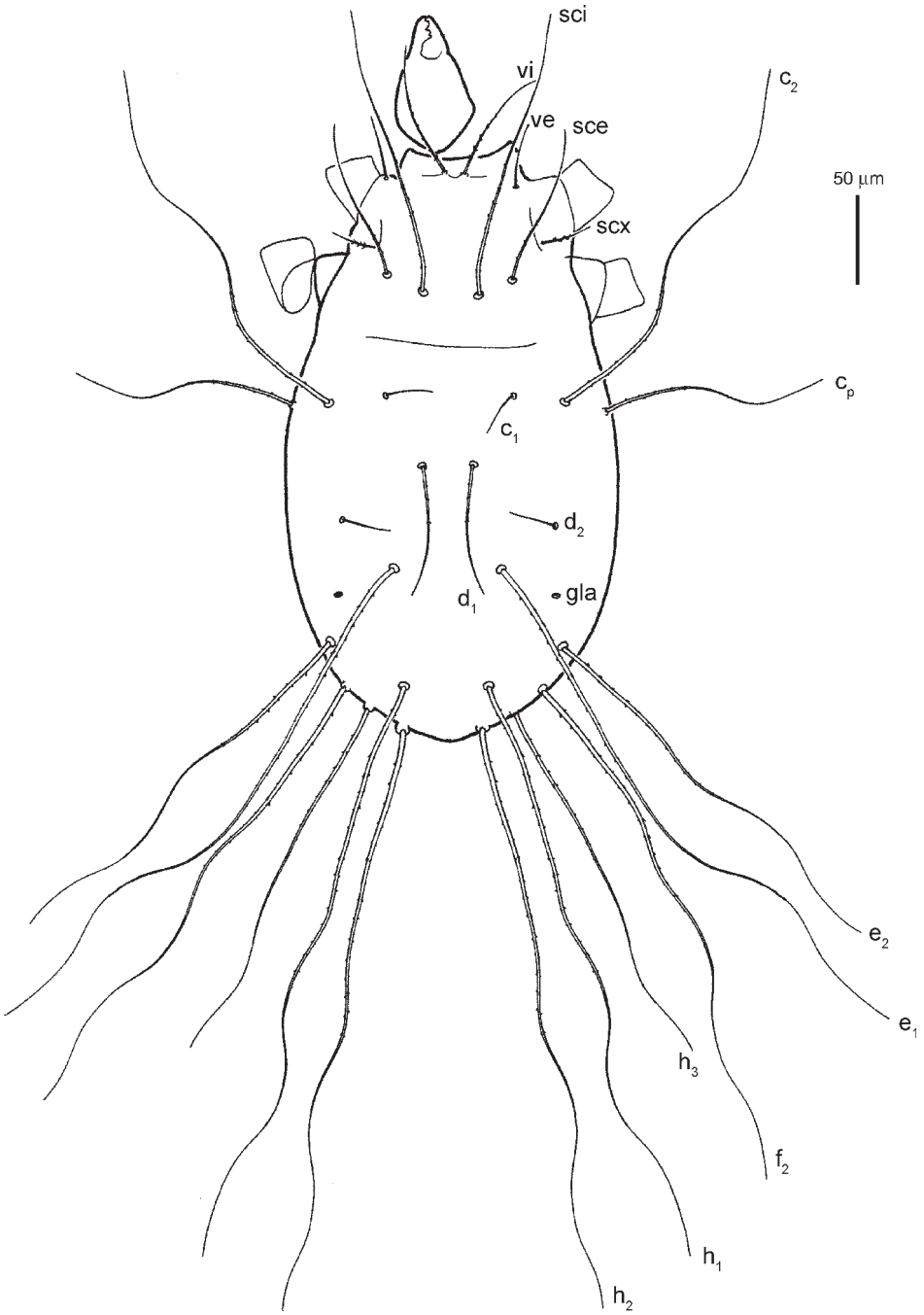


Fig. 68. *Tyrophagus robertsonae* Lynch, 1989 (female). Dorsal view of idiosoma.

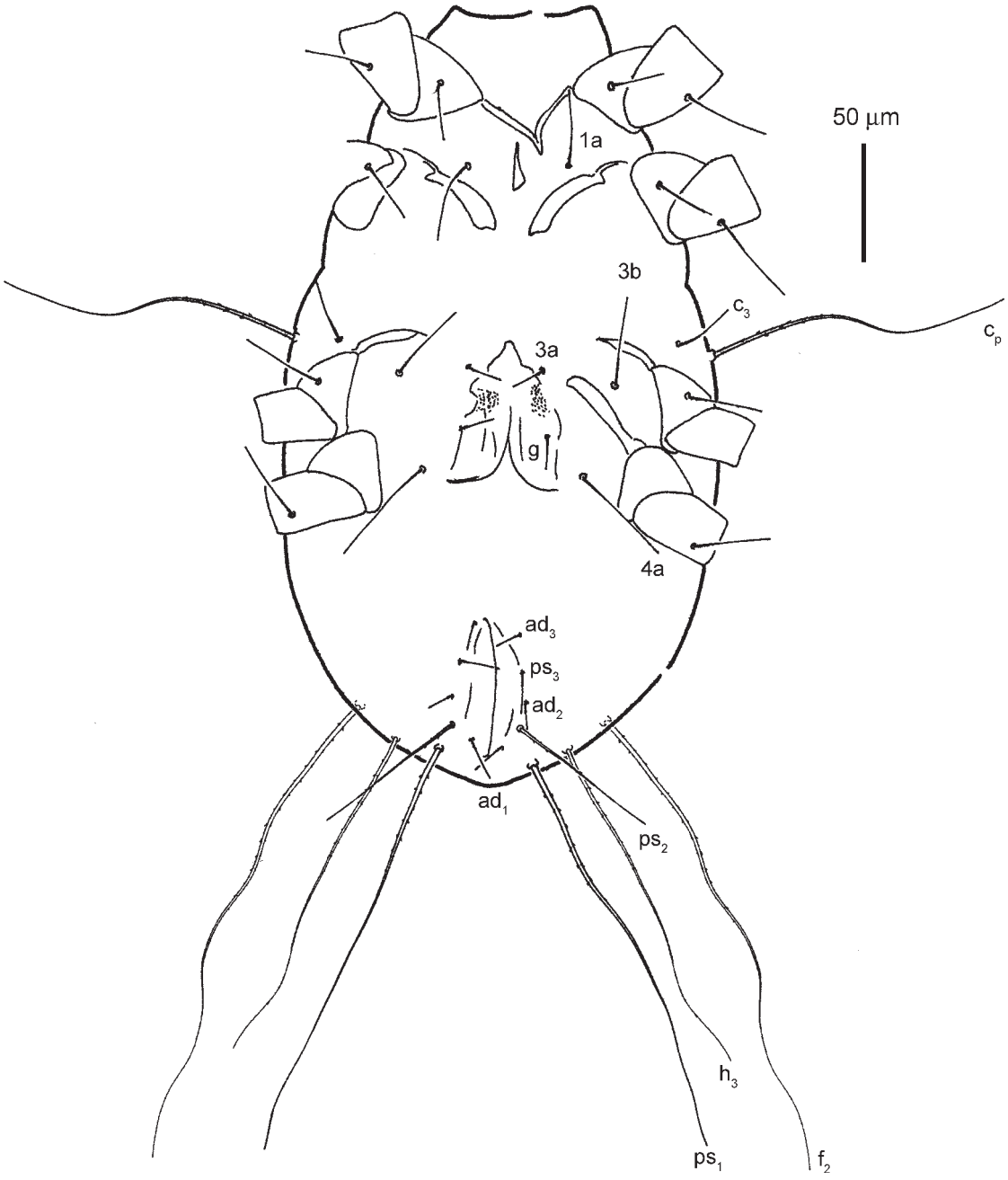


Fig. 69. *Tyrophagus robertsonae* Lynch, 1989 (female). Ventral view of idiosoma.

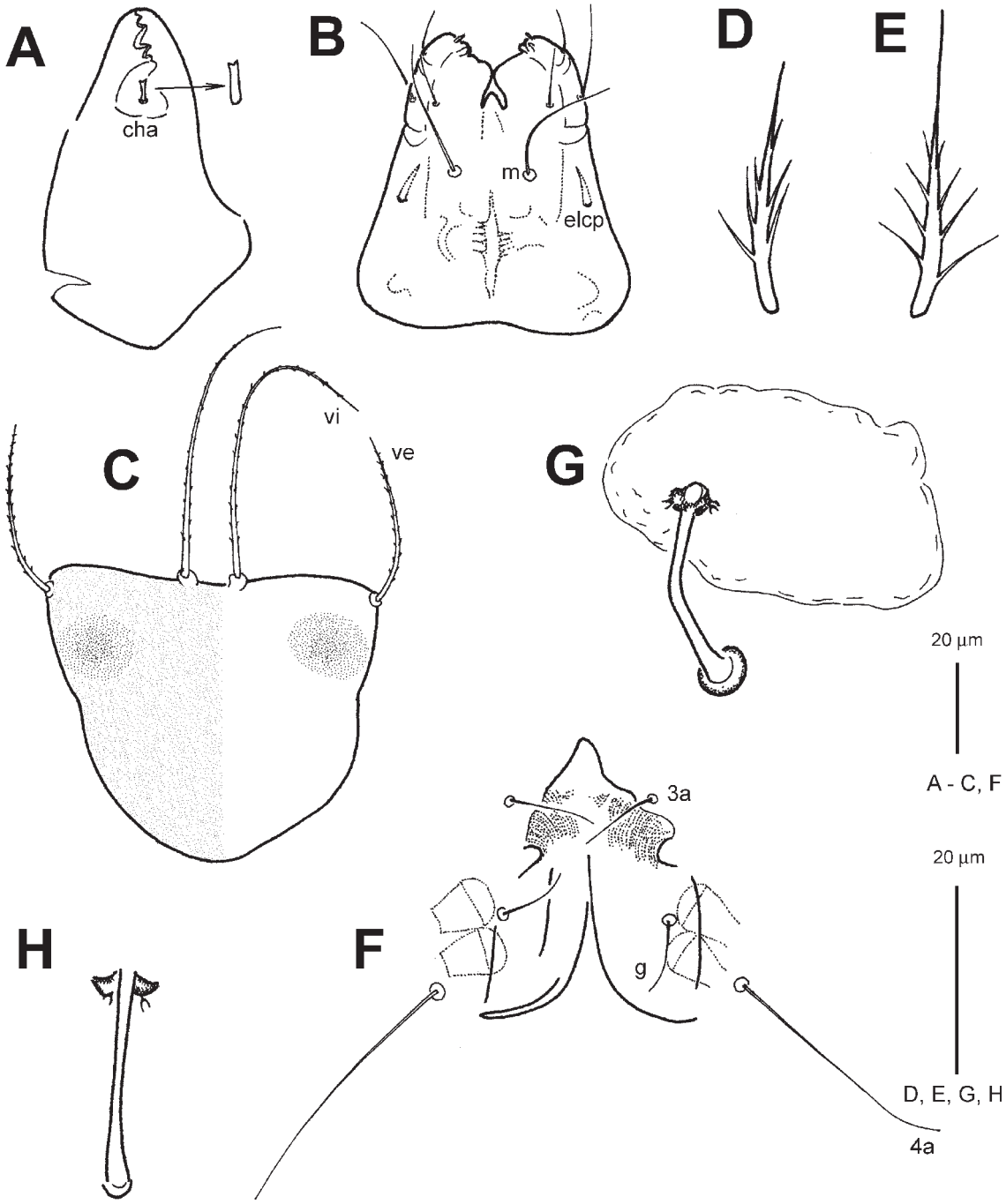


Fig. 70. *Tyrophagus robertsonae* Lynch, 1989 (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, prodorsal shield; D, supracoxal seta; E, supracoxal seta; F, genital opening; G, copulatory opening and spermatheca; H, copulatory opening and base of spermatheca.

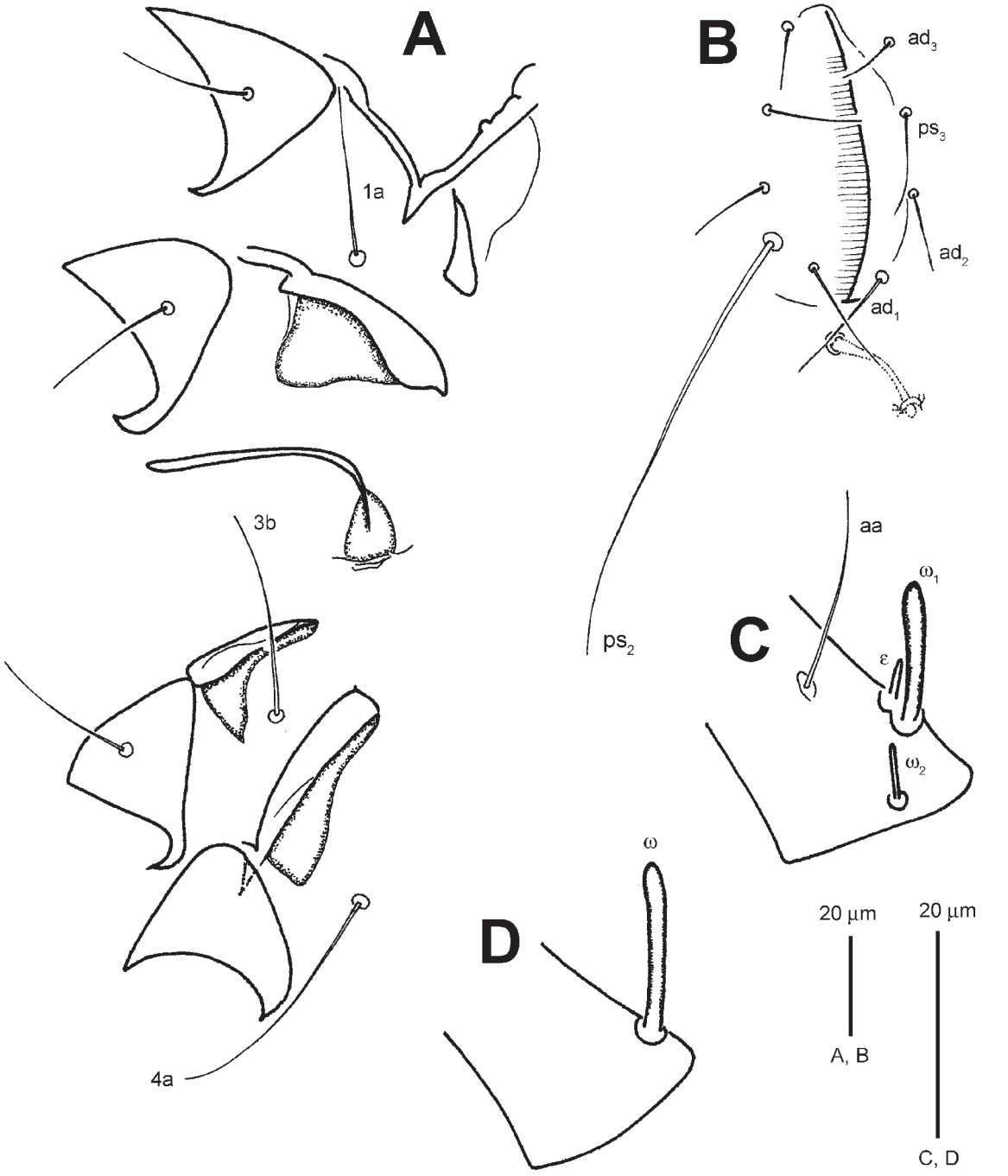


Fig. 71. *Tyrophagus robertsonae* Lynch, 1989 (female). A, coxae I–IV; B, anus; C, solenidia, famulus, and seta of tarsus I; D, solenidion of tarsus II.

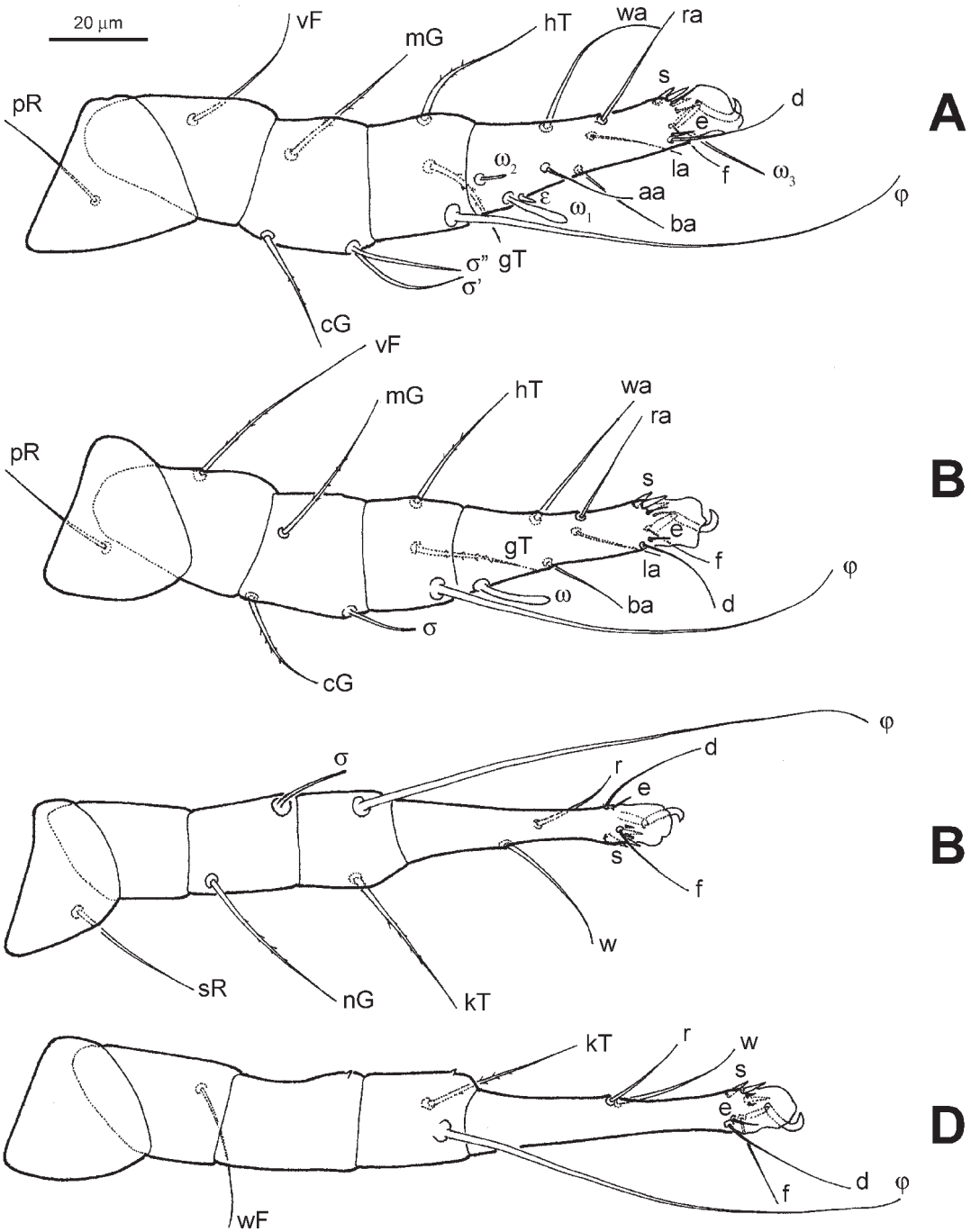


Fig. 72. *Tyrophagus robertsonae* Lynch, 1989 (female). A, leg I; B, leg II; C, leg III; D, leg IV.

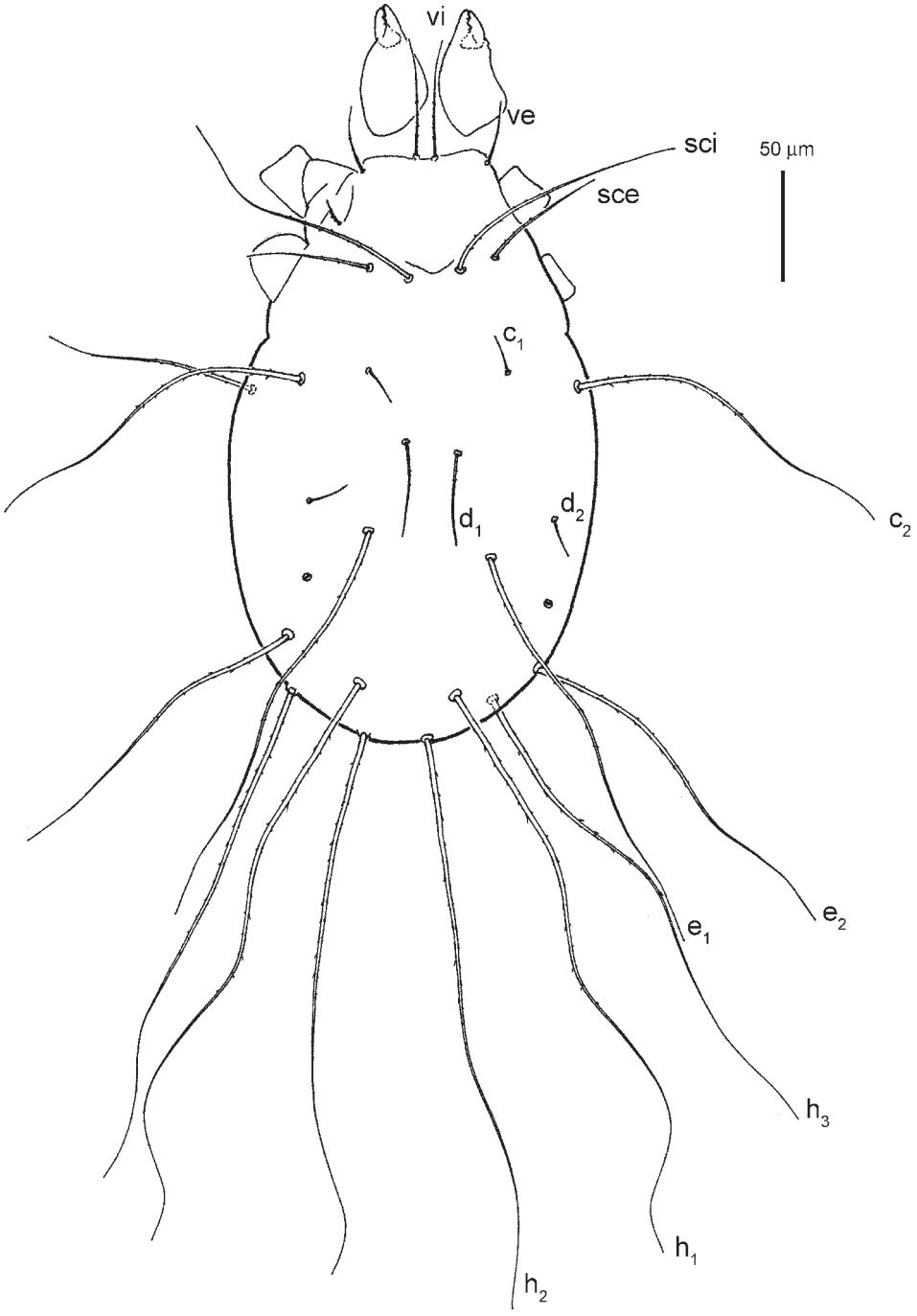


Fig. 73. *Tyrophagus robertsonae* Lynch, 1989 (male). Dorsal view of idiosoma.

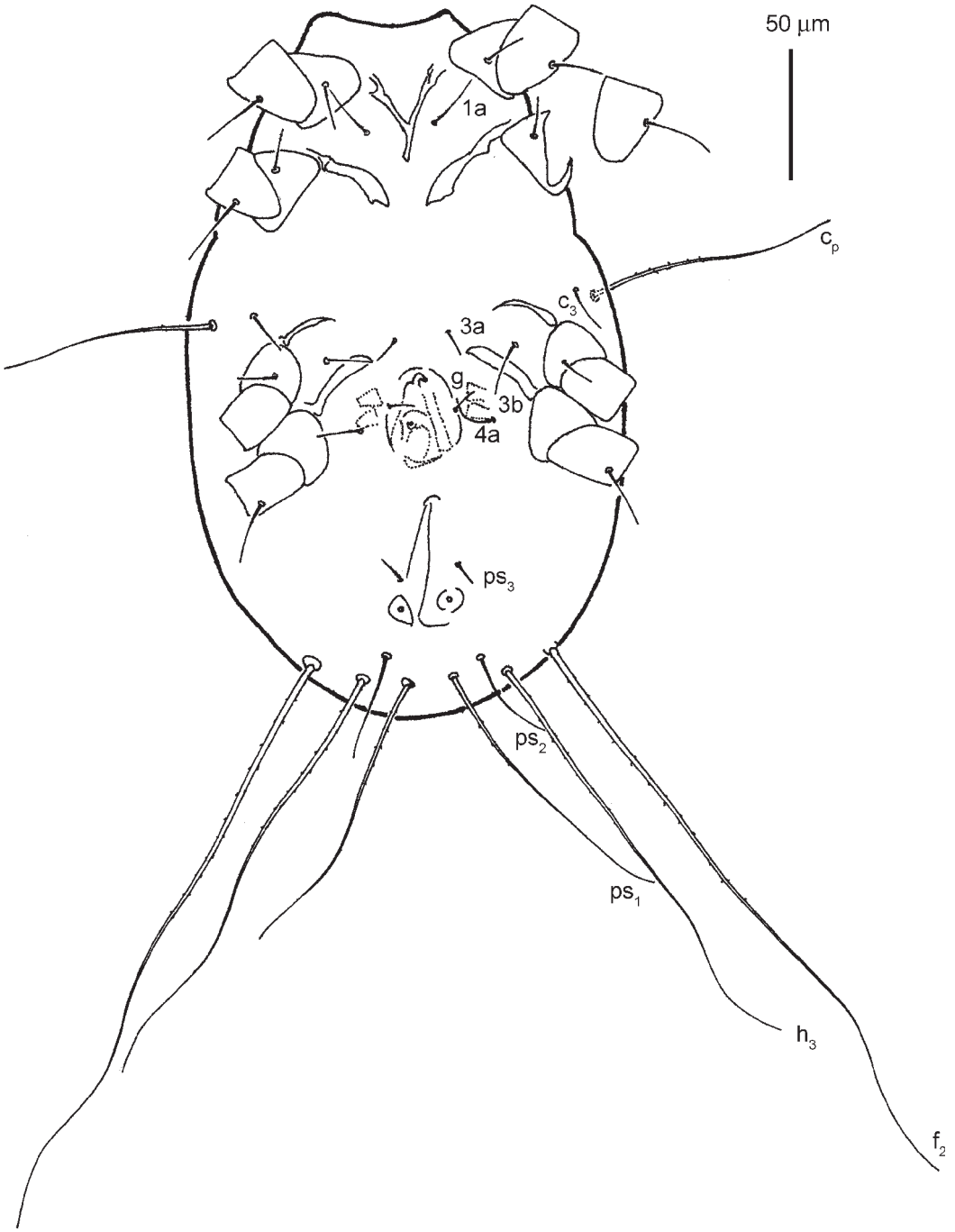


Fig. 74. *Tyrophagus robertsonae* Lynch, 1989 (male). Ventral view of idiosoma.

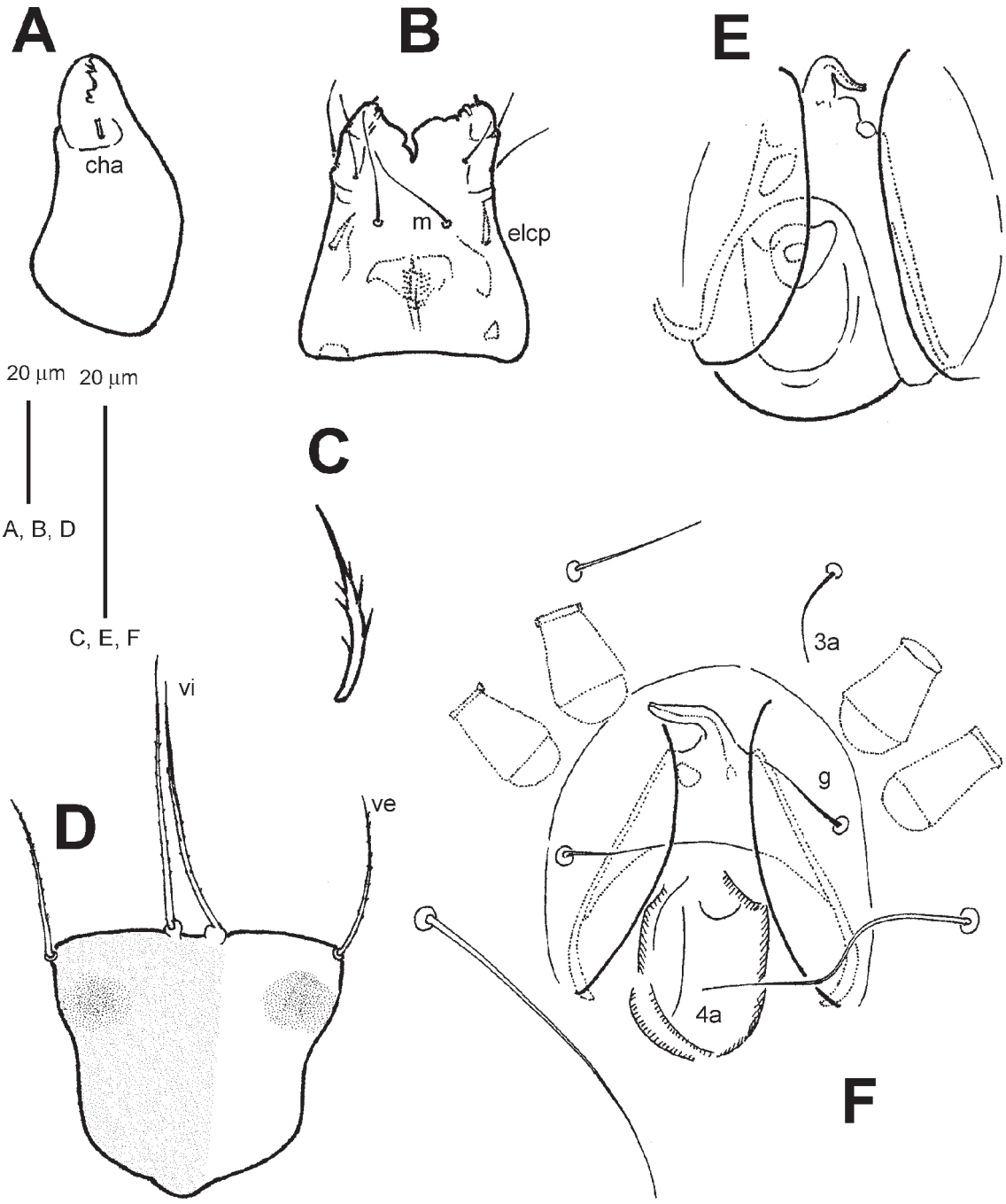


Fig. 75. *Tyrophagus robertsonae* Lynch, 1989 (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, supracoxal seta; D, prodorsal shield; E, genital opening and aedeagus; F, genital opening, aedeagus, and genital papillae.

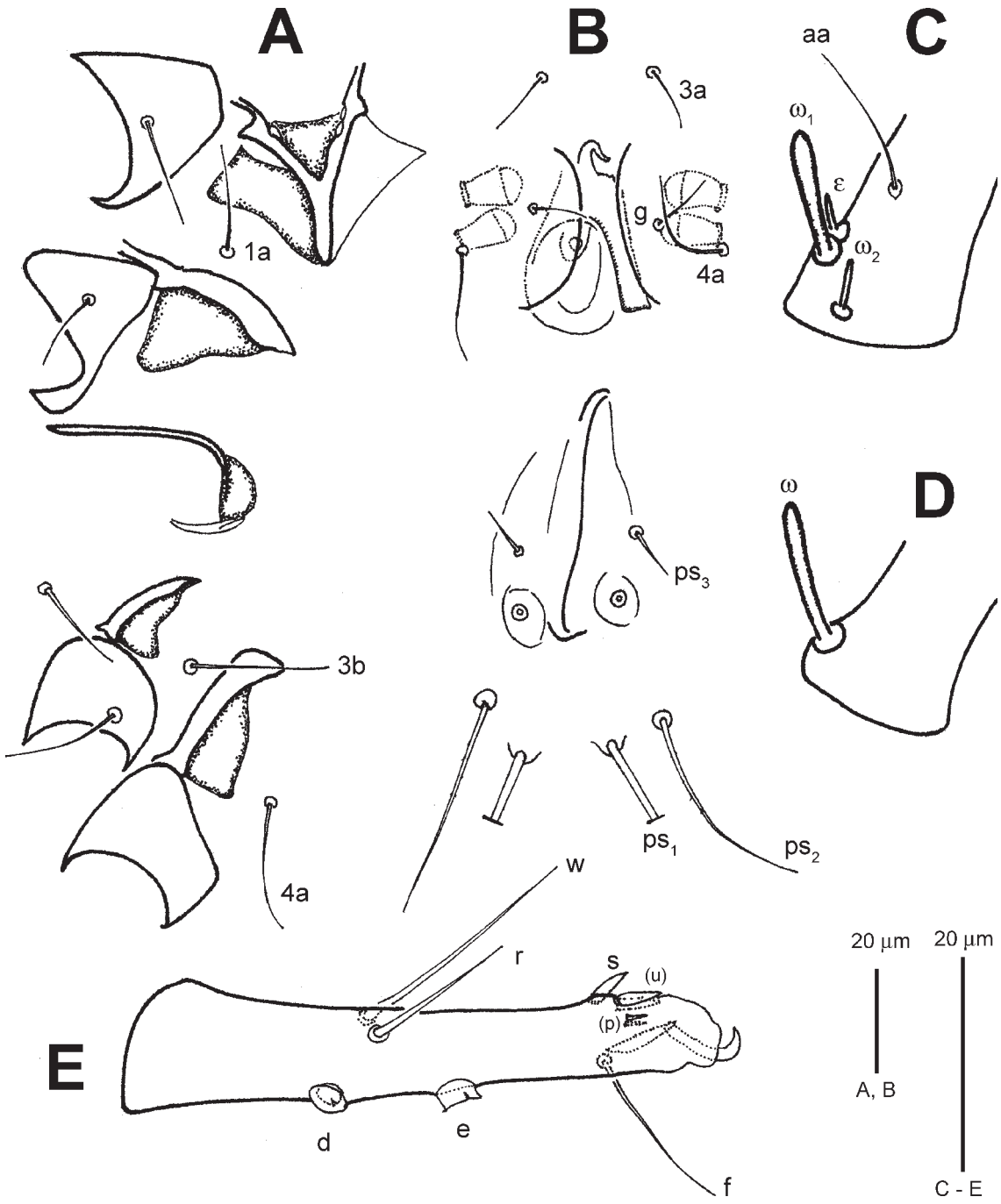


Fig. 76. *Tyrophagus robertsonae* Lynch, 1989 (male). A, coxae I–IV; B, genital opening and anus; C, solenidia, famulus and seta of tarsus I; D, solenidion of tarsus II; E, lateral view of tarsus IV.

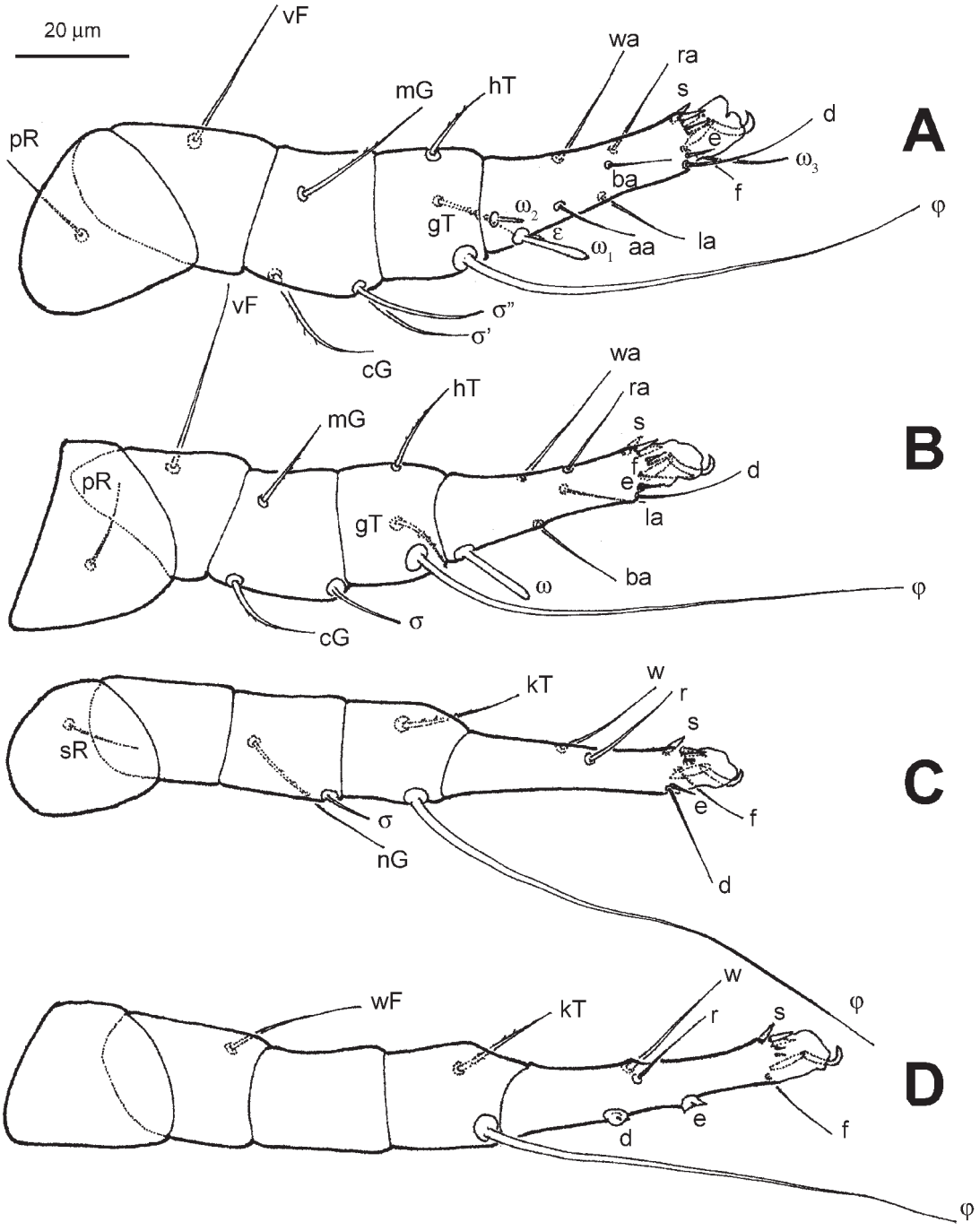


Fig. 77. *Tyrophagus robertsonae* Lynch, 1989 (male). A, leg I; B, leg II; C, leg III; D, leg IV.

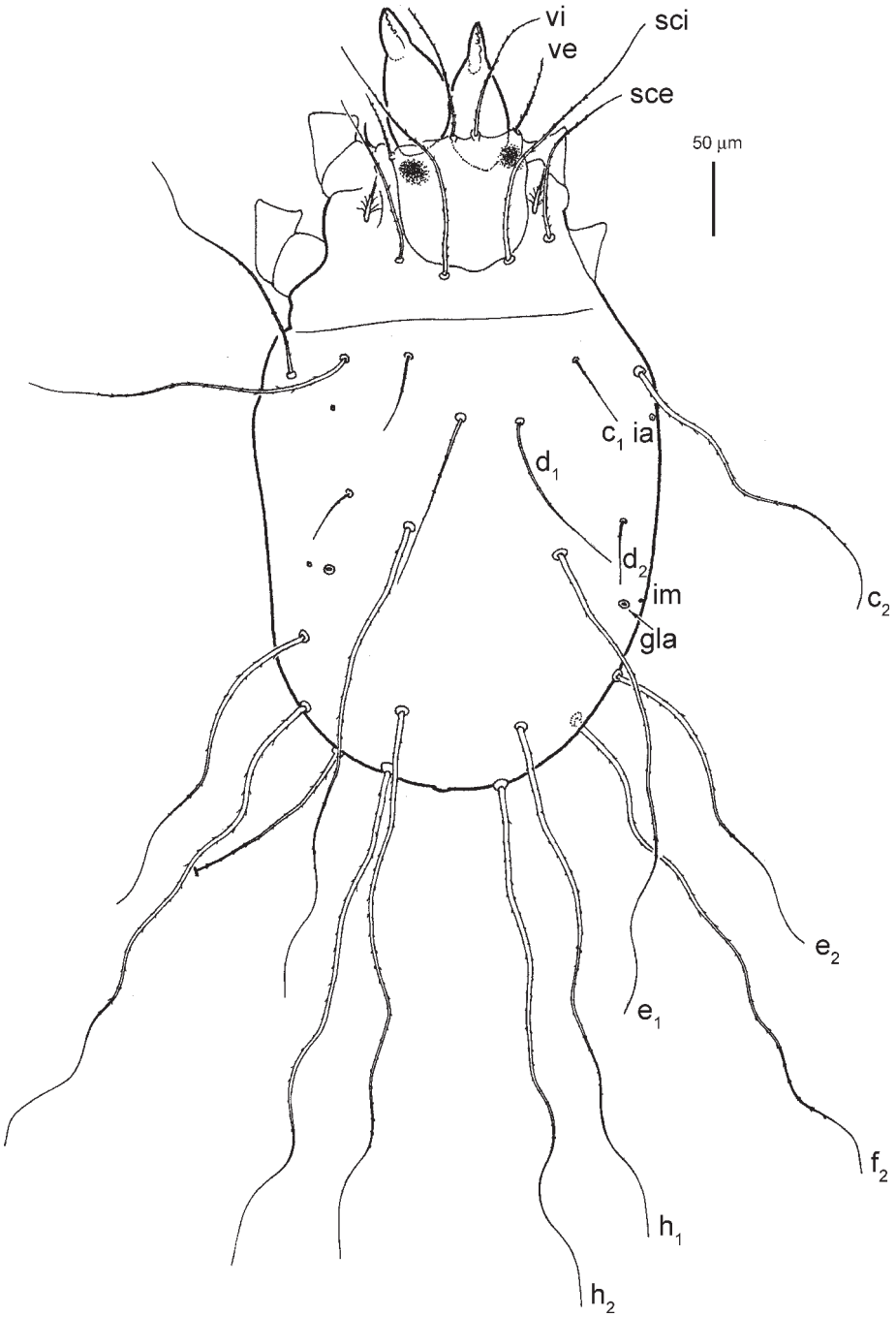


Fig. 78. *Tyrophagus savasi* Lynch, 1989 (female). Dorsal view of idiosoma.

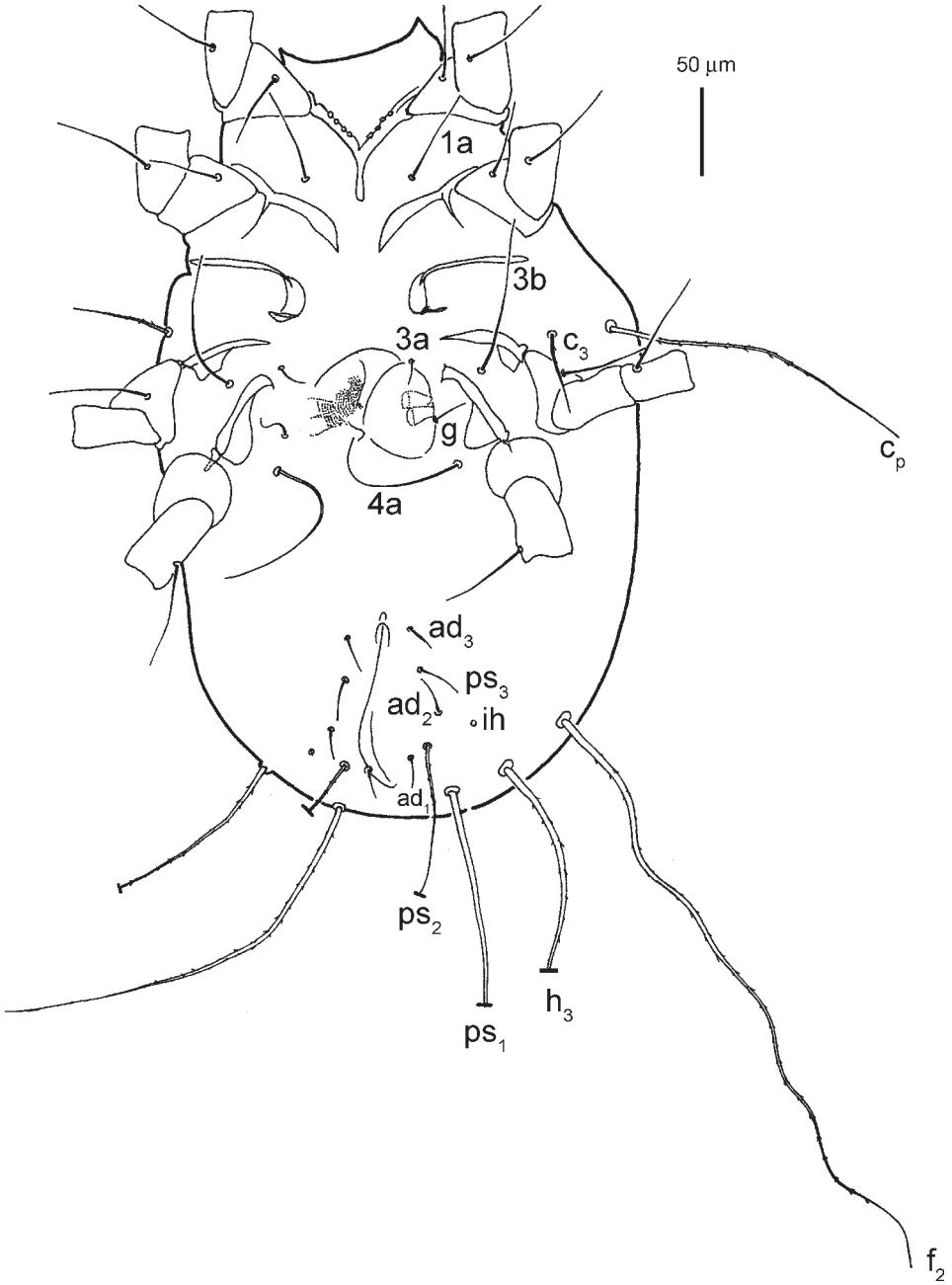


Fig. 79. *Tyrophagus savasi* Lynch, 1989 (female). Ventral view of idiosoma.

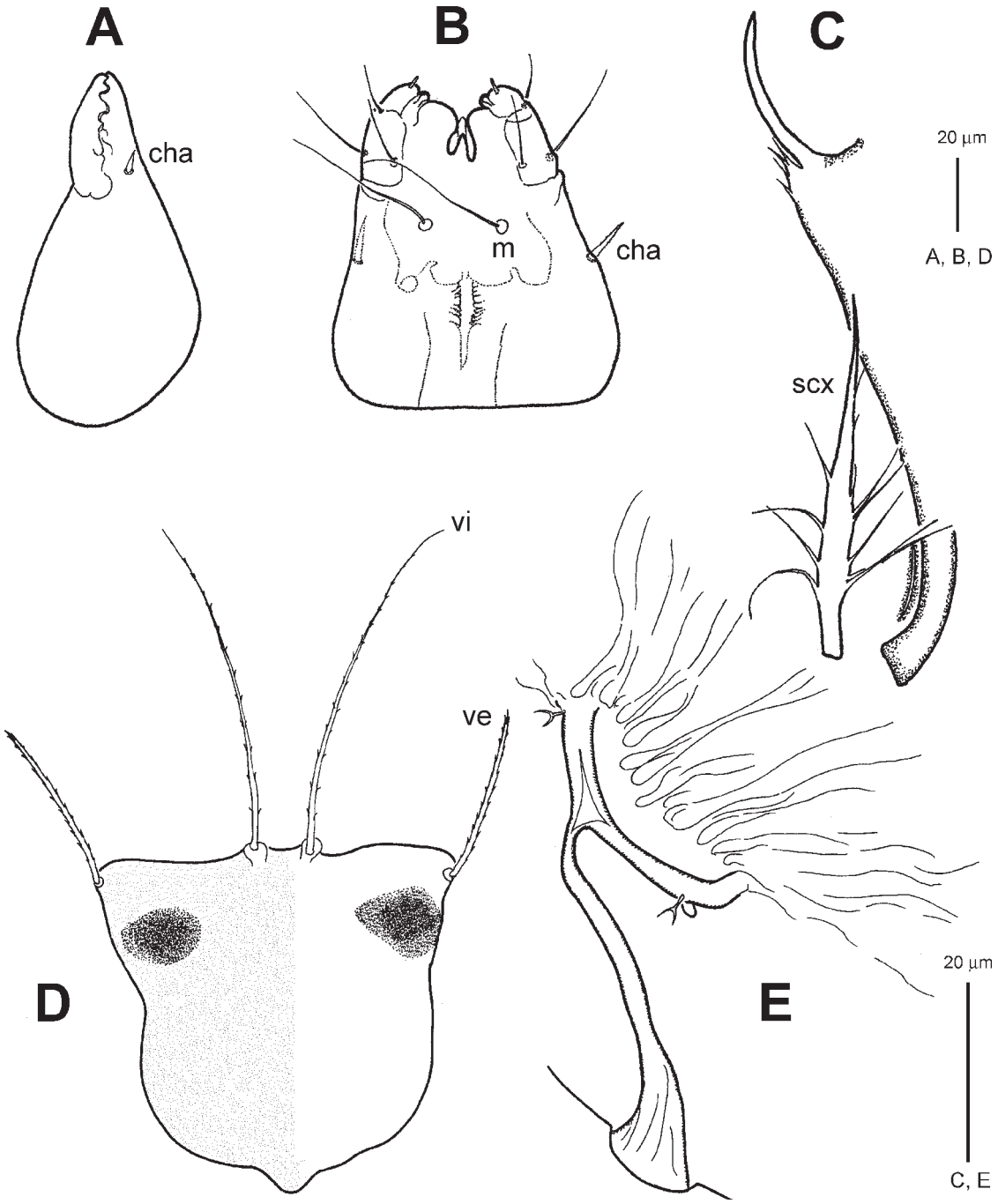


Fig. 80. *Tyrophagus savasi* Lynch, 1989 (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, lateral sclerite and supracoxal seta; D, prodorsal shield; E, copulatory opening and spermatheca.

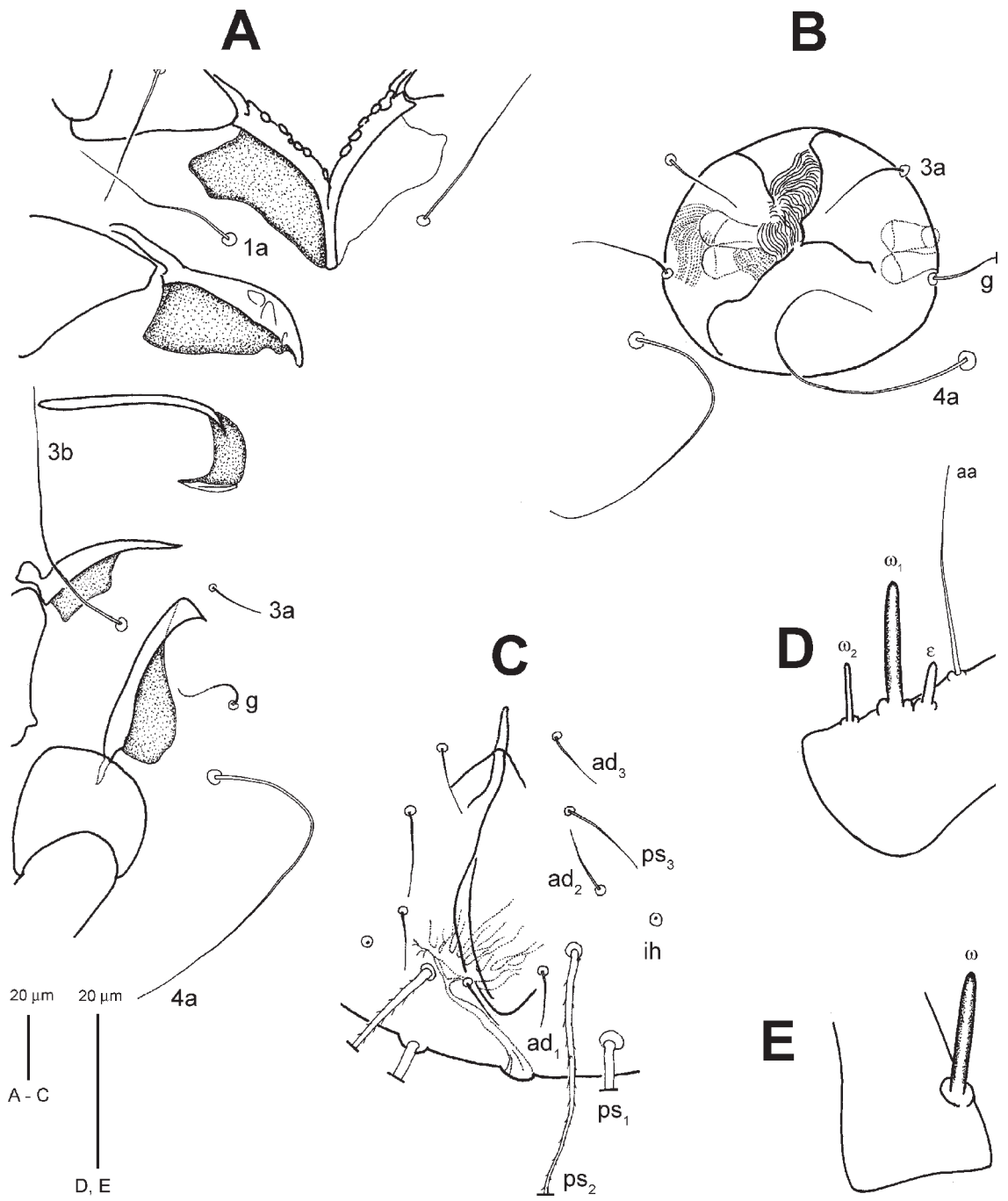


Fig. 81. *Tyrophagus savasi* Lynch, 1989 (female). A, coxae I–IV; B, genital opening; C, anus; D, solenidia, famulus, and seta of tarsus I; E, solenidion of tarsus II.

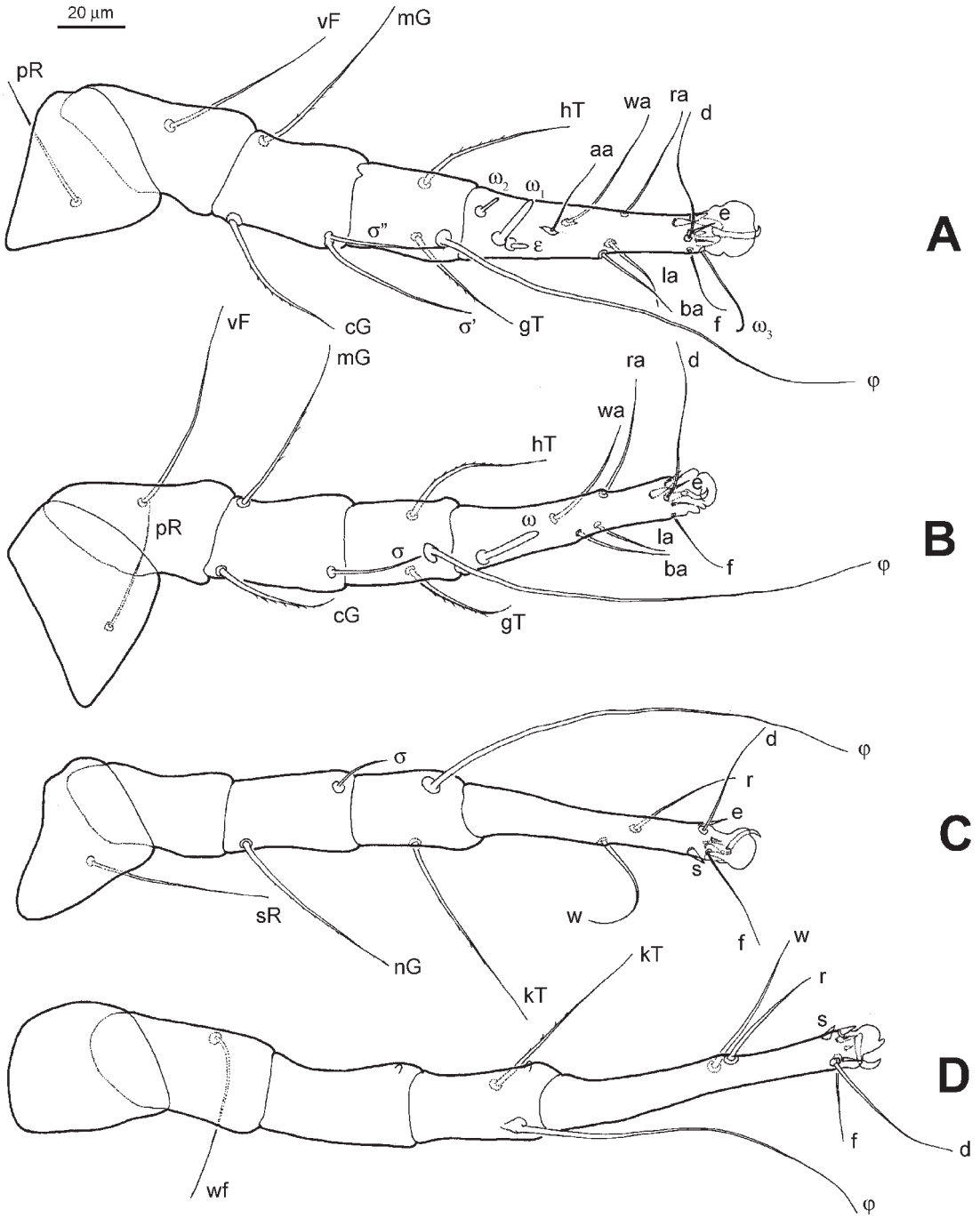


Fig. 82. *Tyrophagus savasi* Lynch, 1989 (female). A, leg I; B, leg II; C, leg III; D, leg IV.

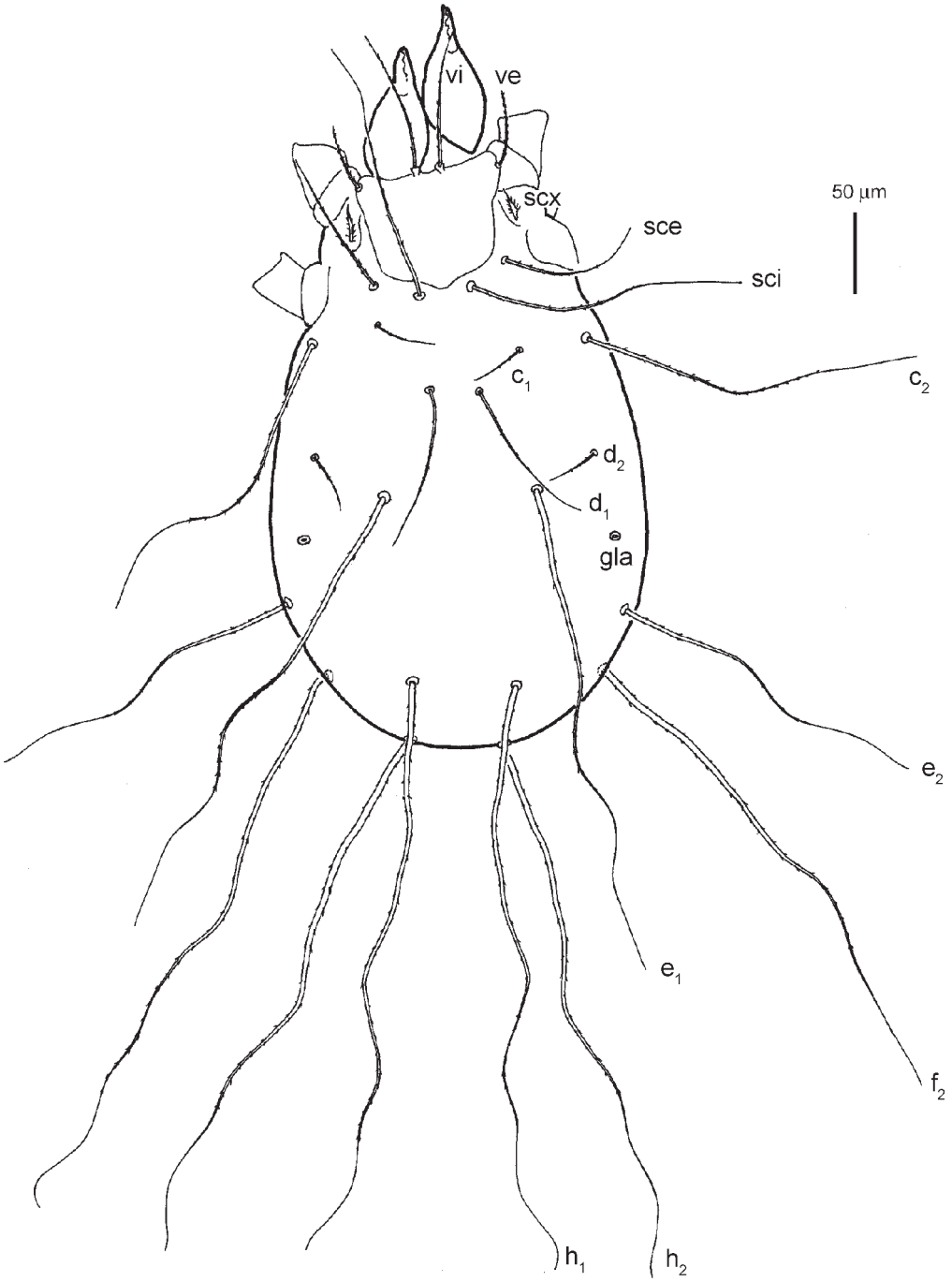


Fig. 83. *Tyrophagus savasi* Lynch, 1989 (male). Dorsal view of idiosoma.

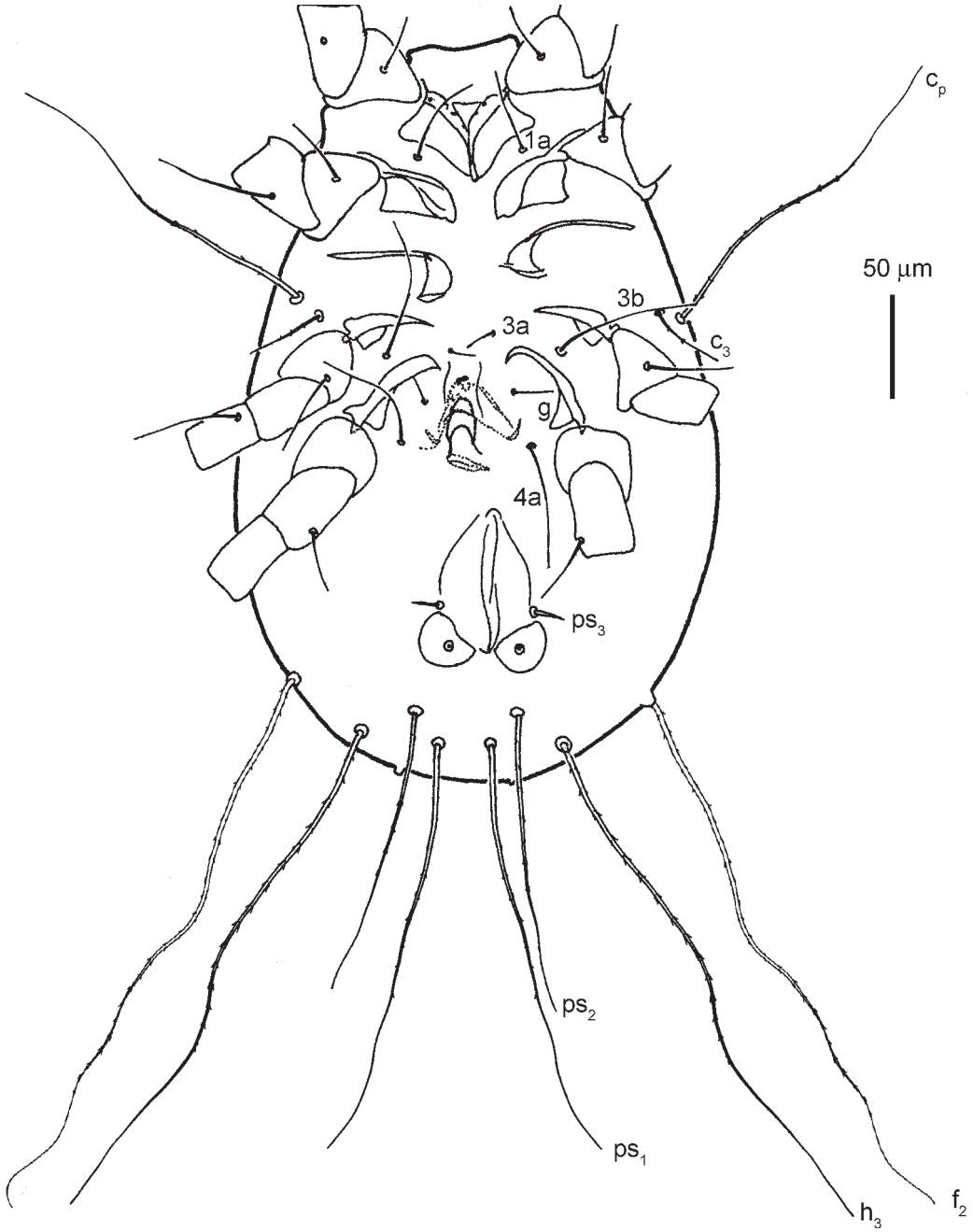


Fig. 84. *Tyrophagus savasi* Lynch, 1989 (male). Ventral view of idiosoma.

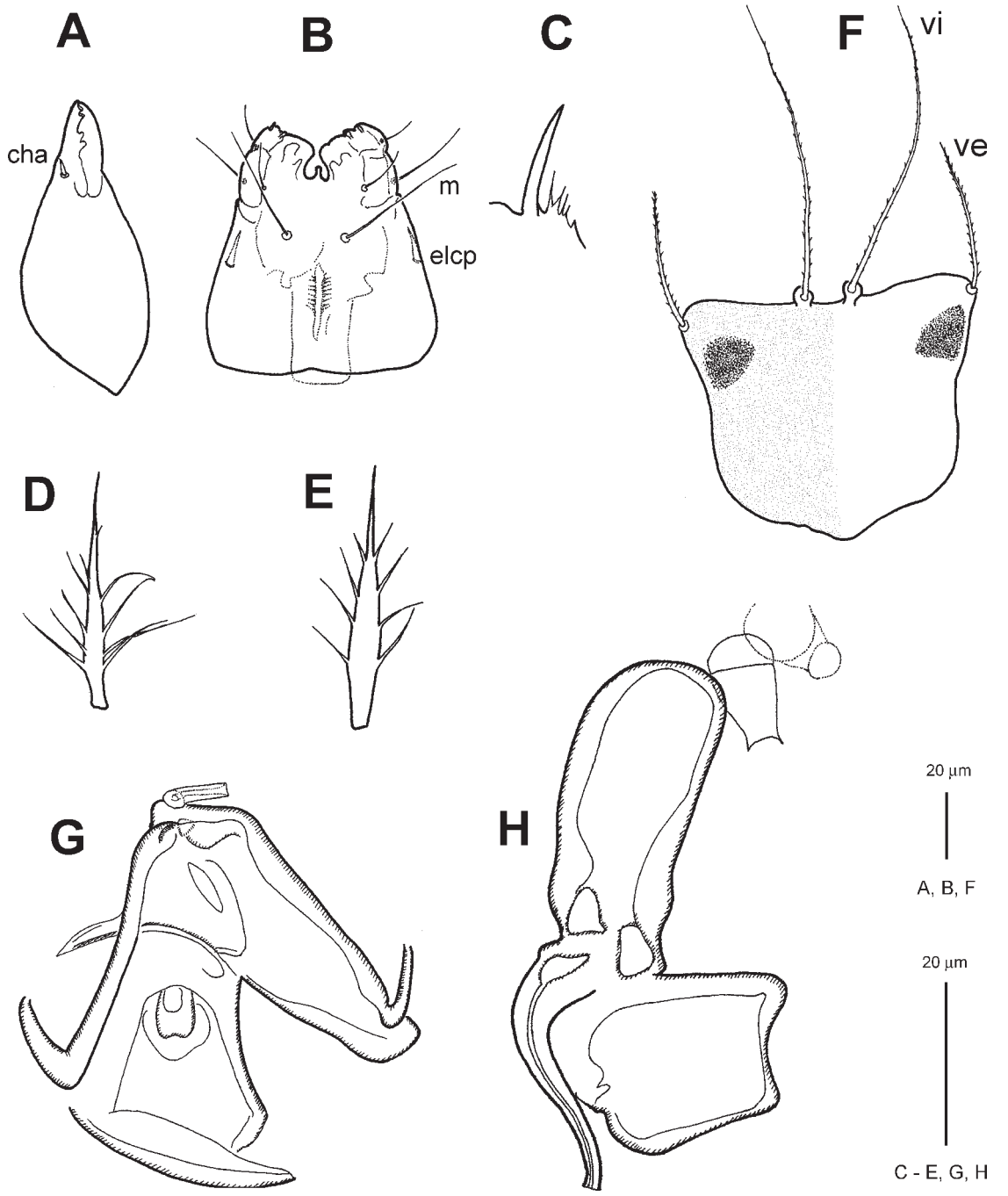


Fig. 85. *Tyrophagus savasi* Lynch, 1989 (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, supracoxal seta; F, prodorsal shield; G, ventral view of aedeagus; H, lateral view of aedeagus.

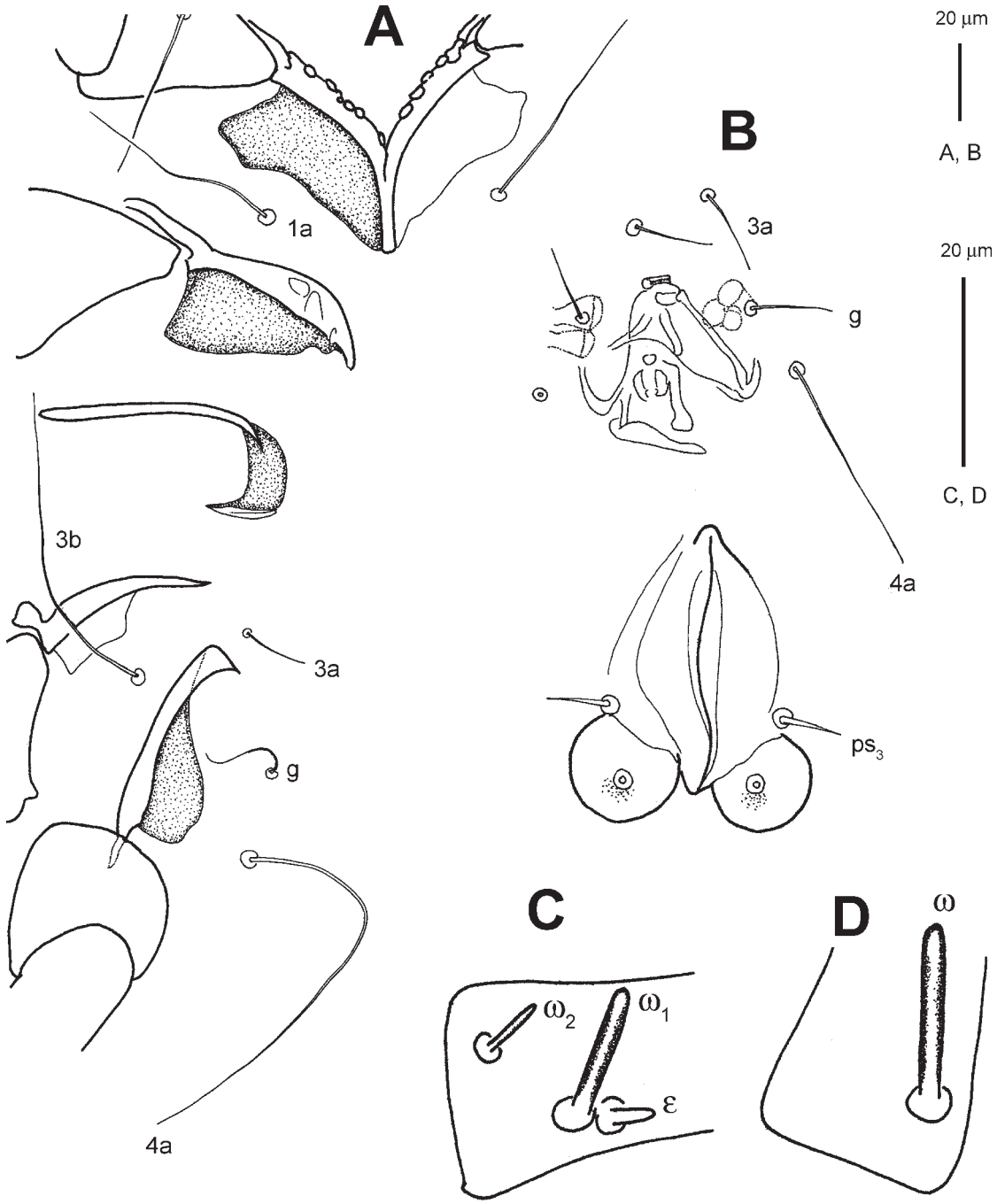


Fig. 86. *Tyrophagus savasi* Lynch, 1989 (male). A, coxae I–IV; B, genital opening and anus; C, solenidia and famulus of tarsus I; D, solenidion of tarsus II.

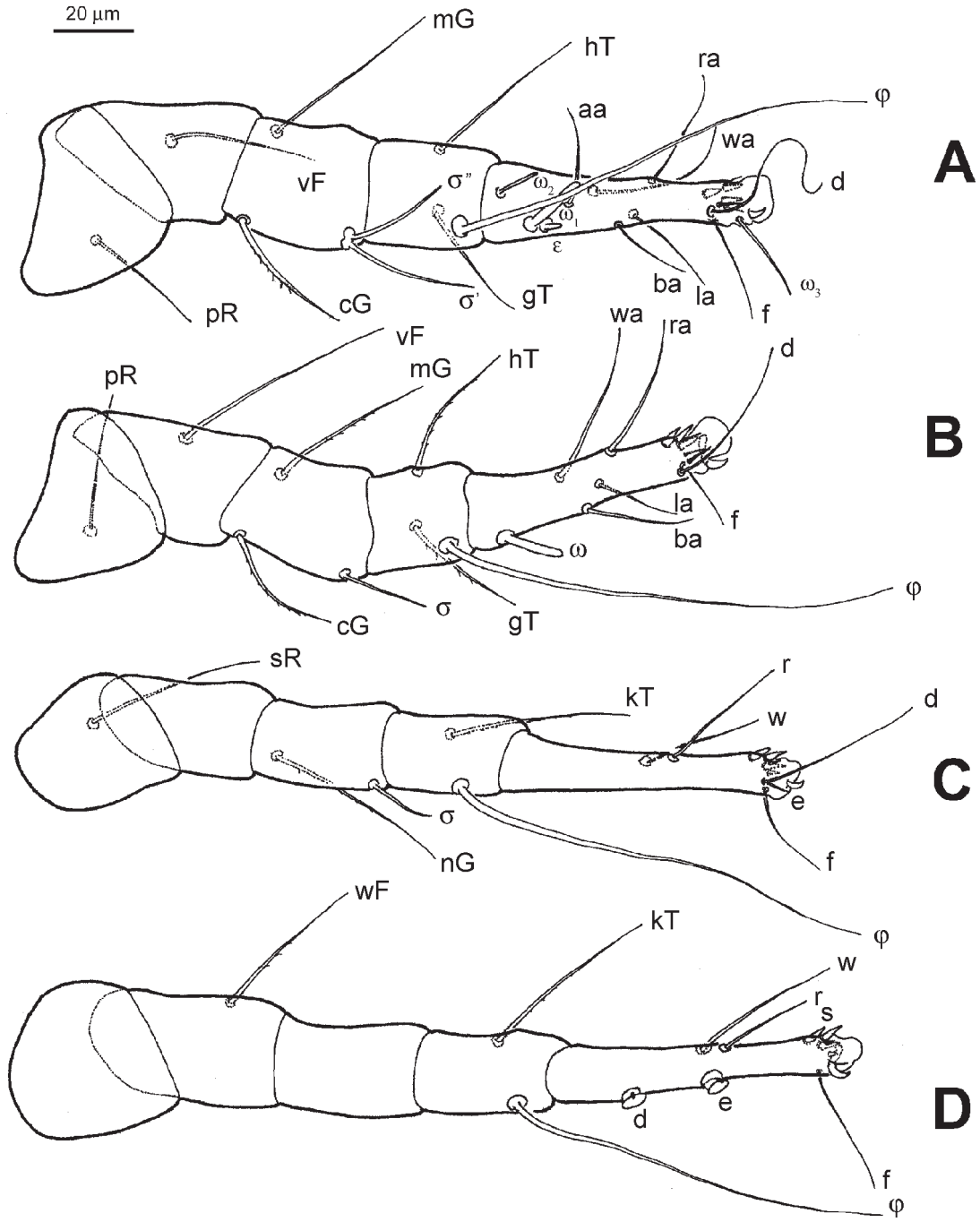


Fig. 87. *Tyrophagus savasi* Lynch, 1989 (male). A, leg I; B, leg II; C, leg III; D, leg IV.

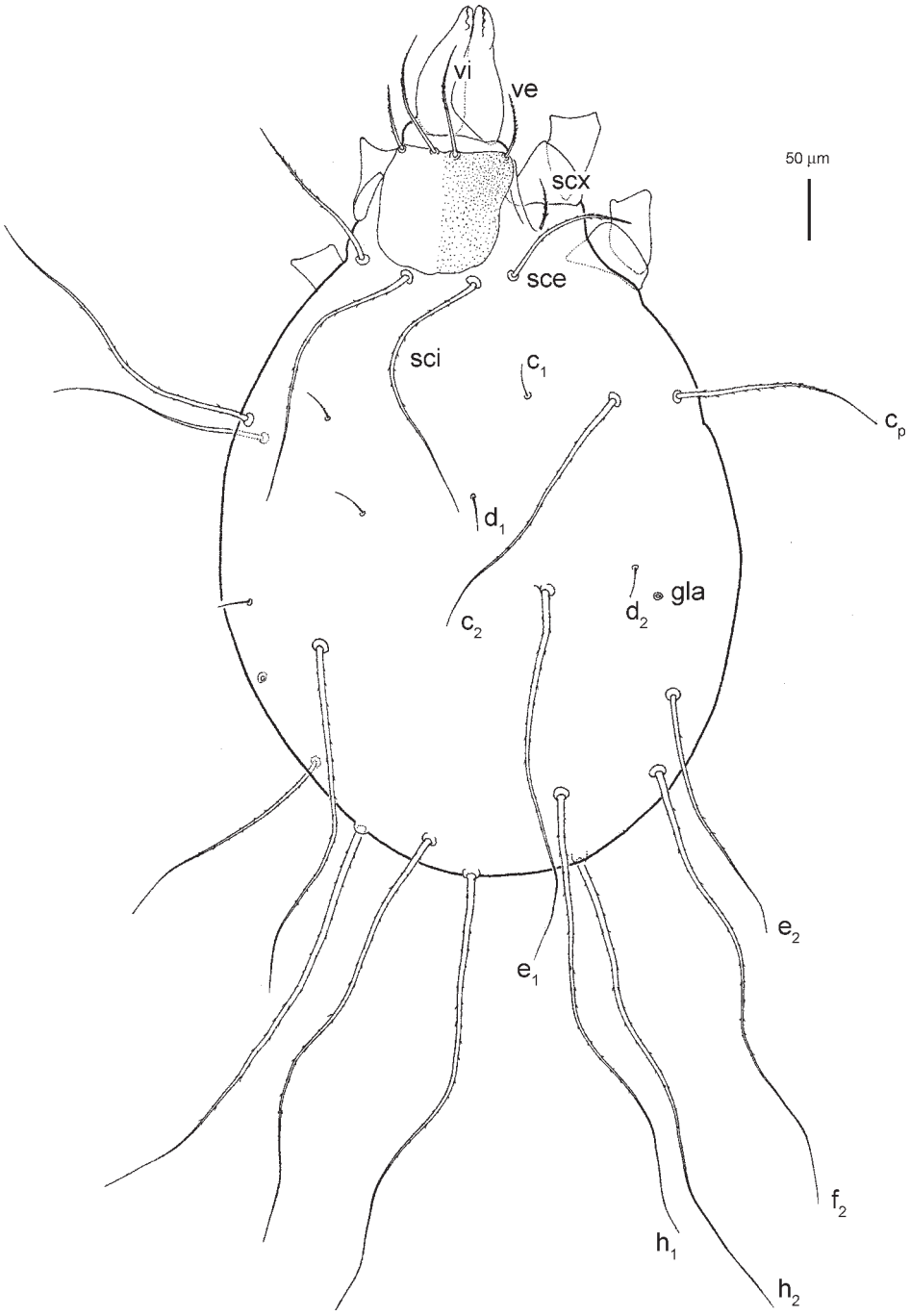


Fig. 88. *Tyrophagus similis* Volgin, 1949 (female). Dorsal view of idiosoma.

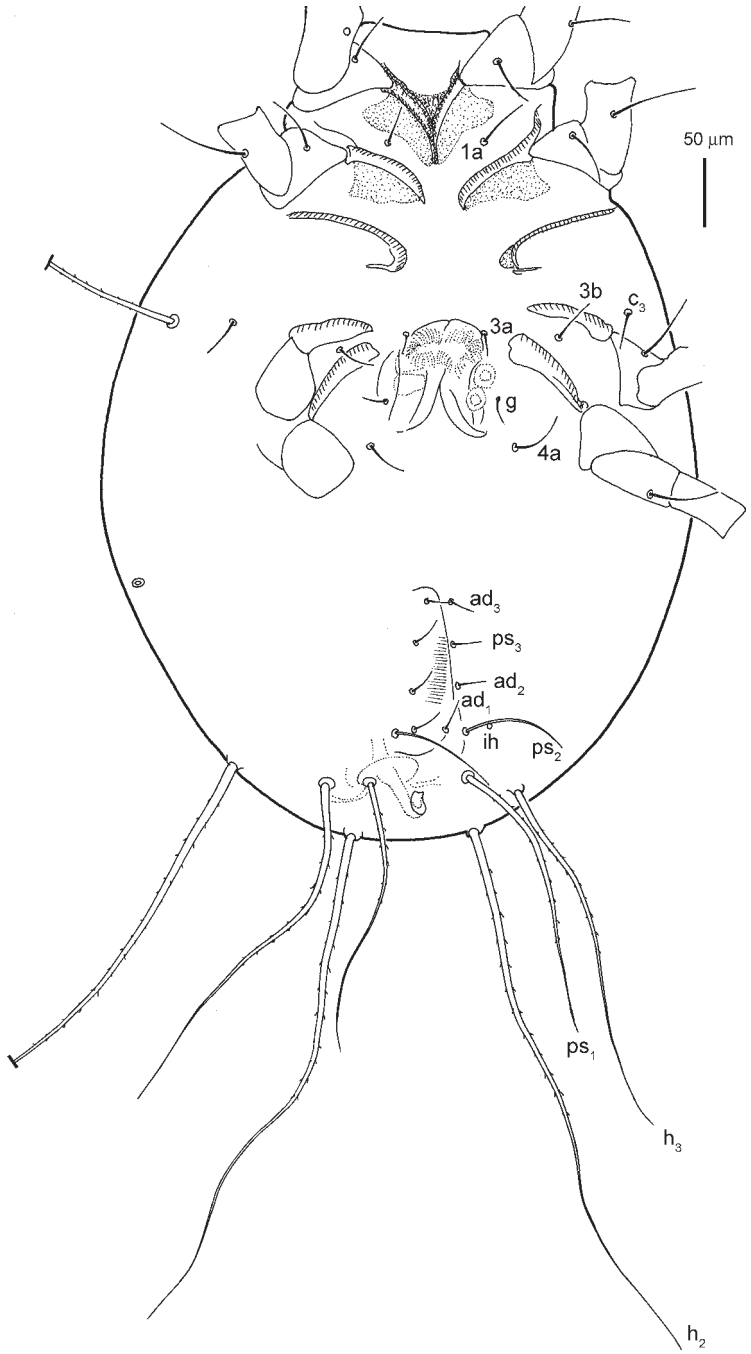


Fig. 89. *Tyrophagus similis* Volgin, 1949 (female). Ventral view of idiosoma.

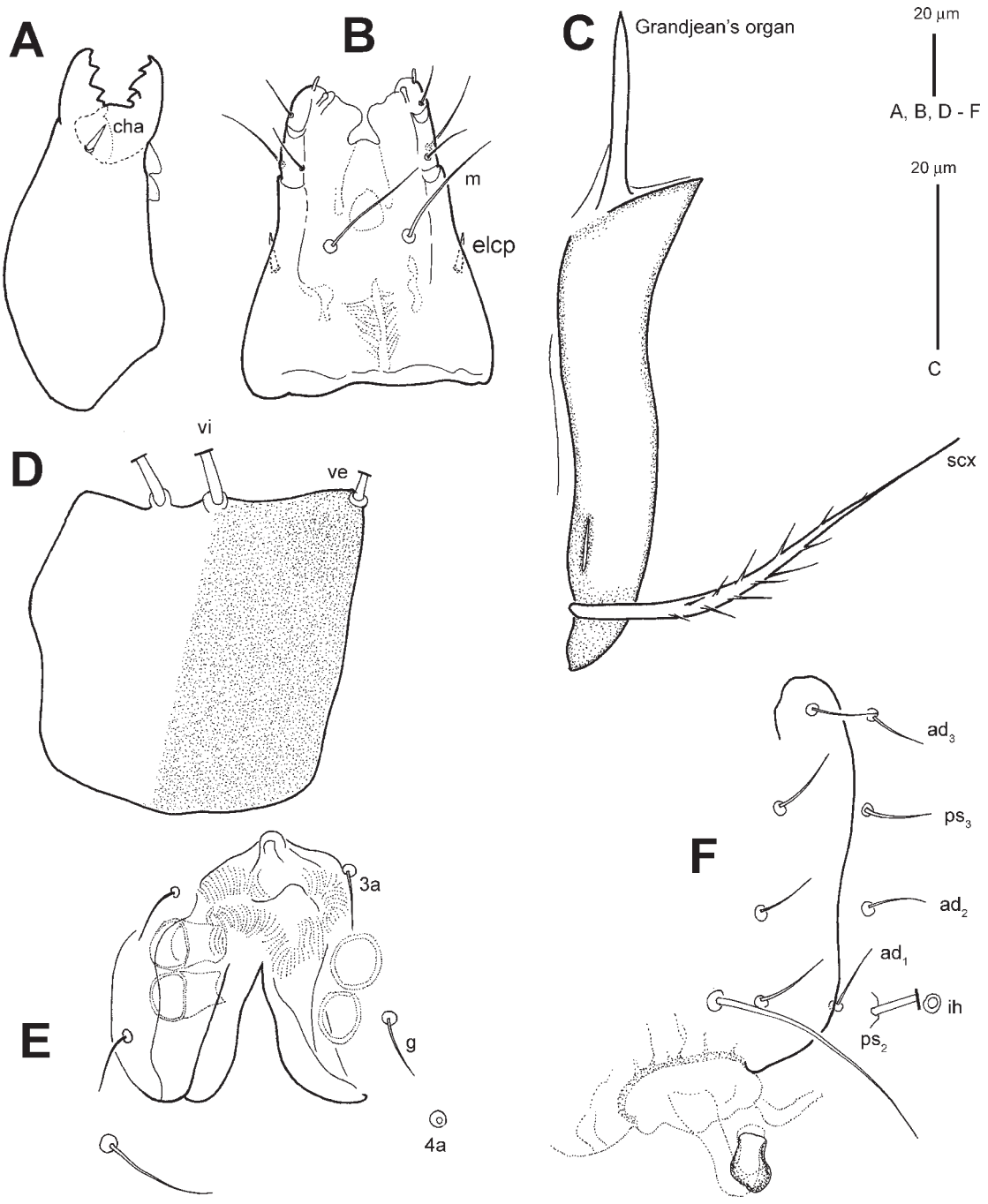


Fig. 90. *Tyrophagus similis* Volgin, 1949 (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, lateral sclerite and supracoxal seta; D, prodorsal shield; E, genital opening; F, anus.

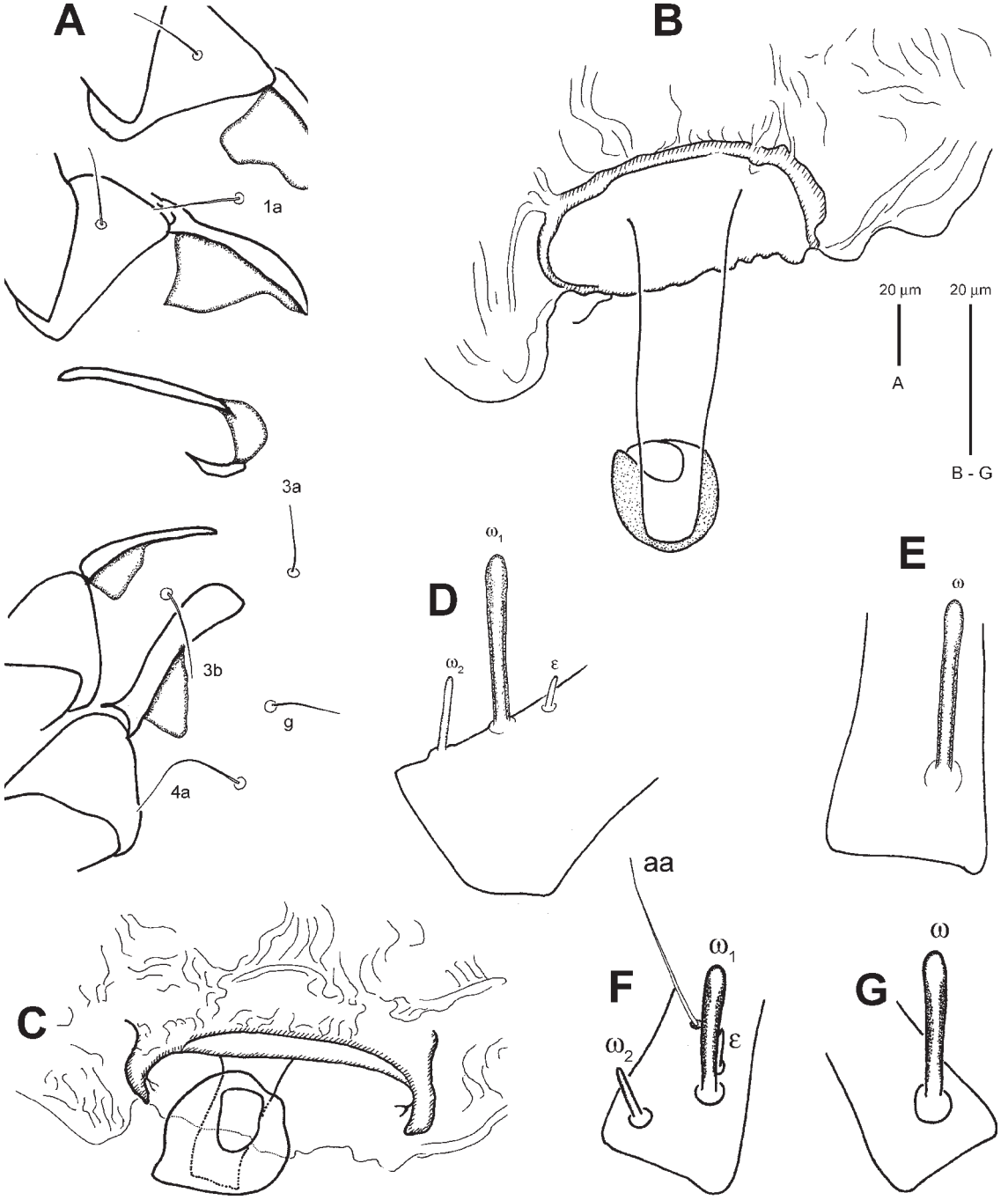


Fig. 91. *Tyrophagus similis* Volgin, 1949 (female). A, coxae I–IV; B, copulatory opening and spermatheca; C, copulatory opening and folded spermatheca; D, solenidia and famulus of tarsus I; E, solenidion of tarsus II; F, solenidia, famulus, and seta of tarsus I; G, solenidion of tarsus II.

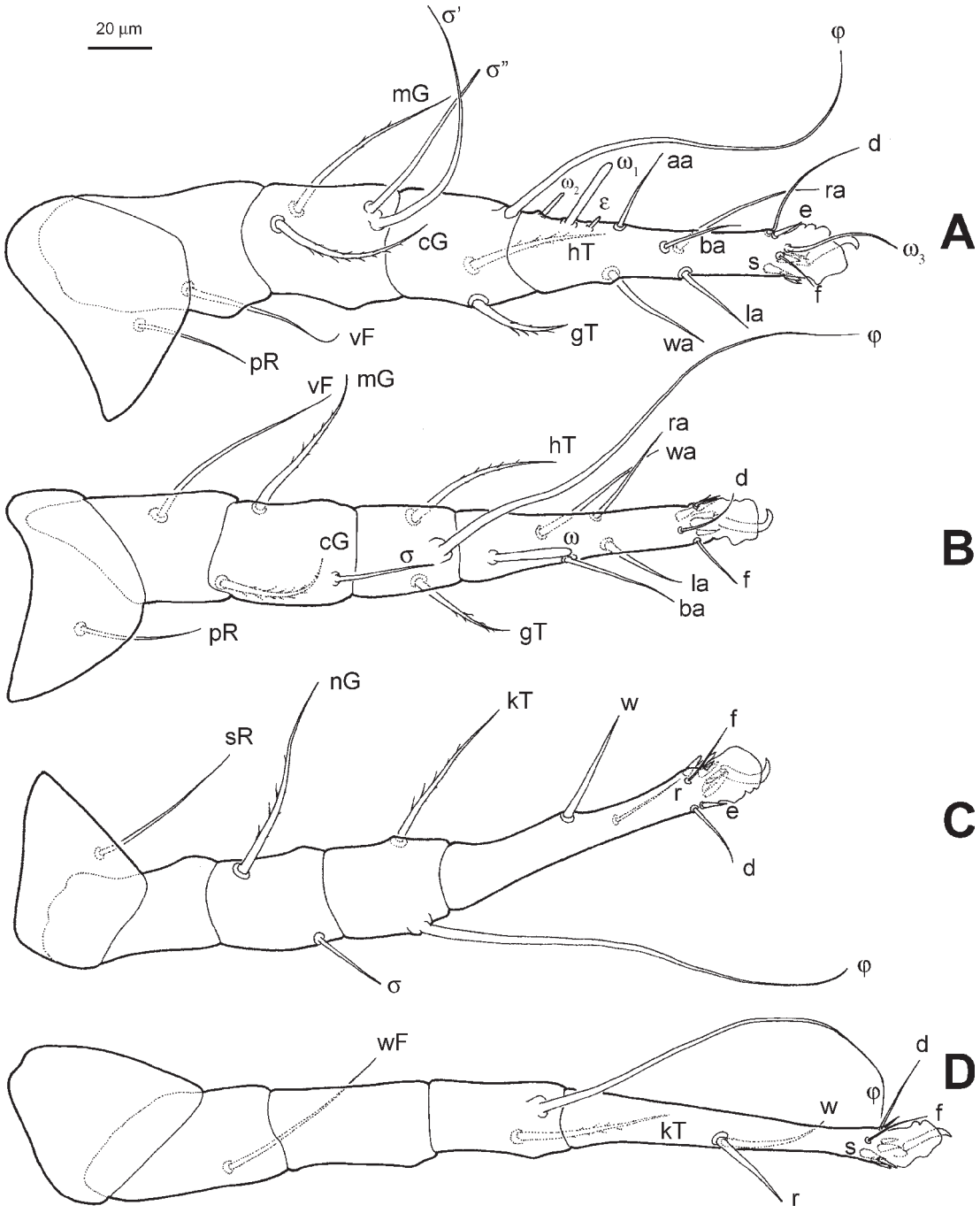


Fig. 92. *Tyrophagus similis* Volgin, 1949 (female). A, leg I; B, leg II; C, leg III; D, leg IV.

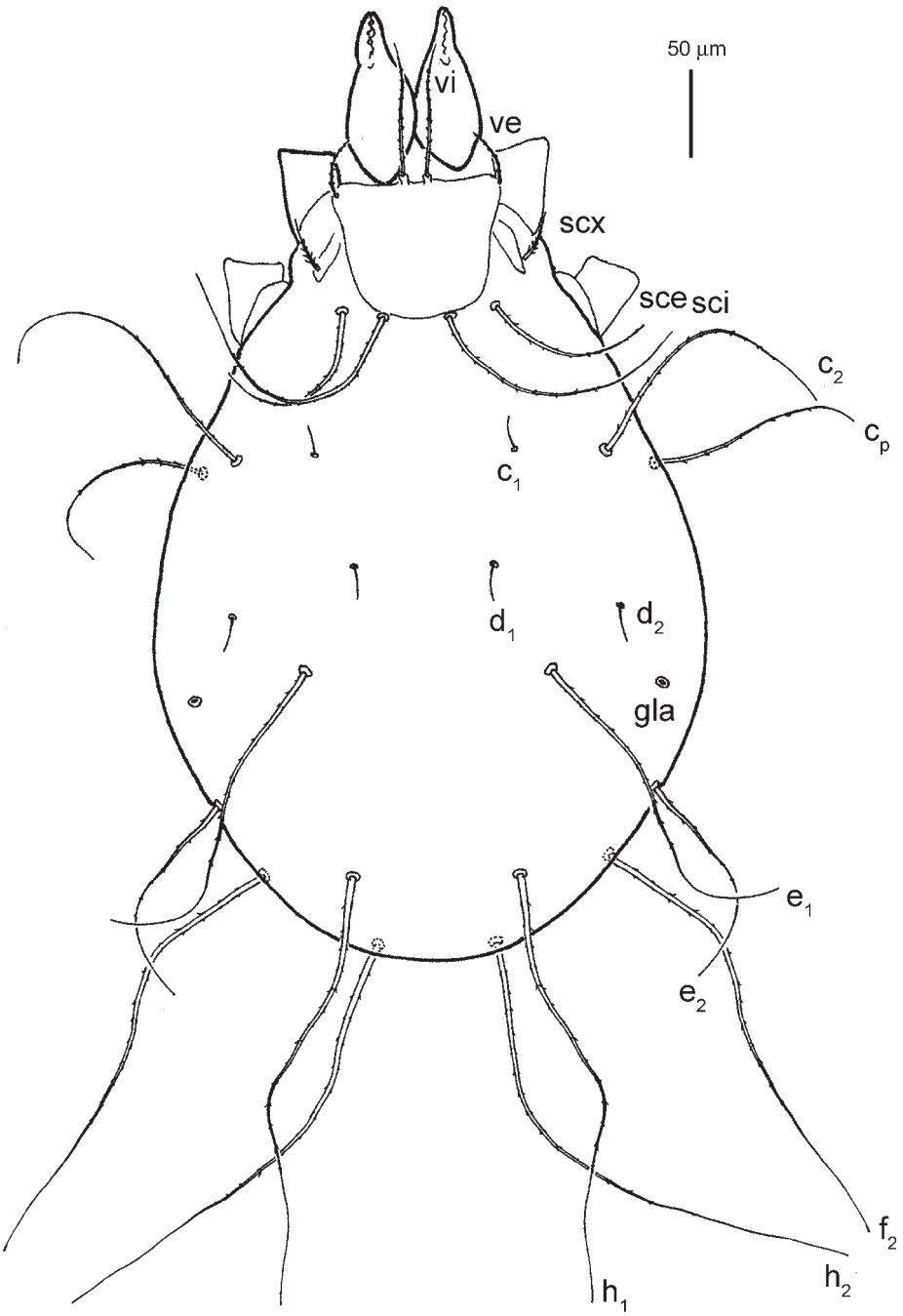


Fig. 93. *Tyrophagus similis* Volgin, 1949 (male). Dorsal view of idiosoma.

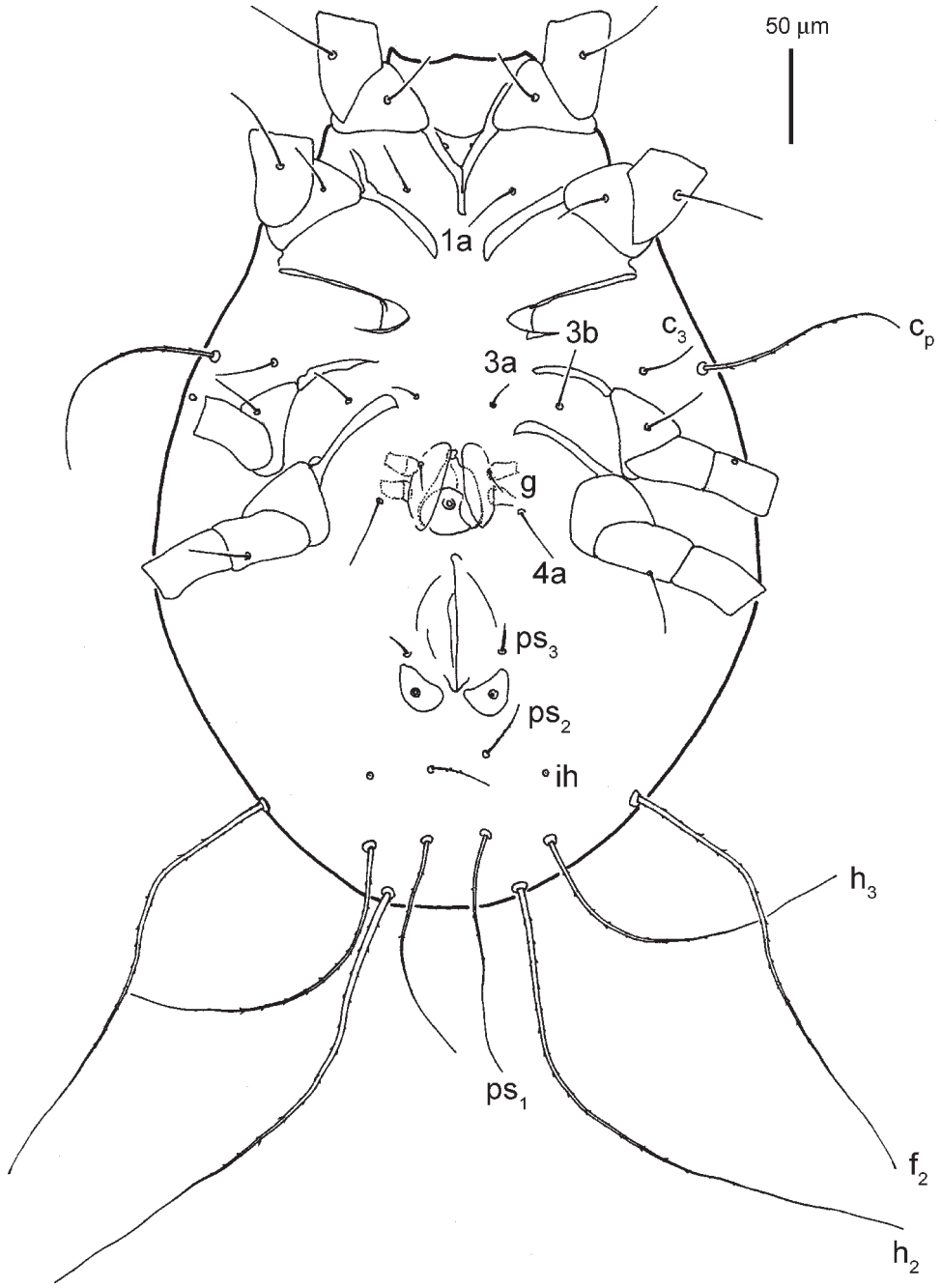


Fig. 94. *Tyrophagus similis* Volgin, 1949 (male). Ventral view of idiosoma.

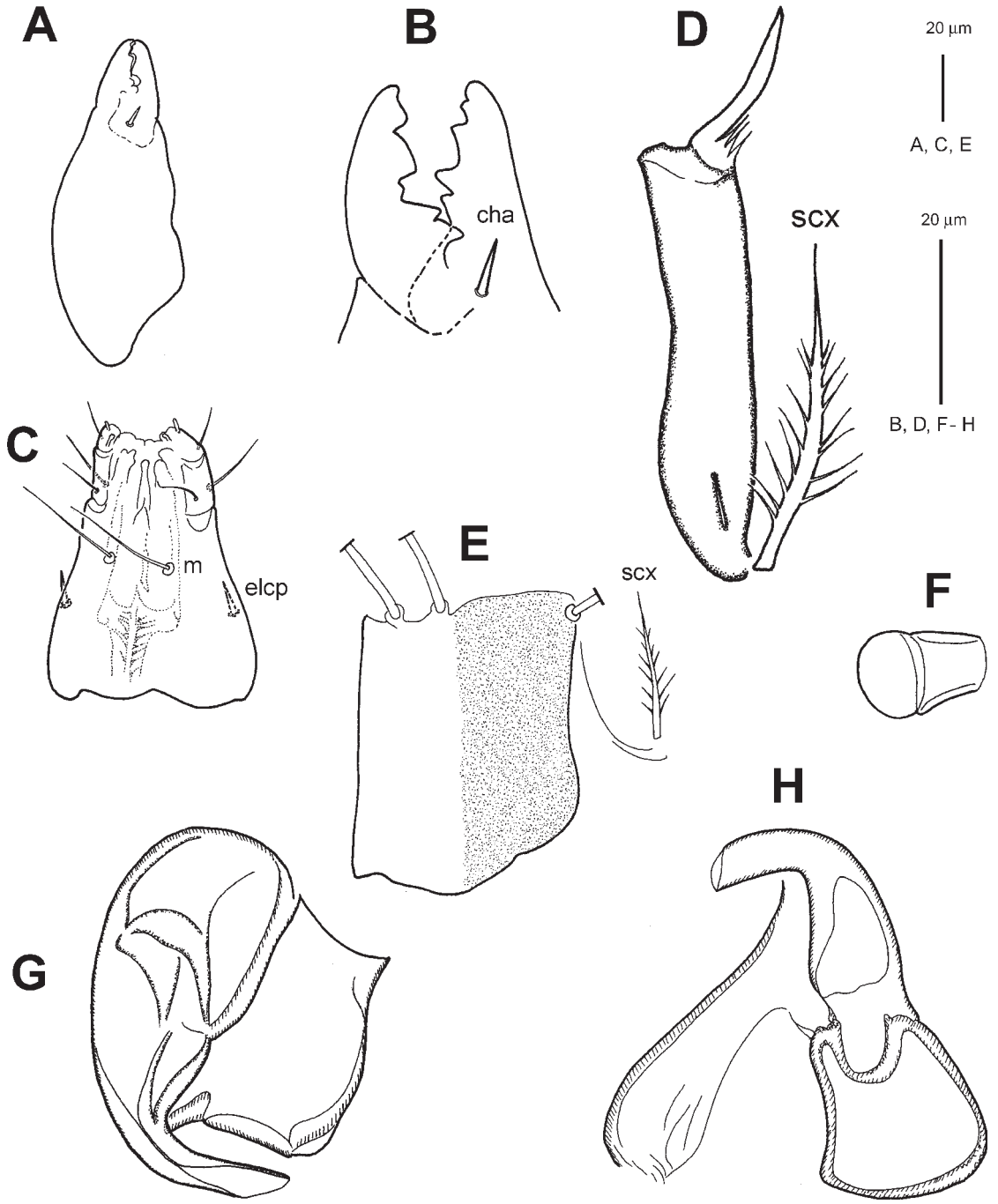


Fig. 95. *Tyrophagus similis* Volgin, 1949 (male). A, ventral view of chelicera; B, detail view of cheliceral digits; C, ventral view of subcapitulum; D, lateral sclerite and supracoxal seta; E, prodorsal shield and supracoxal seta; F, genital papilla; G, lateral view of aedeagus; H, lateral view of aedeagus.

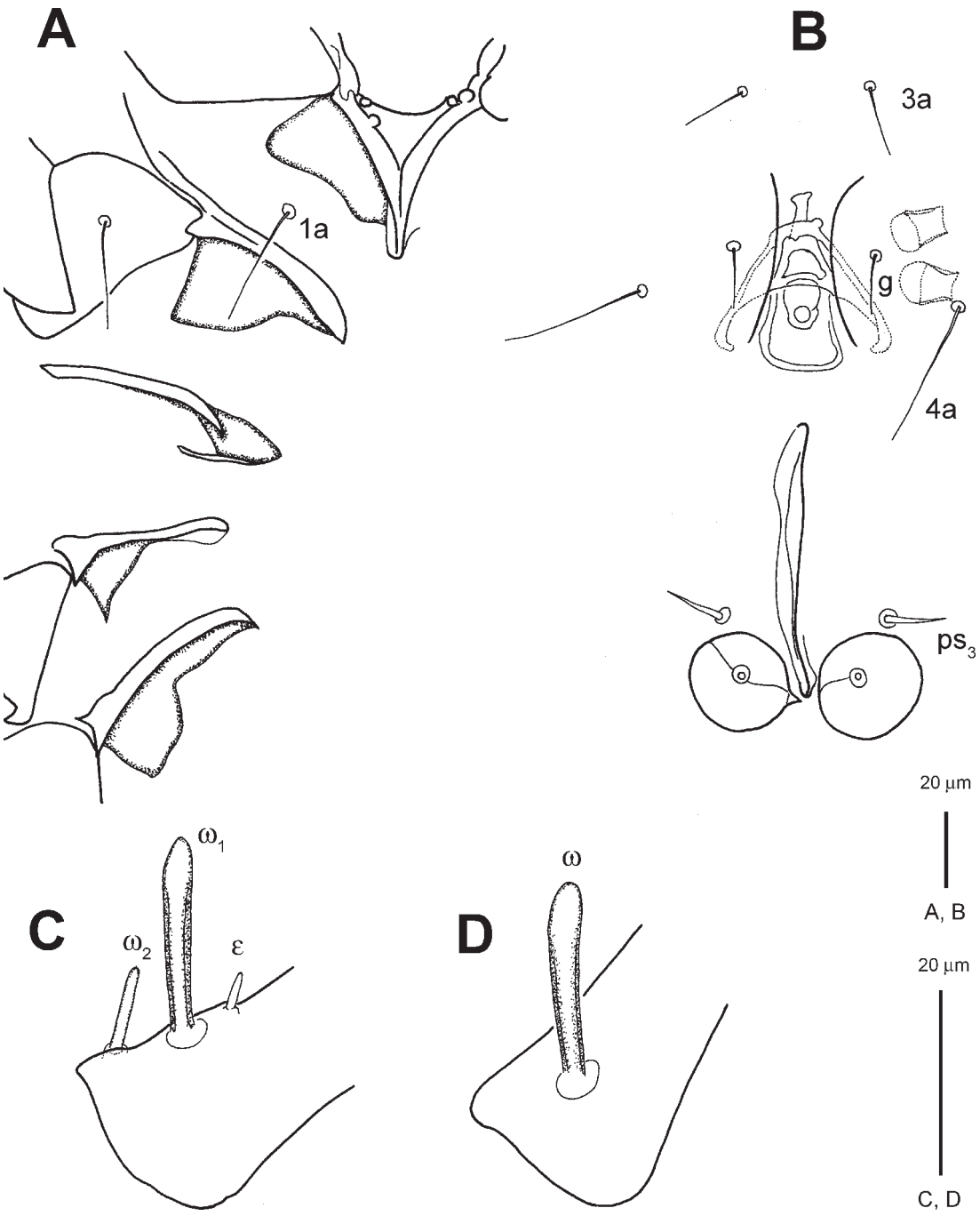


Fig. 96. *Tyrophagus similis* Volgin, 1949 (male). A, coxae I–IV; B, genital opening and anus; C, solenidia and famulus of tarsus I; D, solenidion of tarsus II.

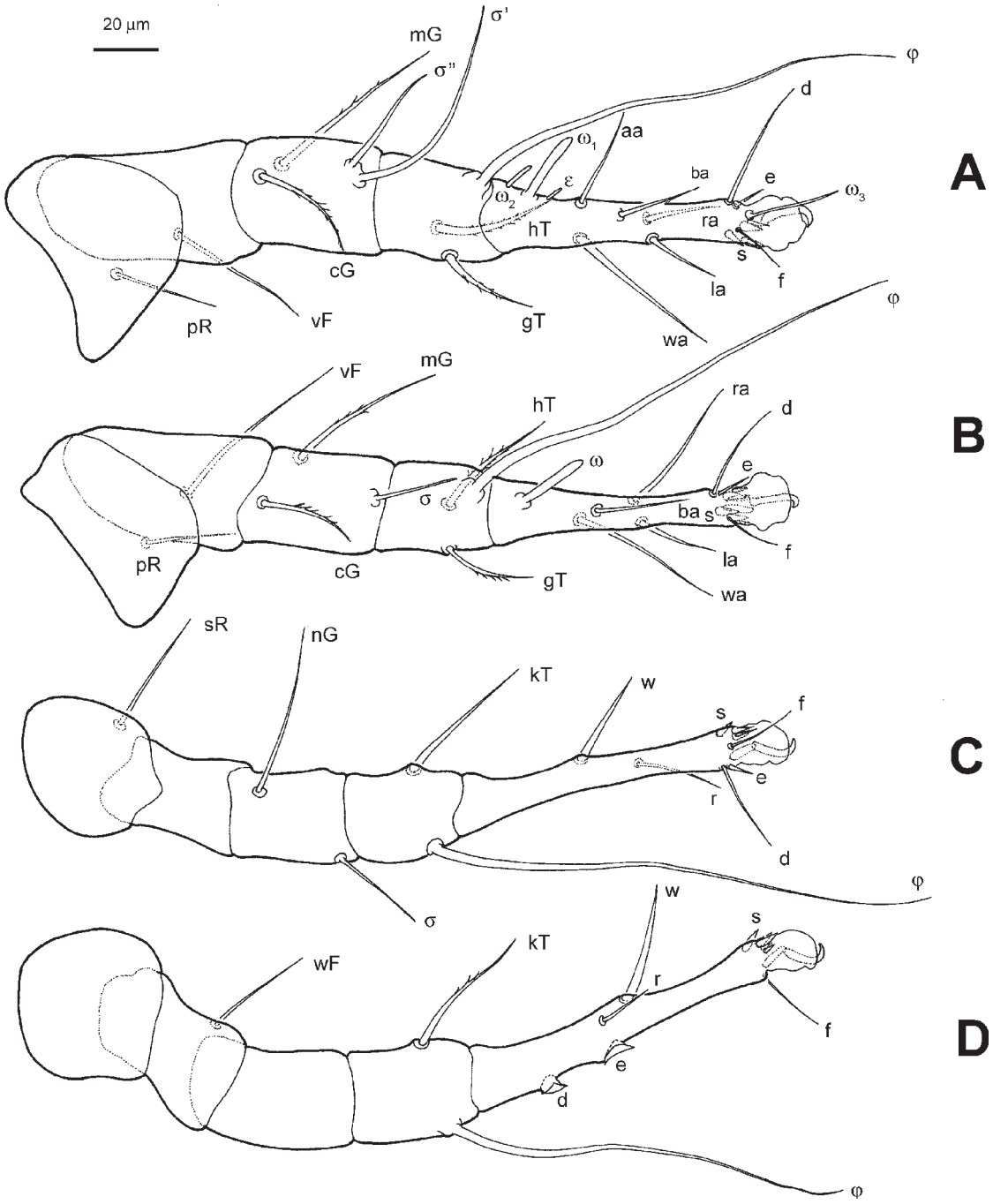


Fig. 97. *Tyrophagus similis* Volgin, 1949 (male). A, leg I; B, leg II; C, leg III; D, leg IV.

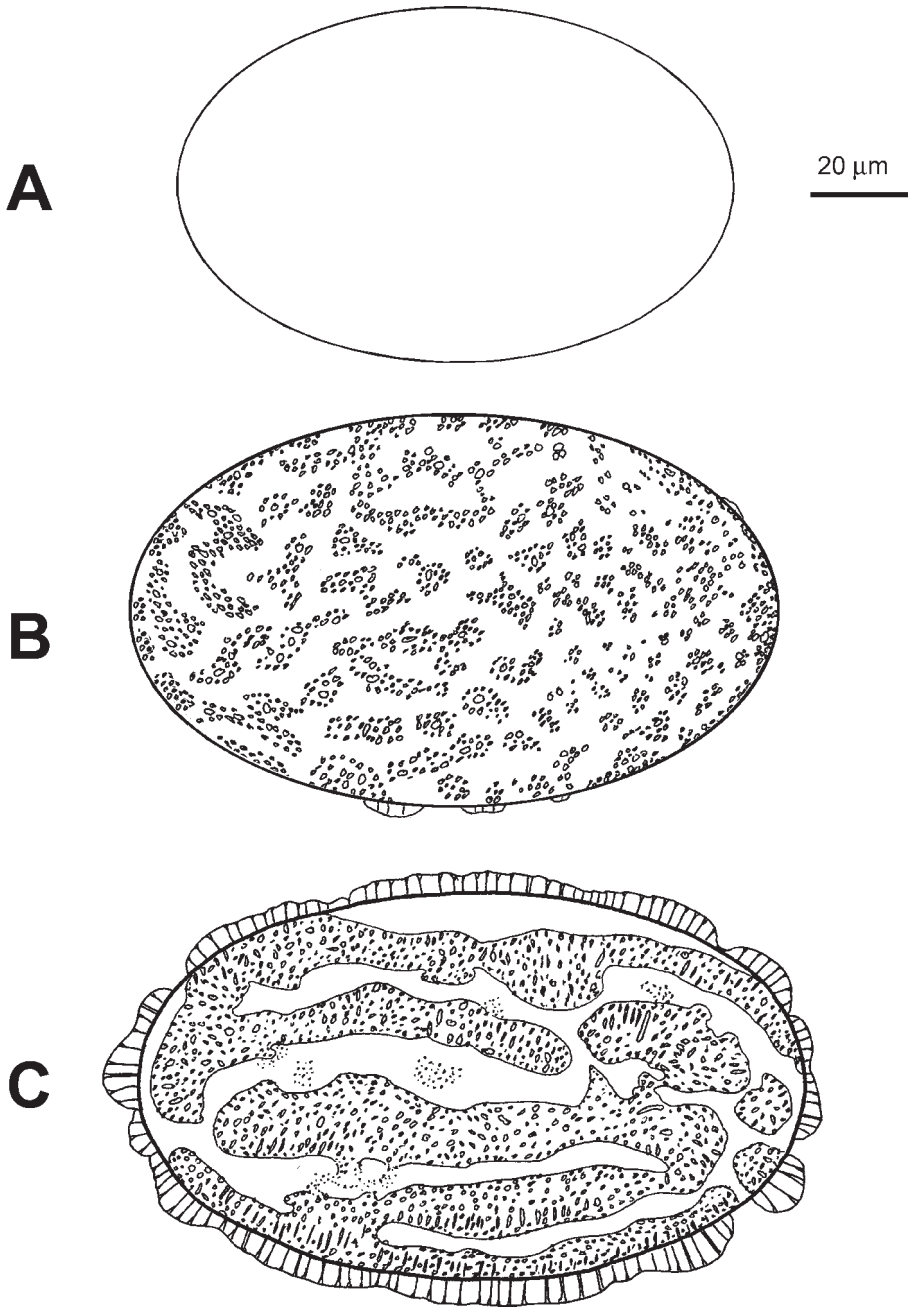


Fig. 98. *Tyrophagus similis* Volgin, 1949. A, newly formed egg; B, partially developed egg; C, fully developed egg.

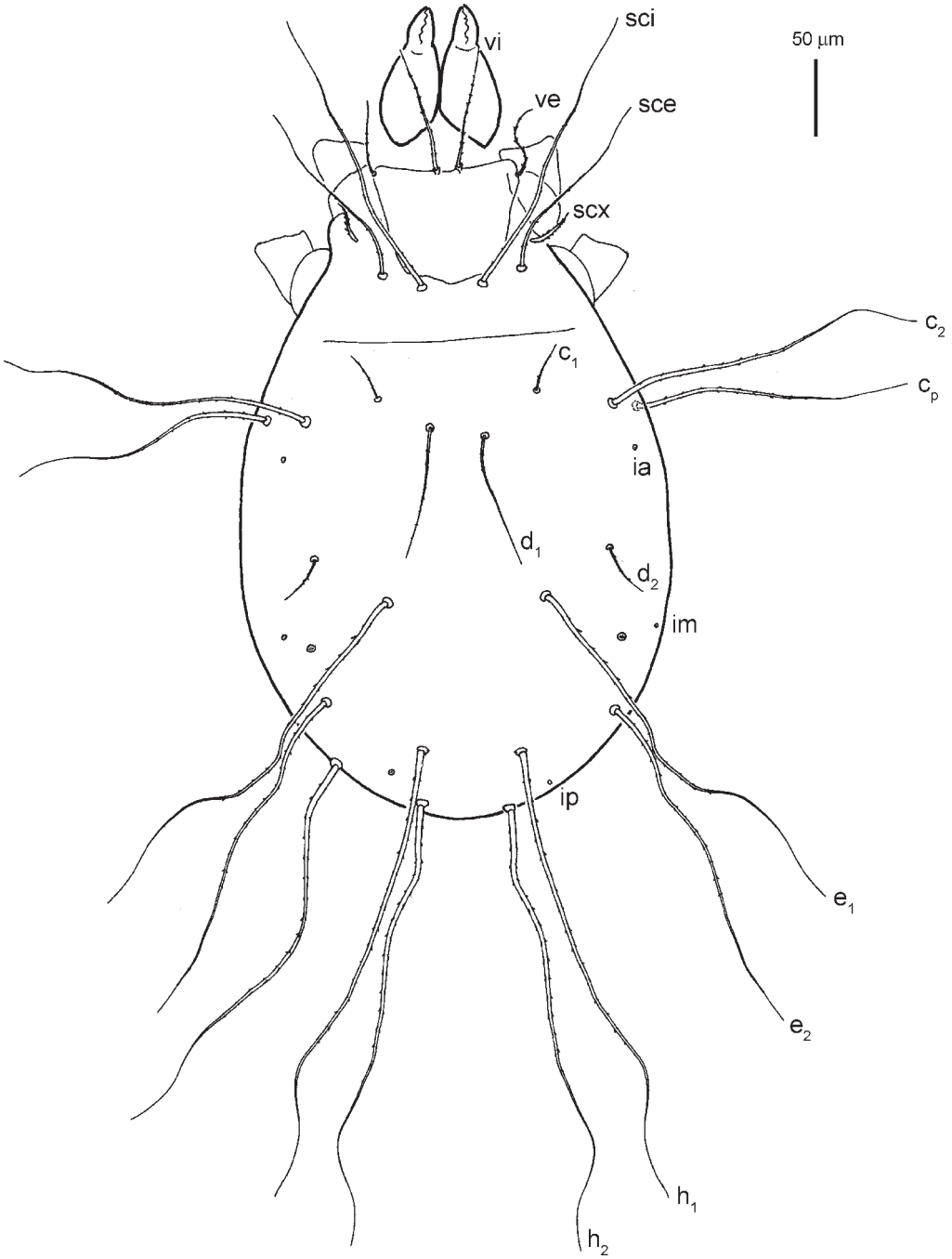


Fig. 99. *Tyrophagus vanheurni* Oudemans, 1924 (female). Dorsal view of idiosoma.

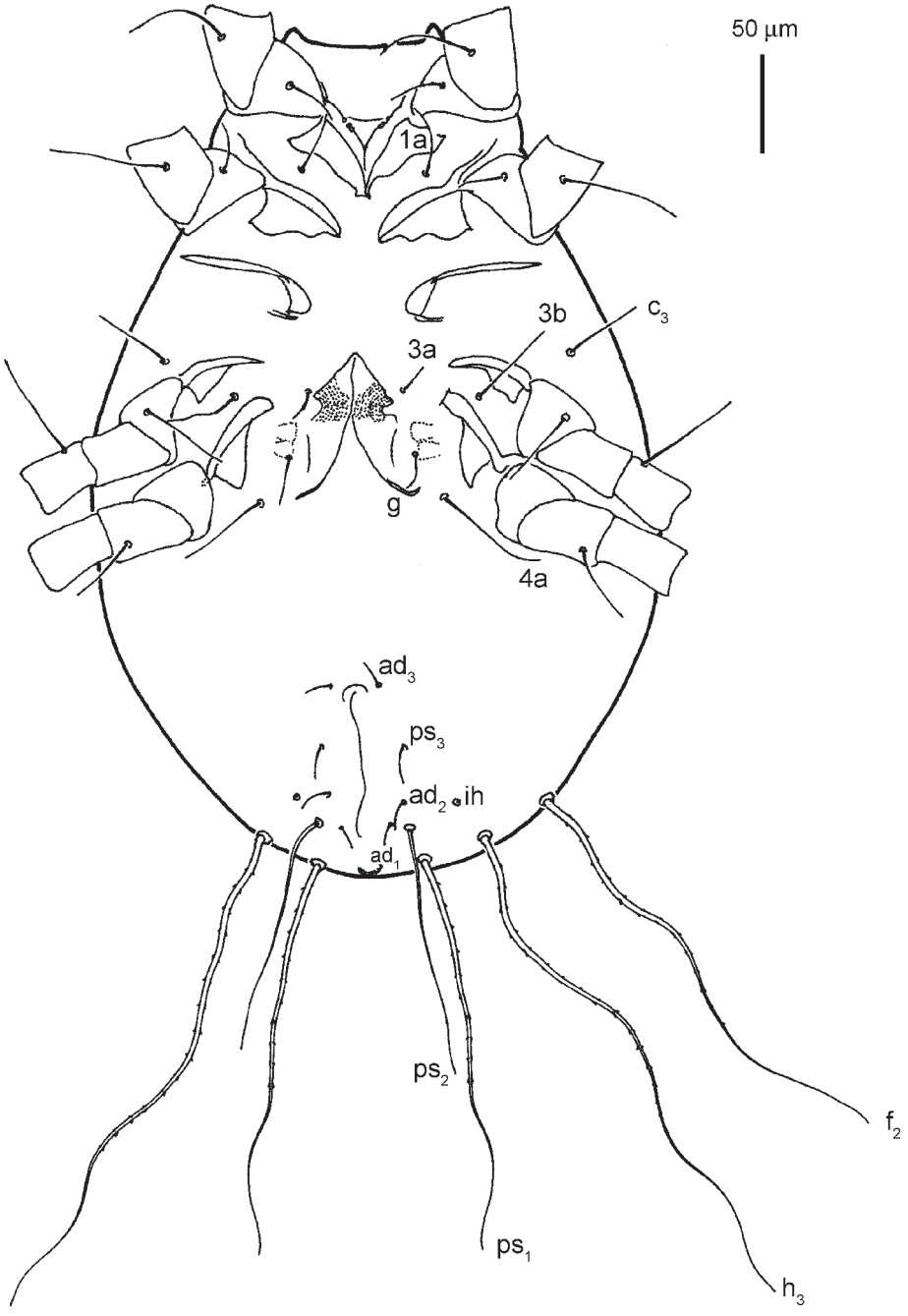


Fig. 100. *Tyrophagus vanheurni* Oudemans, 1924 (female). Ventral view of idiosoma.

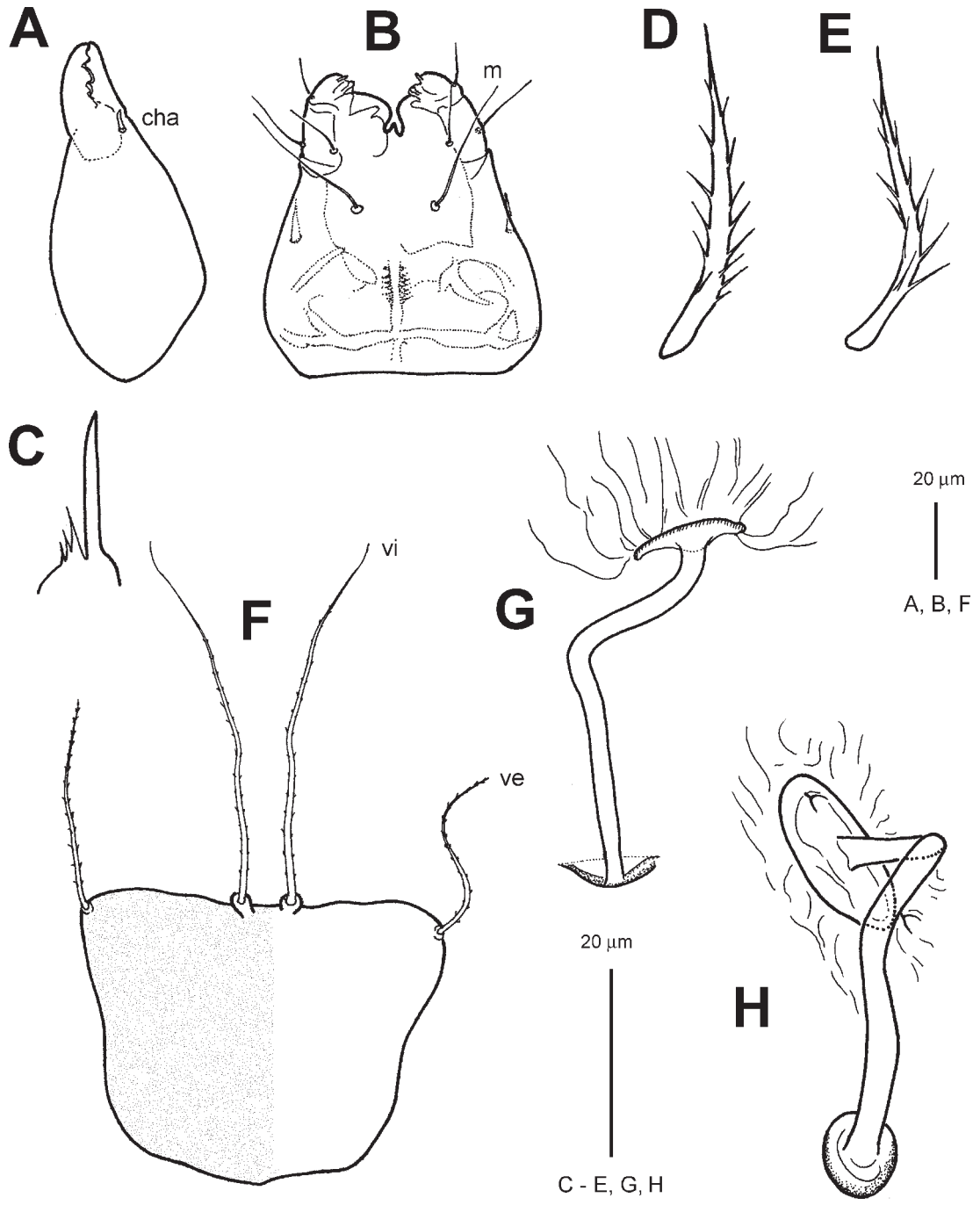


Fig. 101. *Tyrophagus vanheurni* Oudemans, 1924 (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, supracoxal seta; F, prodorsal shield; G, copulatory opening and spermatheca; H, copulatory opening and spermatheca.

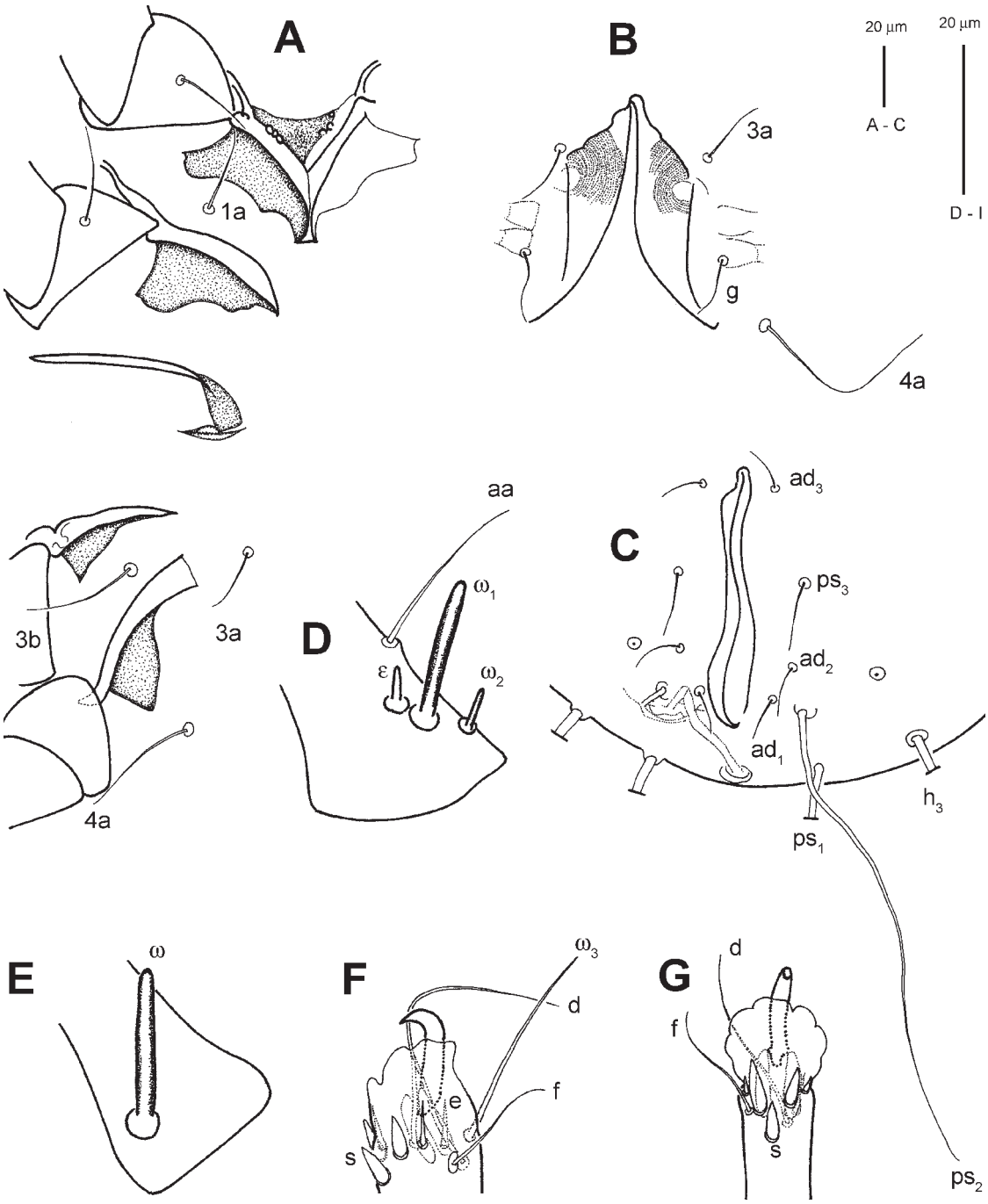


Fig. 102. *Tyrophagus vanheurni* Oudemans, 1924 (female). A, coxae I–IV; B, genital opening; C, anus; D, solenidia, famulus, and seta of tarsus I; E, solenidion of tarsus II; F, latero-ventral view of distal part of tarsus I; G, ventral view of distal part of tarsus IV.

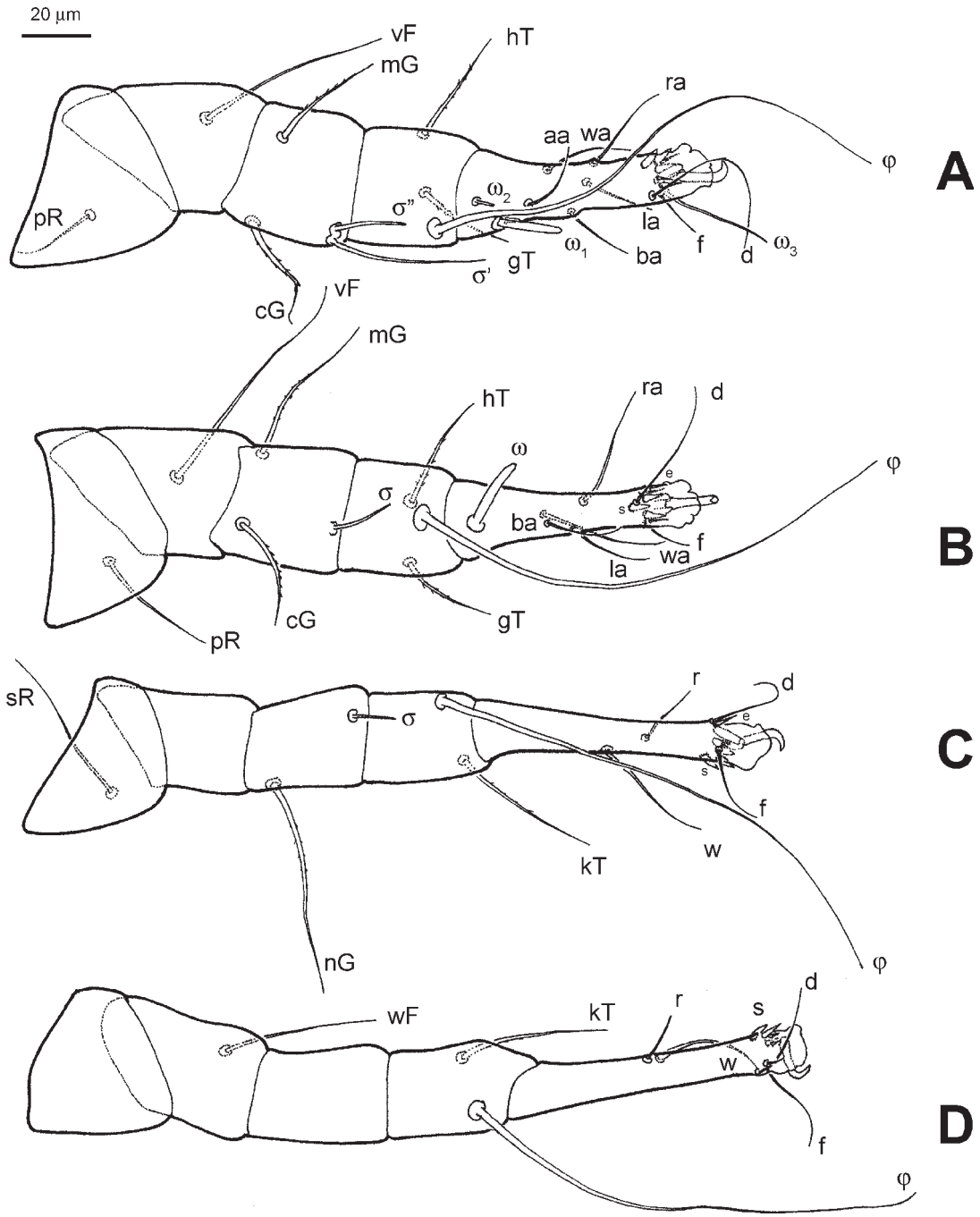


Fig. 103. *Tyrophagus vanheurni* Oudemans, 1924 (female). A, leg I; B, leg II; C, leg III; D, leg IV.

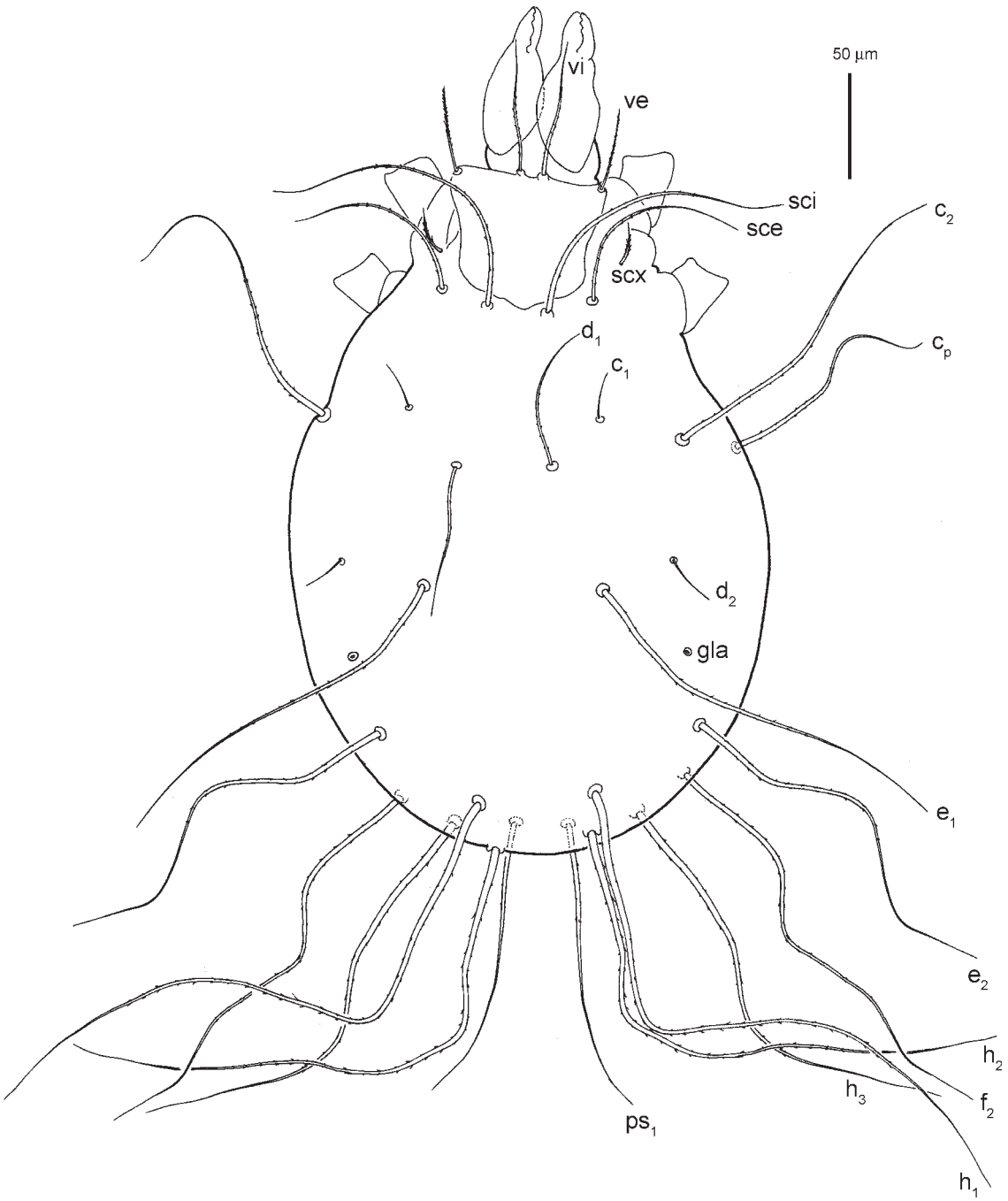


Fig. 104. *Tyrophagus vanheurni* Oudemans, 1924 (male). Dorsal view of idiosoma.

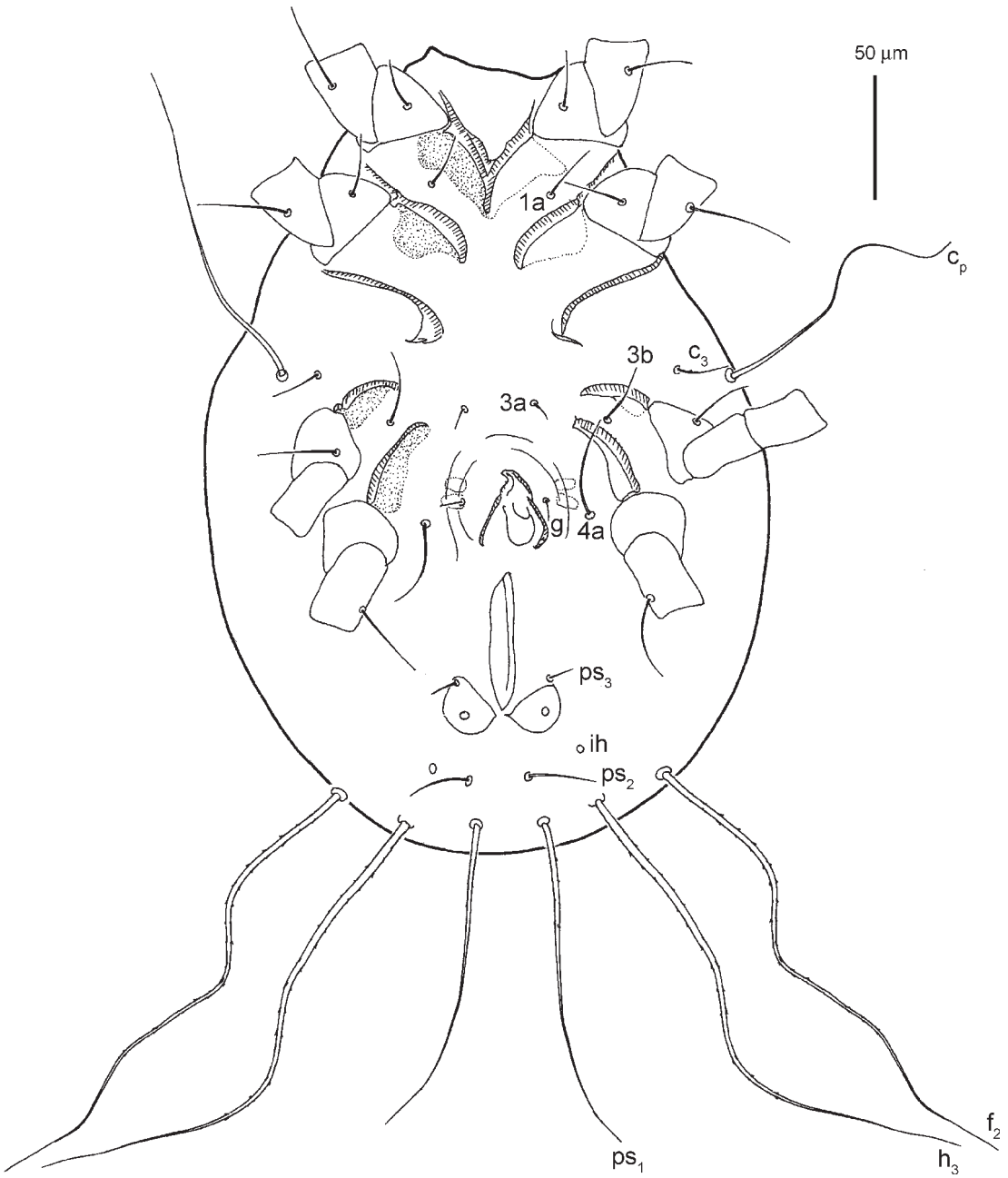


Fig. 105. *Tyrophagus vanheurni* Oudemans, 1924 (male). Ventral view of idiosoma.

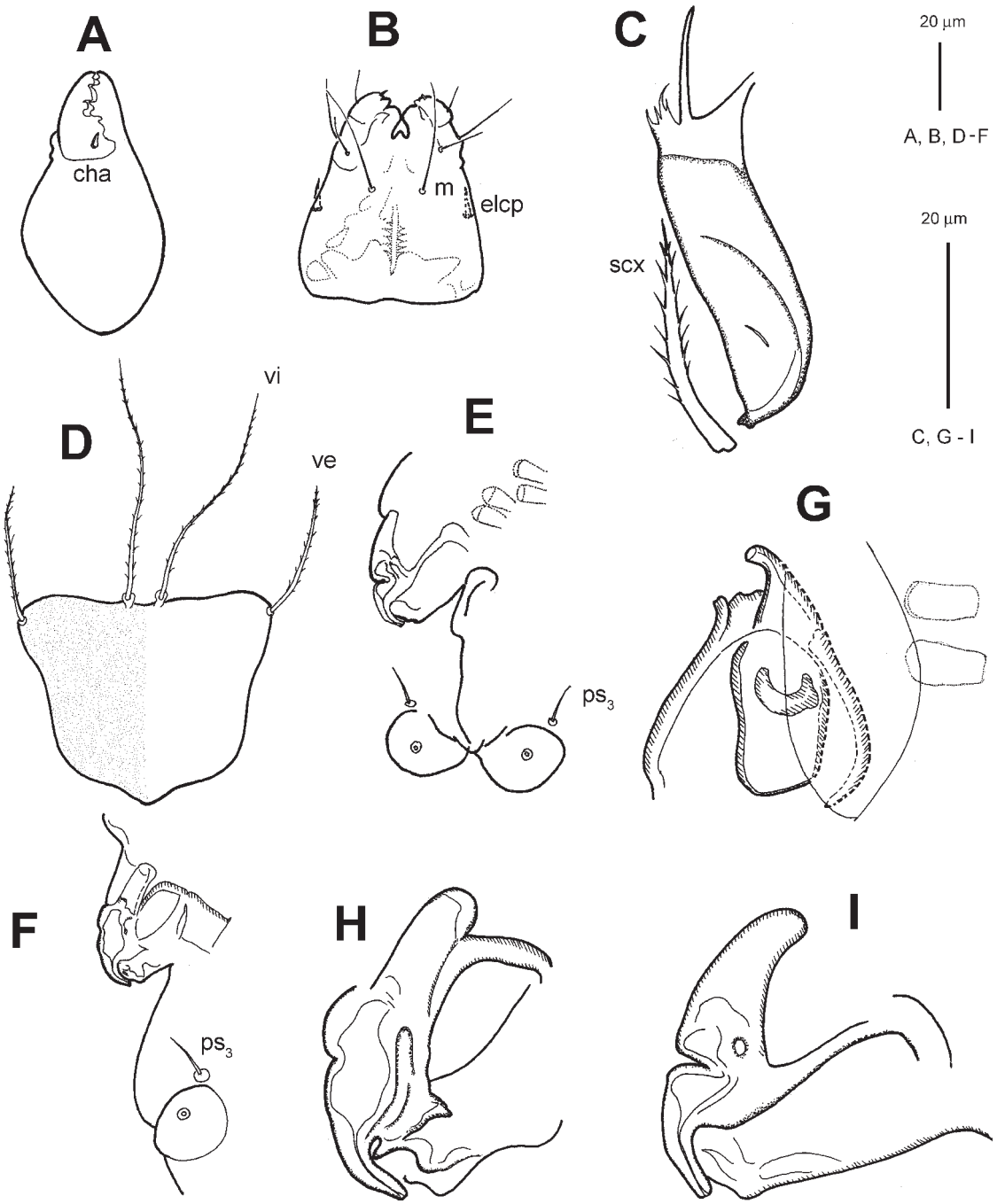


Fig. 106. *Tyrophagus vanheurni* Oudemans, 1924 (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, lateral sclerite and supracoxal seta; D, prodorsal shield; E, lateral view of aedeagus and anus; F, lateral view of aedeagus and anus; G, ventral view of aedeagus; H, lateral view of aedeagus; I, lateral view of aedeagus.

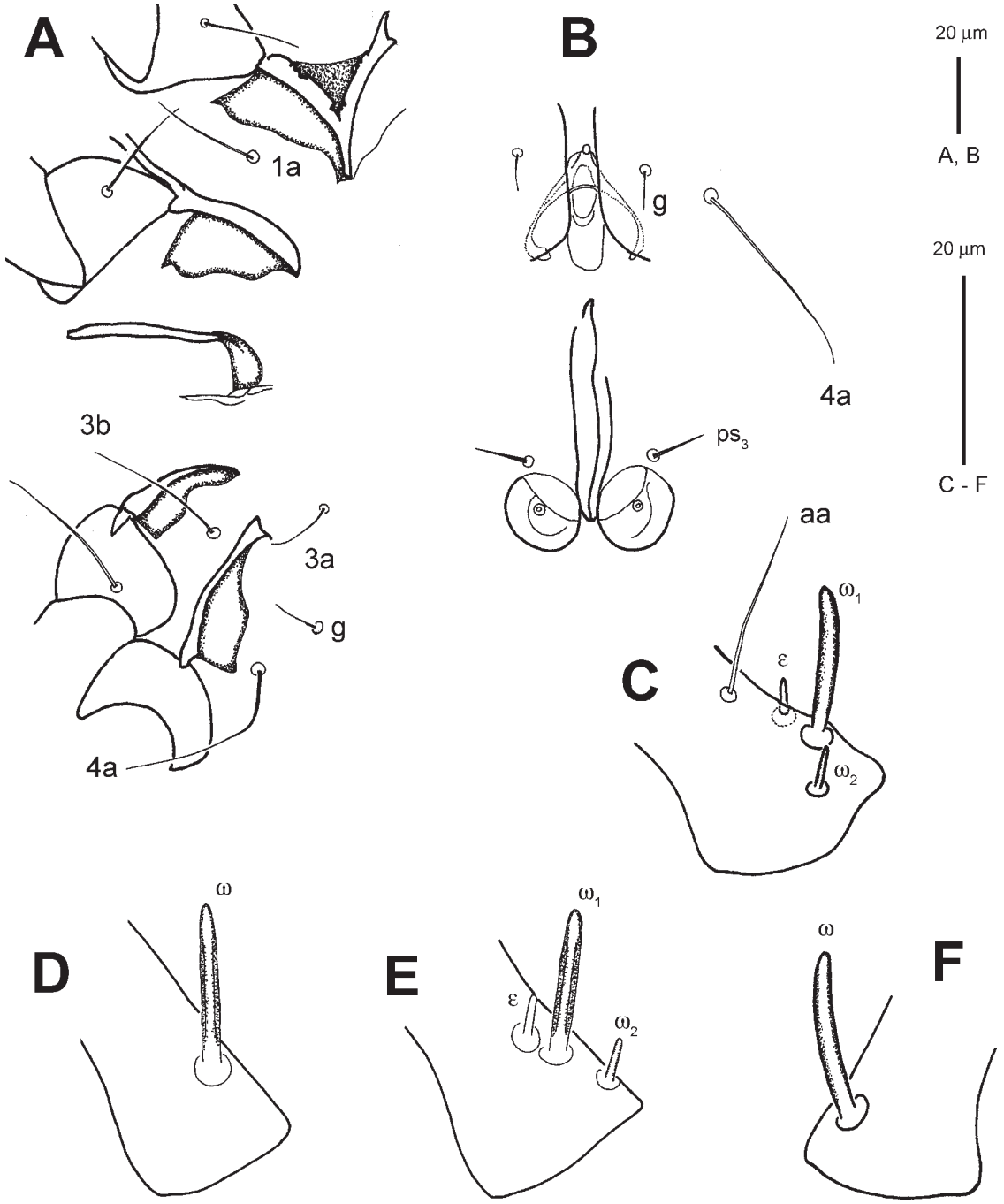


Fig. 107. *Tyrophagus vanheurni* Oudemans, 1924 (male). A, coxae I–IV; B, genital opening and anus; C, solenidia, famulus, and seta of tarsus I; D, solenidion of tarsus II; E, solenidia and famulus of tarsus I; F, solenidion of tarsus II.

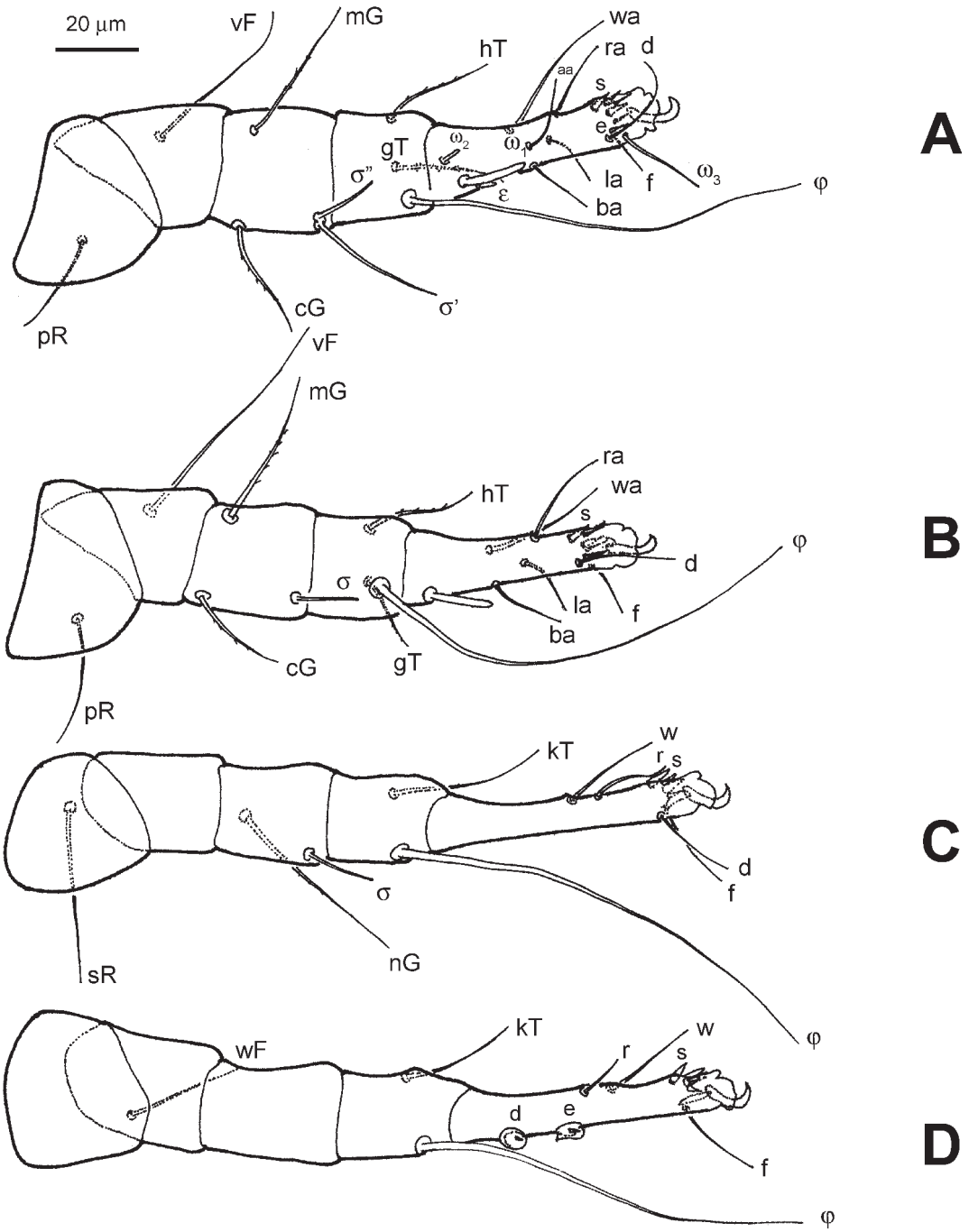


Fig. 108. *Tyrophagus vanheurni* Oudemans, 1924 (male). A, leg I; B, leg II; C, leg III; D, leg IV.

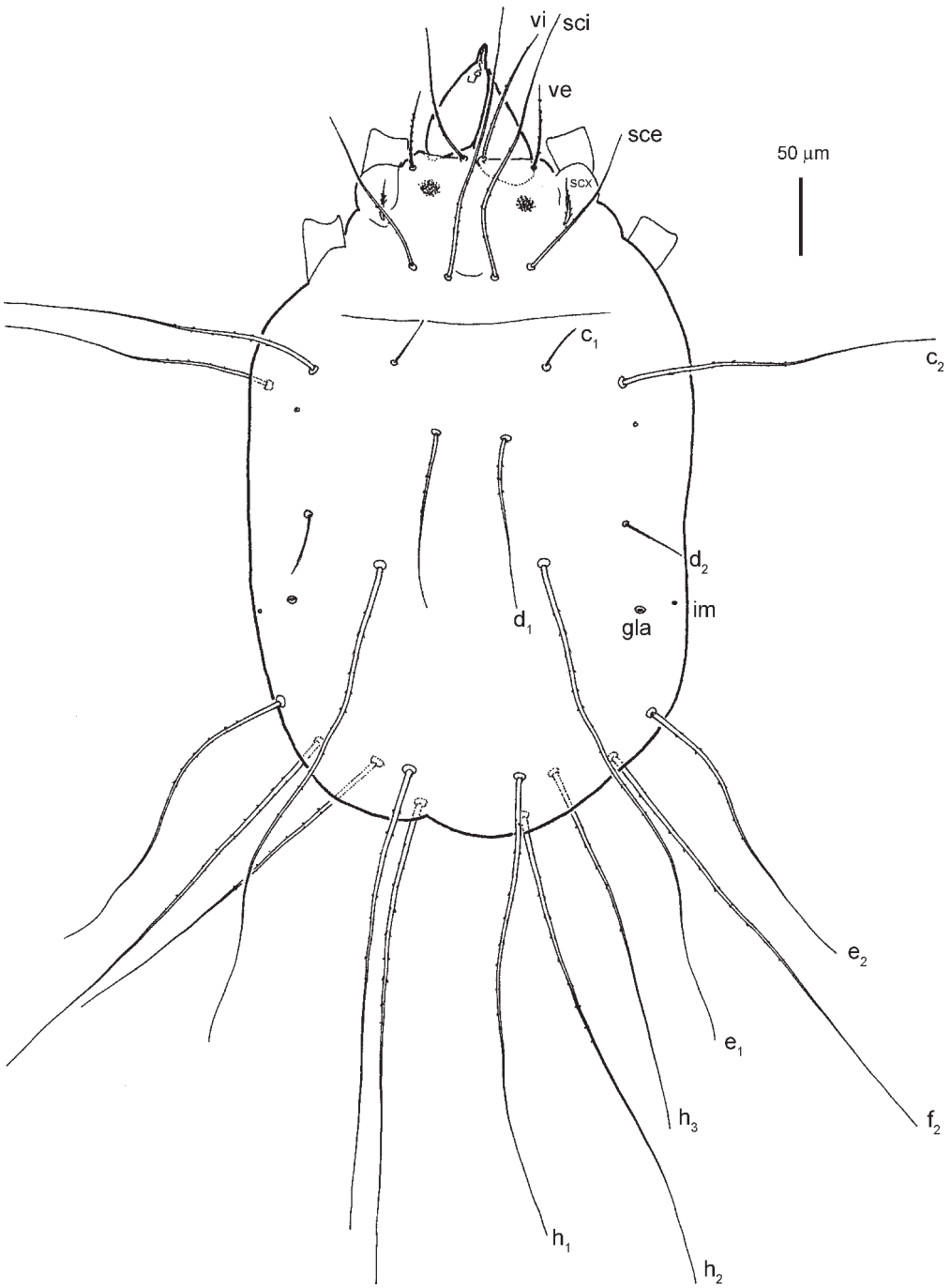


Fig. 109. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6921). Dorsal view of idiosoma.

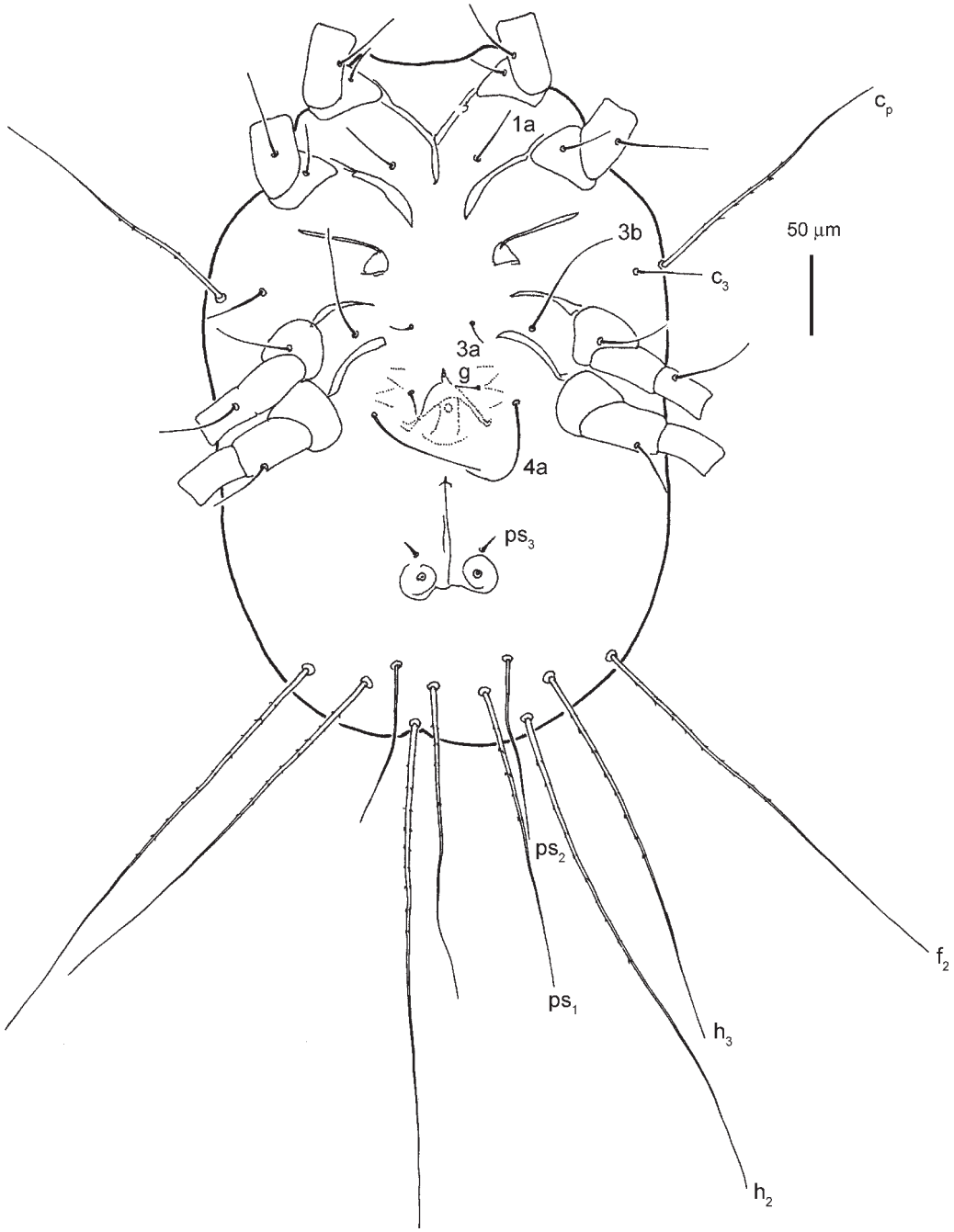


Fig. 110. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6921). Ventral view of idiosoma.

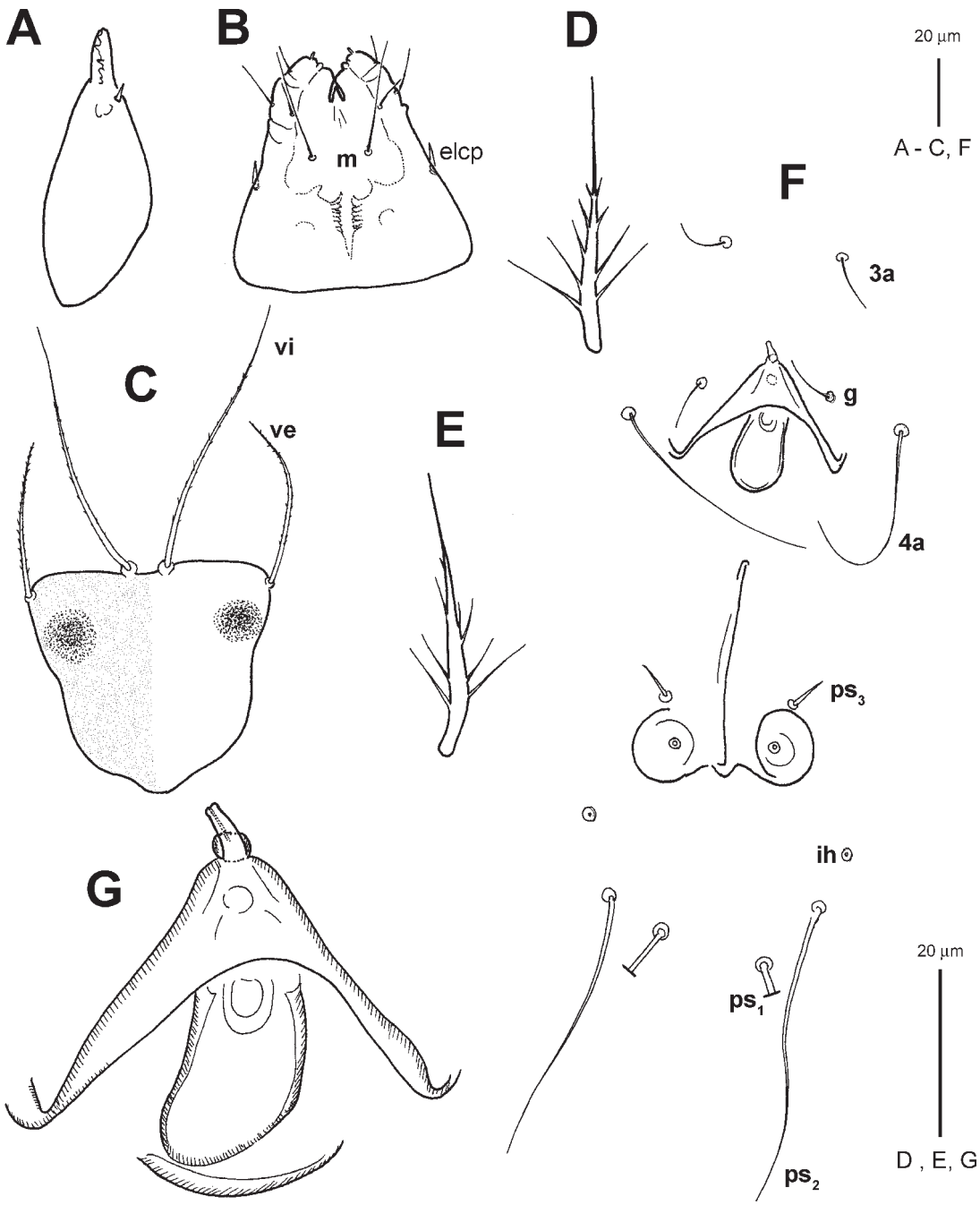


Fig. 111. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6921). A, ventral view of chelicera; B, ventral view of subcapitulum; C, prodorsal shield; D, supracoxal seta; E, supracoxal seta; F, genital opening and anus; G, ventral view of aedeagus.

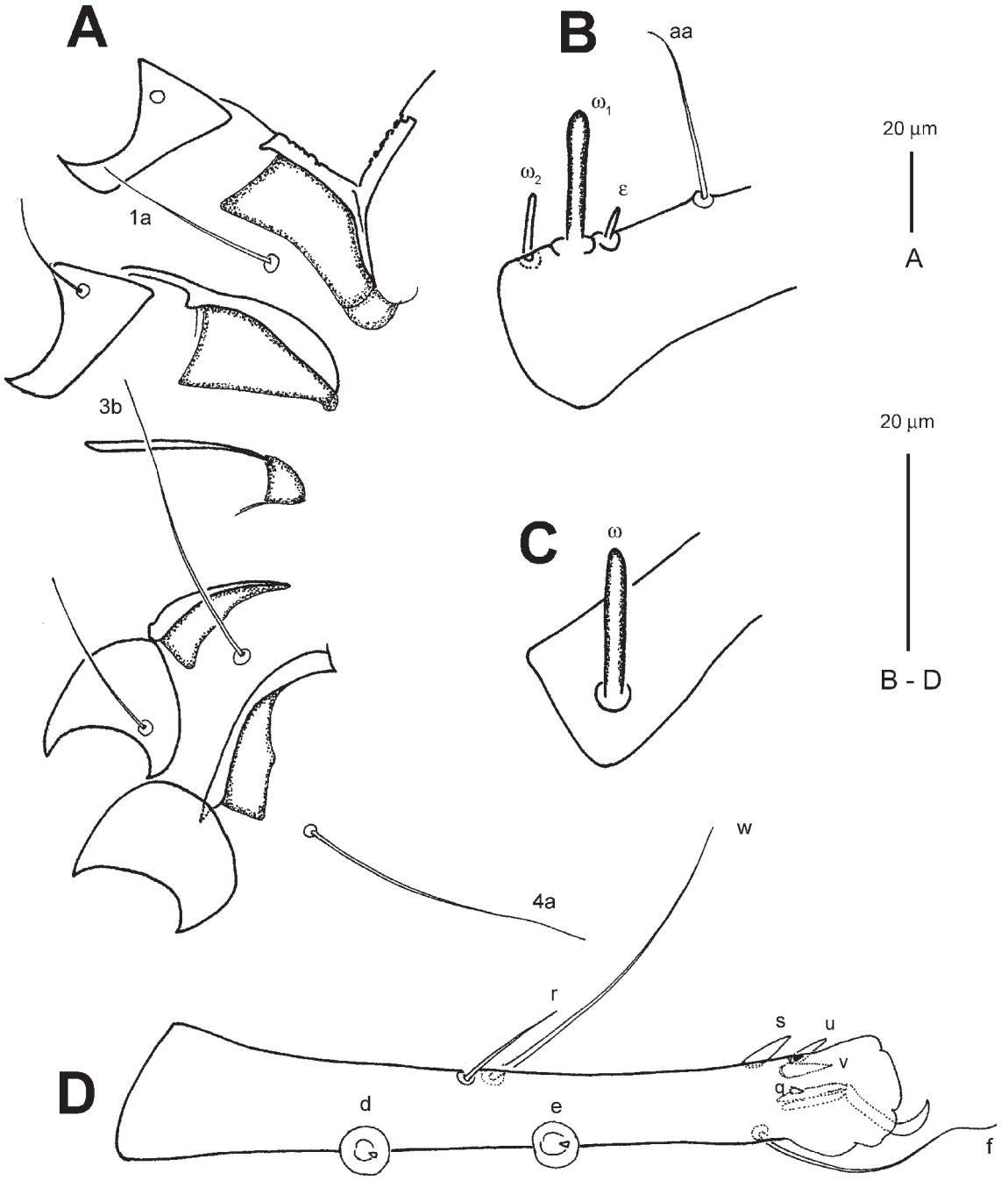


Fig. 112. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6921). A, coxae I–IV; B, solenidia, famulus, and seta of tarsus I; C, solenidion of tarsus II; D, lateral view of tarsus IV.

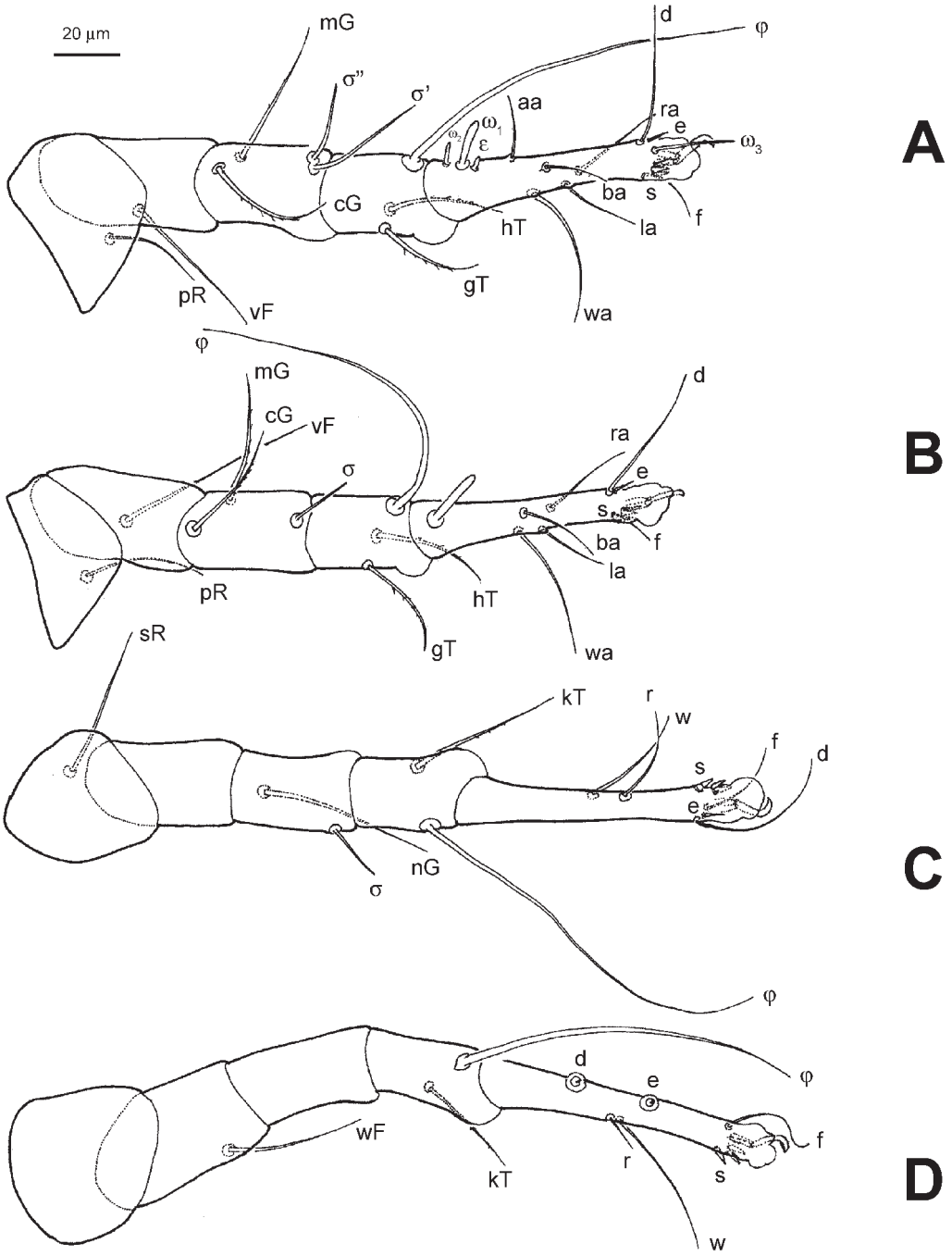


Fig. 113. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6921). A, leg I; B, leg II; C, leg III; D, leg IV.

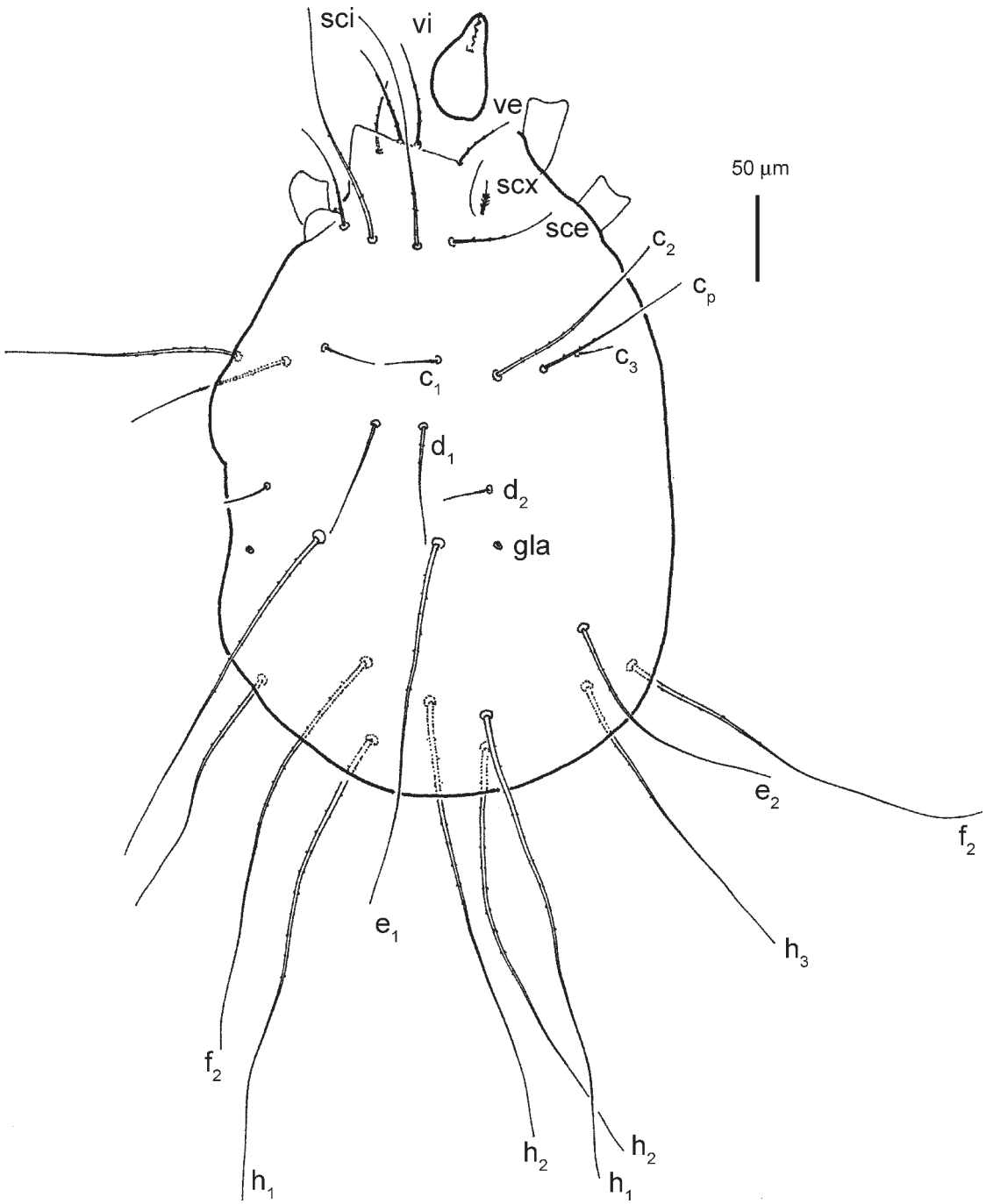


Fig. 114. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6910). Dorsal view of idiosoma.

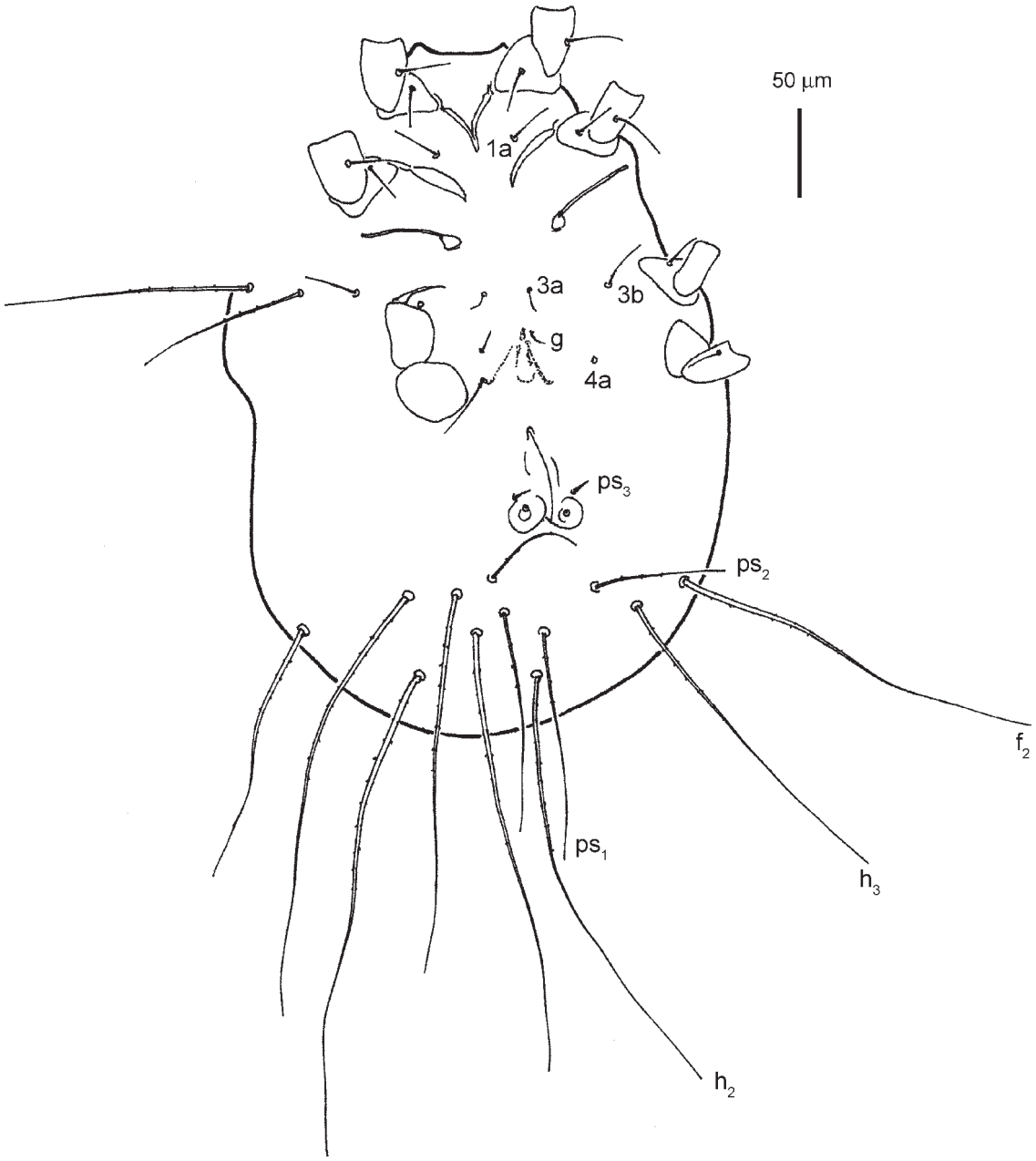


Fig. 115. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6910). Ventral view of idiosoma.

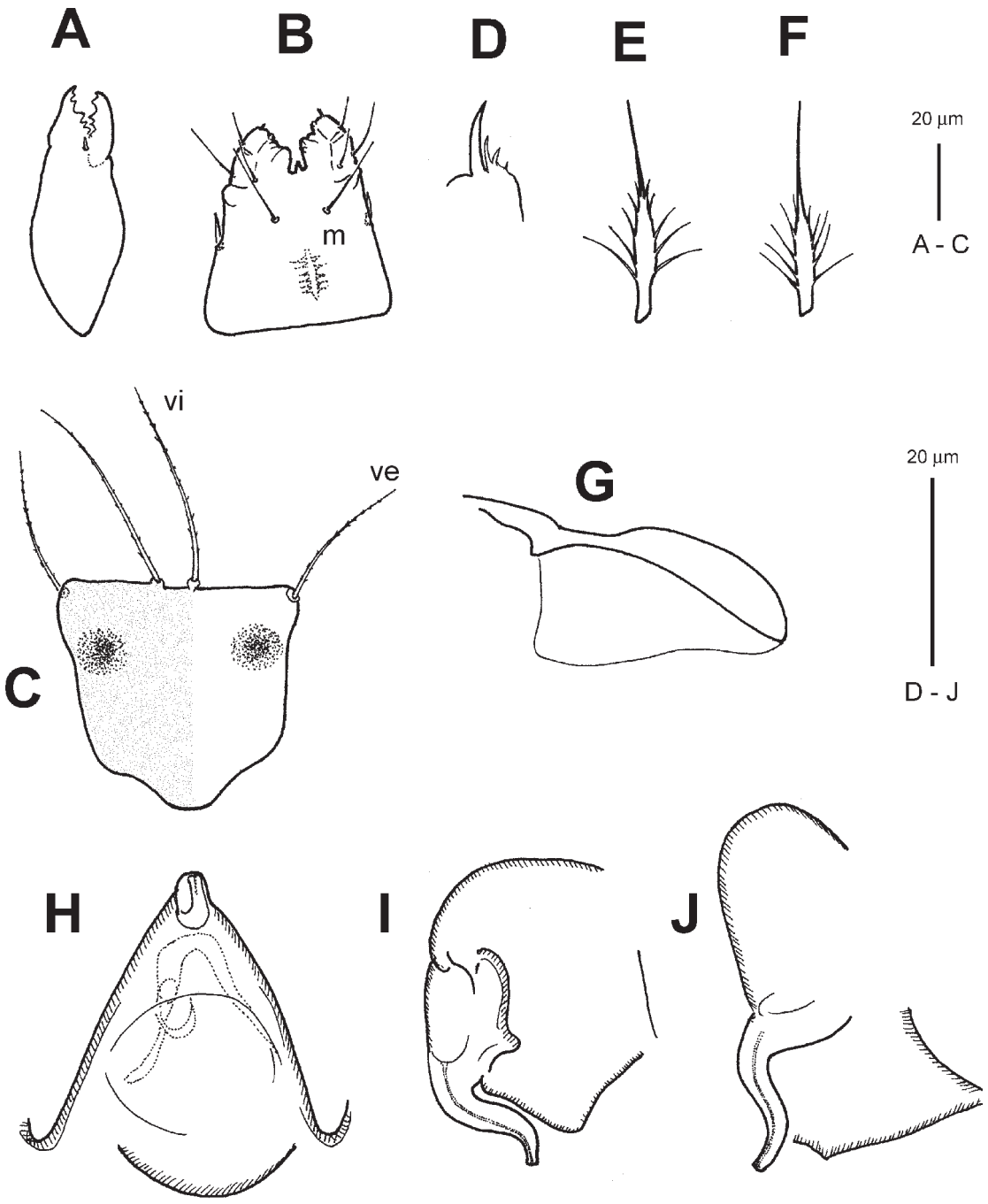


Fig. 116. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6910). A, ventral view of chelicera; B, ventral view of subcapitulum; C, prodorsal shield; D, Grandjean's organ; E, supracoxal seta; F, supracoxal seta; G, coxa II; H, ventral view of aedeagus; I, lateral view of aedeagus; J, lateral view of aedeagus.

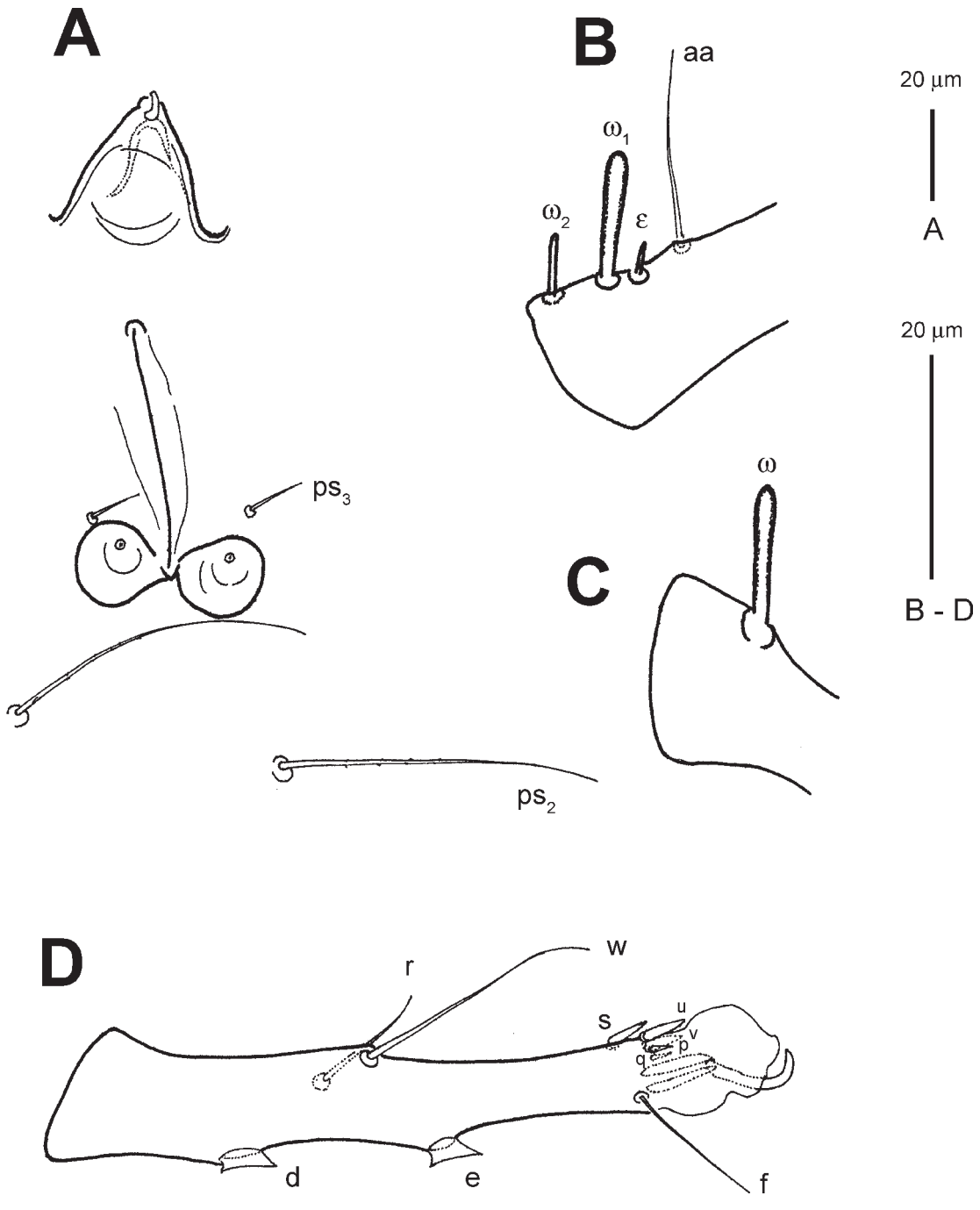


Fig. 117. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6910). A, genital opening and anus; B, solenidia, famulus, and seta of tarsus I; C, solenidion of tarsus II; D, latral view of tarsus IV.

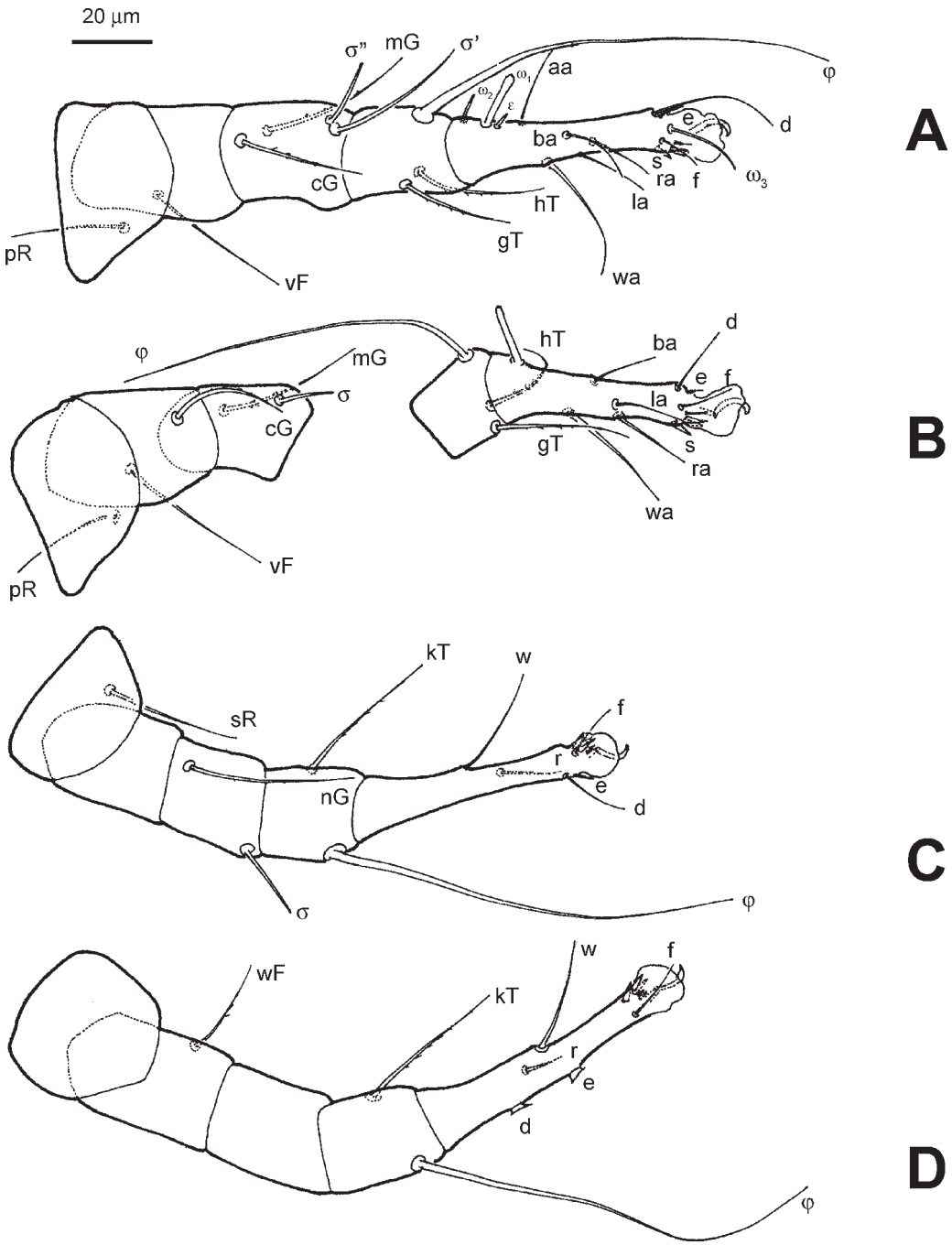


Fig. 118. *Tyrophagus australasiae* (Oudemans, 1916) (male, P6910). A, leg I; B, leg II; C, leg III; D, leg IV.

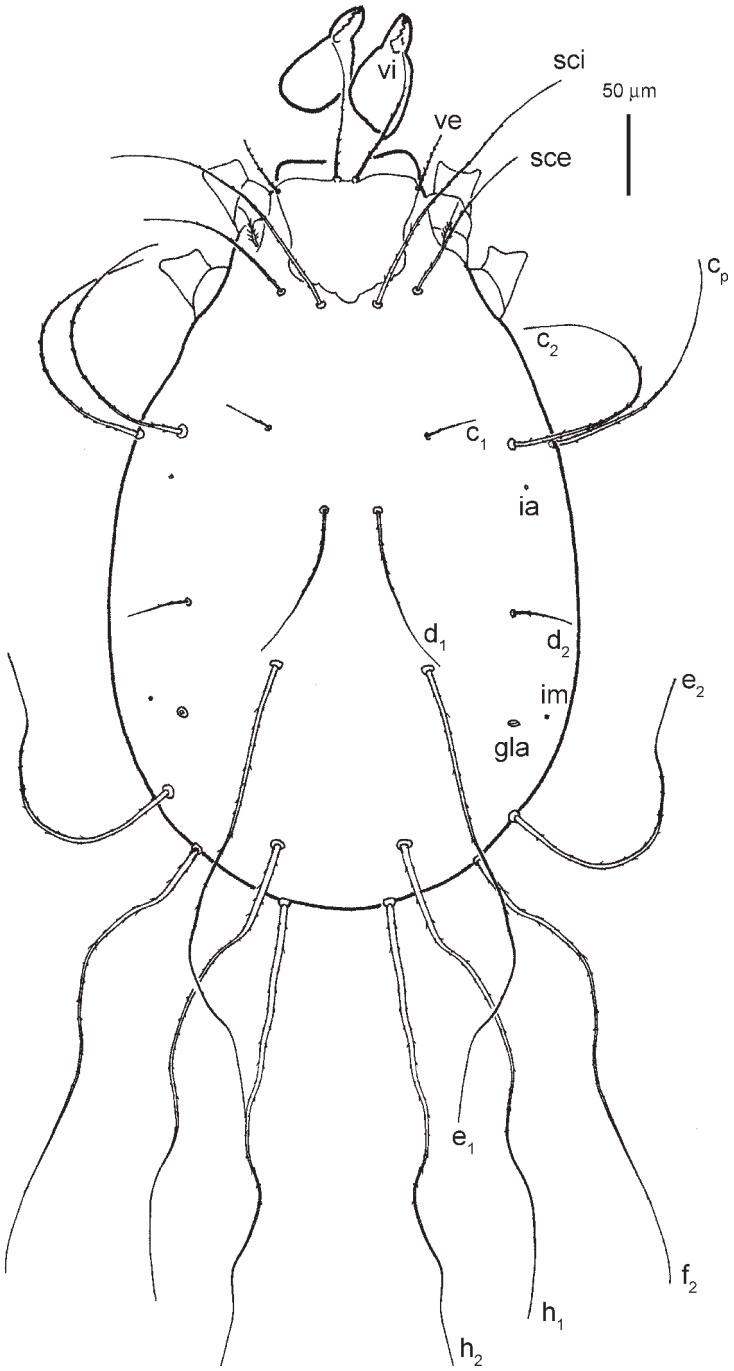


Fig. 119. *Tyrophagus javensis* (Oudemans, 1916) (female). Dorsal view of idiosoma.

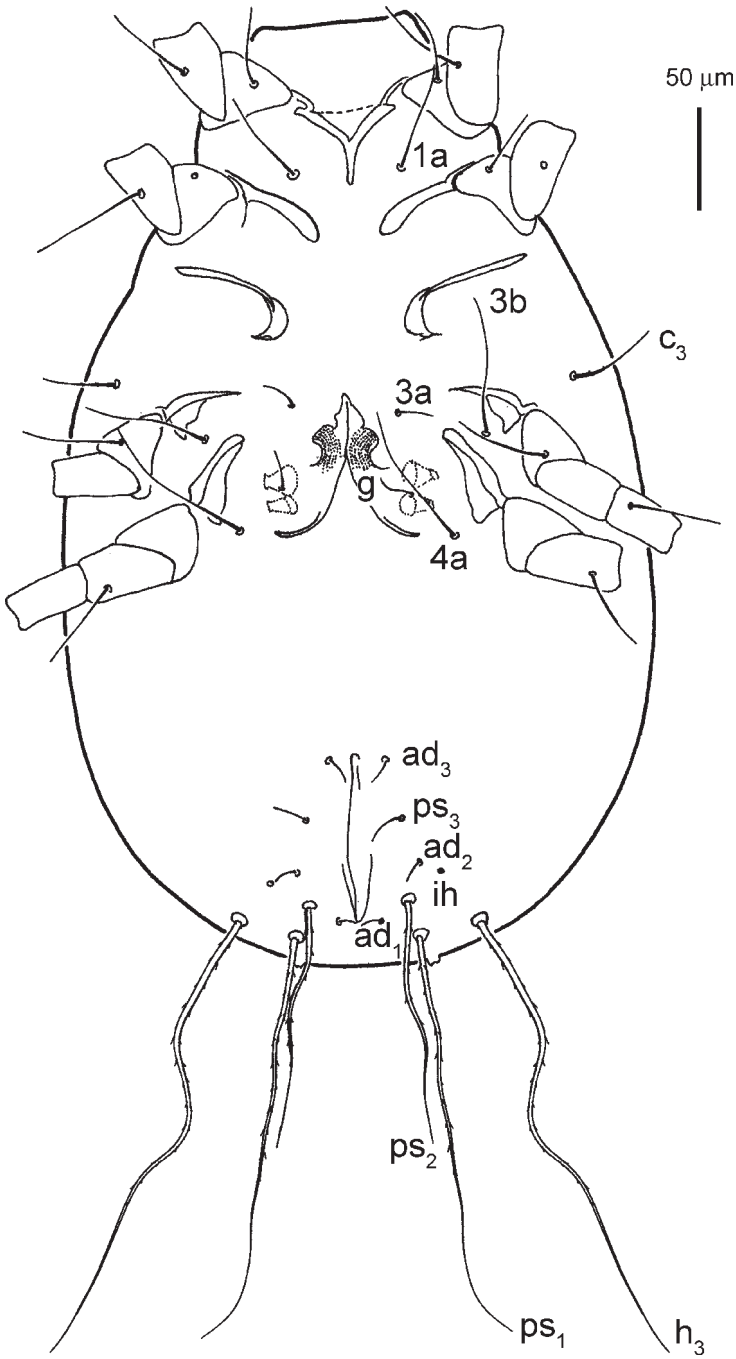


Fig. 120. *Tyrophagus javensis* (Oudemans, 1916) (female). Ventral view of idiosoma.

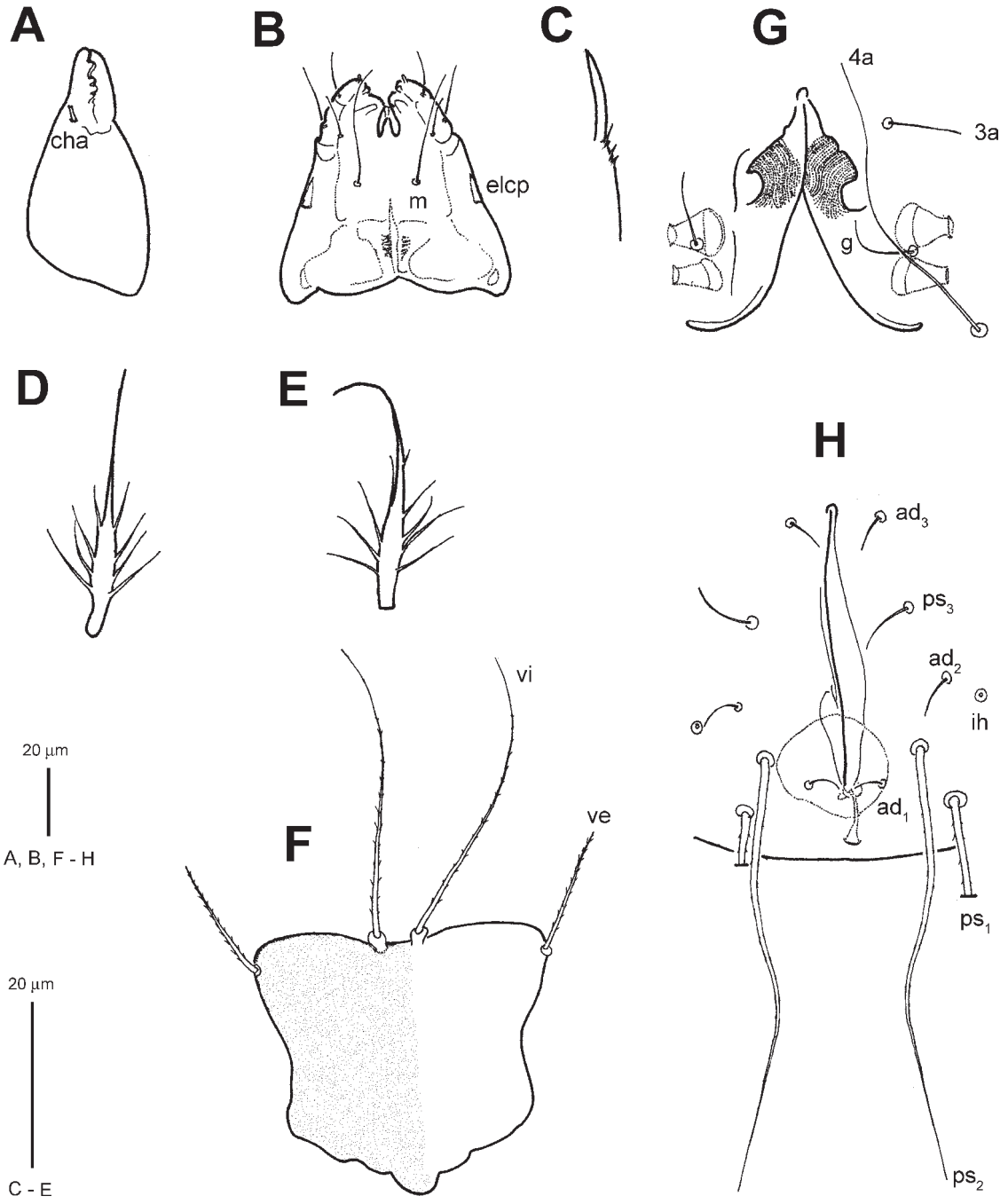


Fig. 121. *Tyrophagus javensis* (Oudemans, 1916) (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, supracoxal seta; F, prodorsal shield; G, genital opening; H, anus.

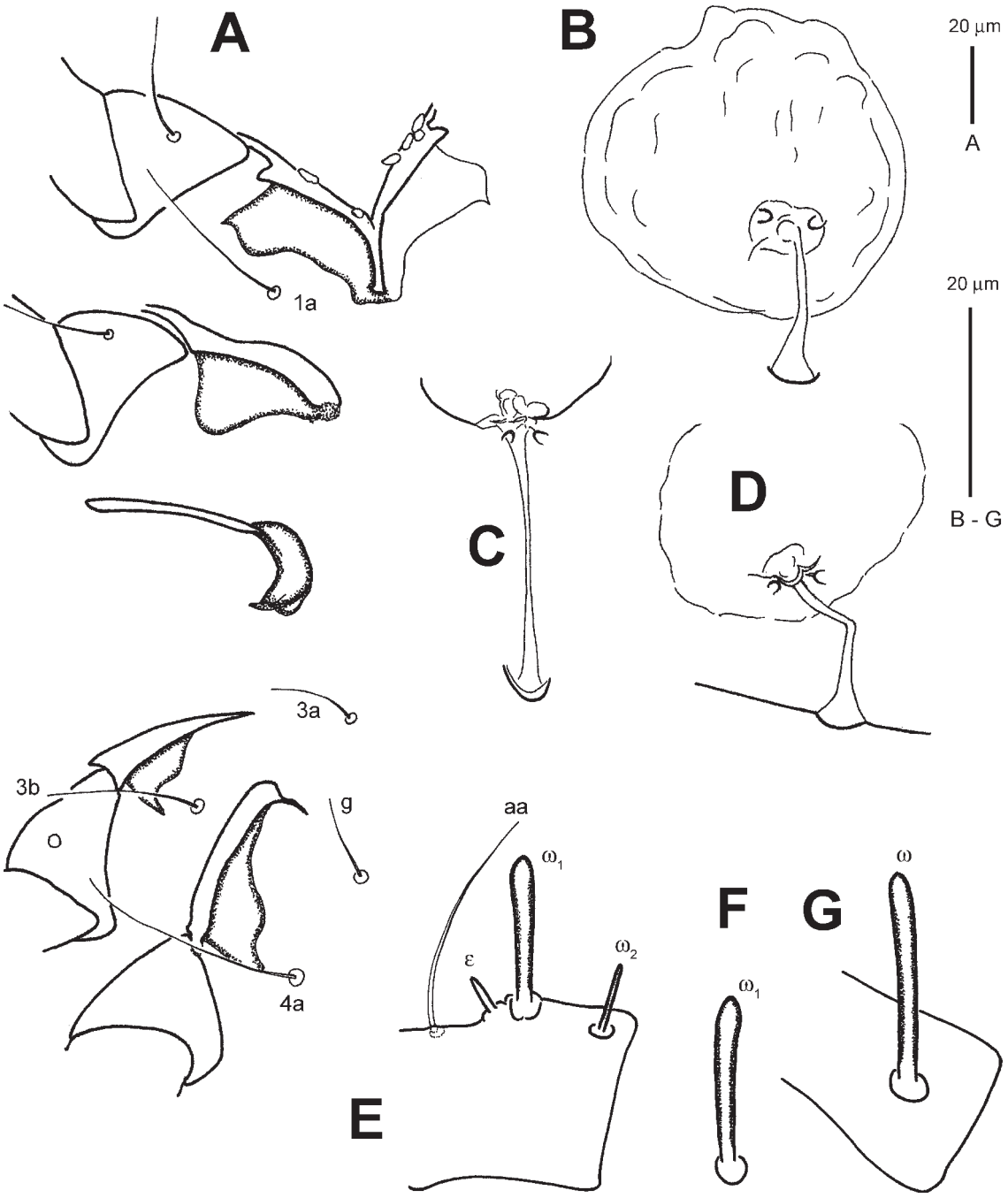


Fig. 122. *Tyrophagus javensis* (Oudemans, 1916) (female). A, coxae I–IV; B, copulatory opening and spermatheca; C, copulatory opening and spermatheca; D, copulatory opening and spermatheca; E, solenidia, famulus, and seta of tarsus I; F, omega I of tarsus I; G, solenidion of tarsus II.

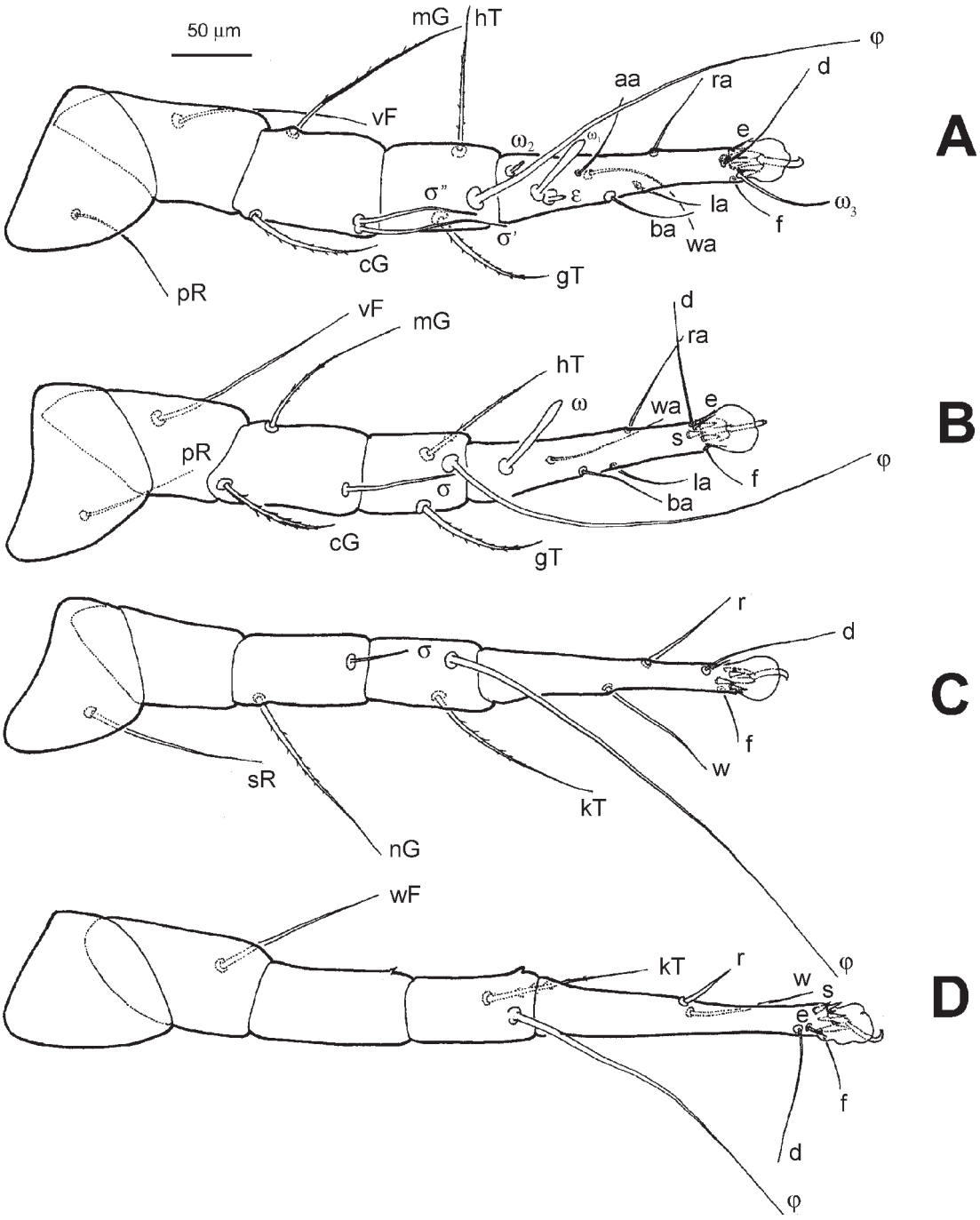


Fig. 123. *Tyrophagus javensis* (Oudemans, 1916) (female). A, leg I; B, leg II; C, leg III; D, leg IV.

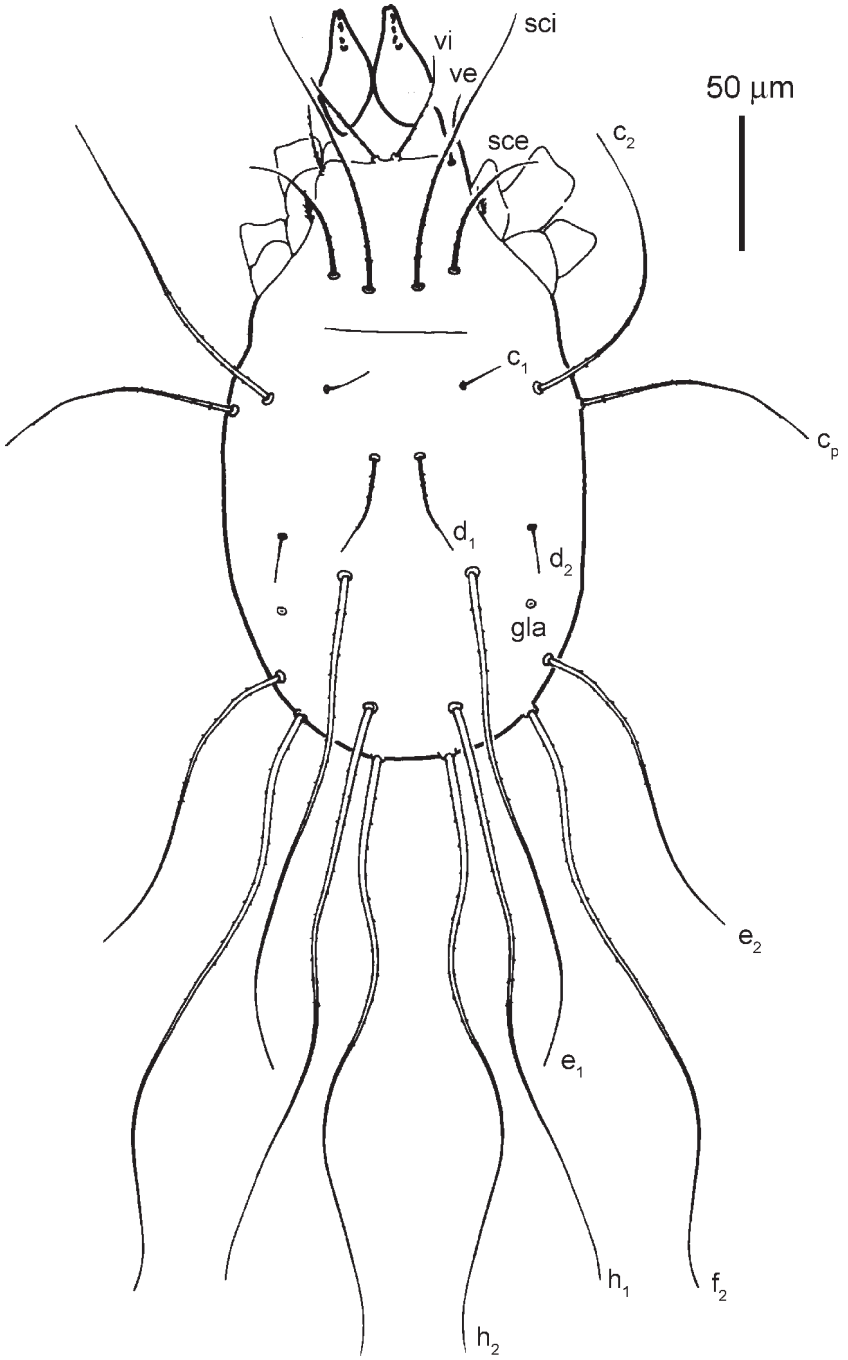


Fig. 124. *Tyrophagus javensis* (Oudemans, 1916) (male). Dorsal view of idiosoma.

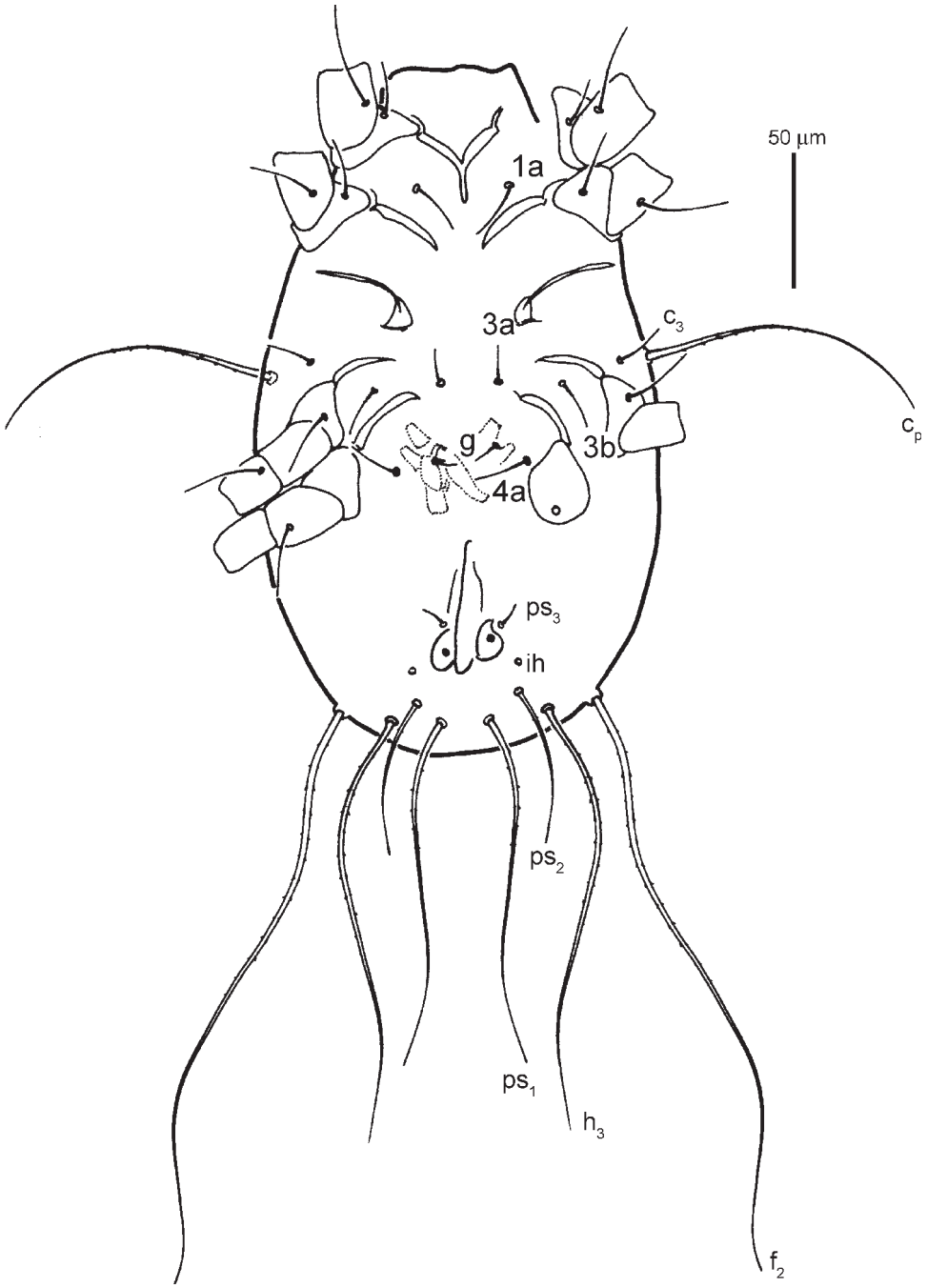


Fig. 125. *Tyrophagus javensis* (Oudemans, 1916) (male). Ventral view of idiosoma.

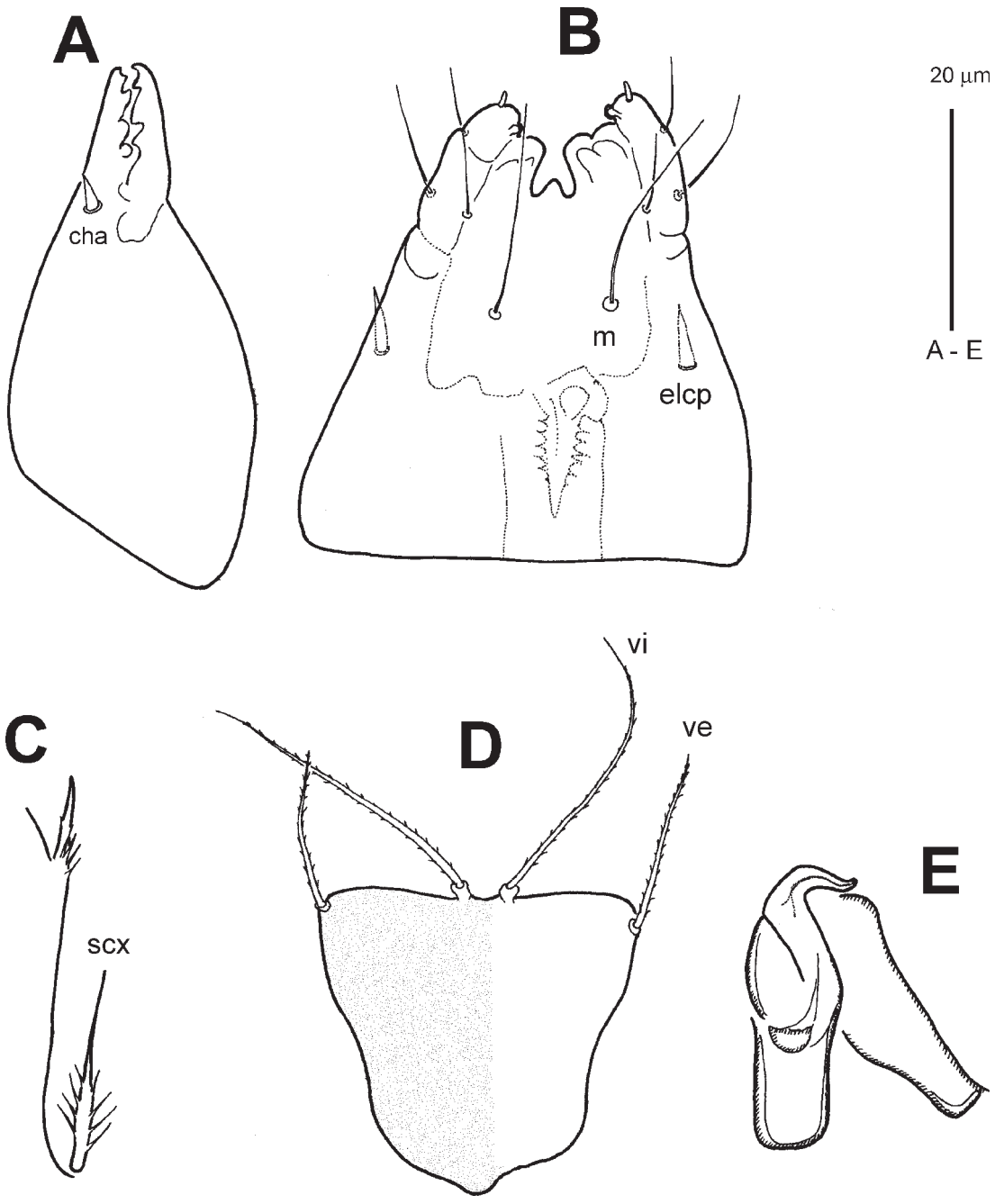


Fig. 126. *Tyrophagus javensis* (Oudemans, 1916) (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, lateral sclerite and supracoxal seta; D, prodorsal shield; E, lateral view of aedeagus.

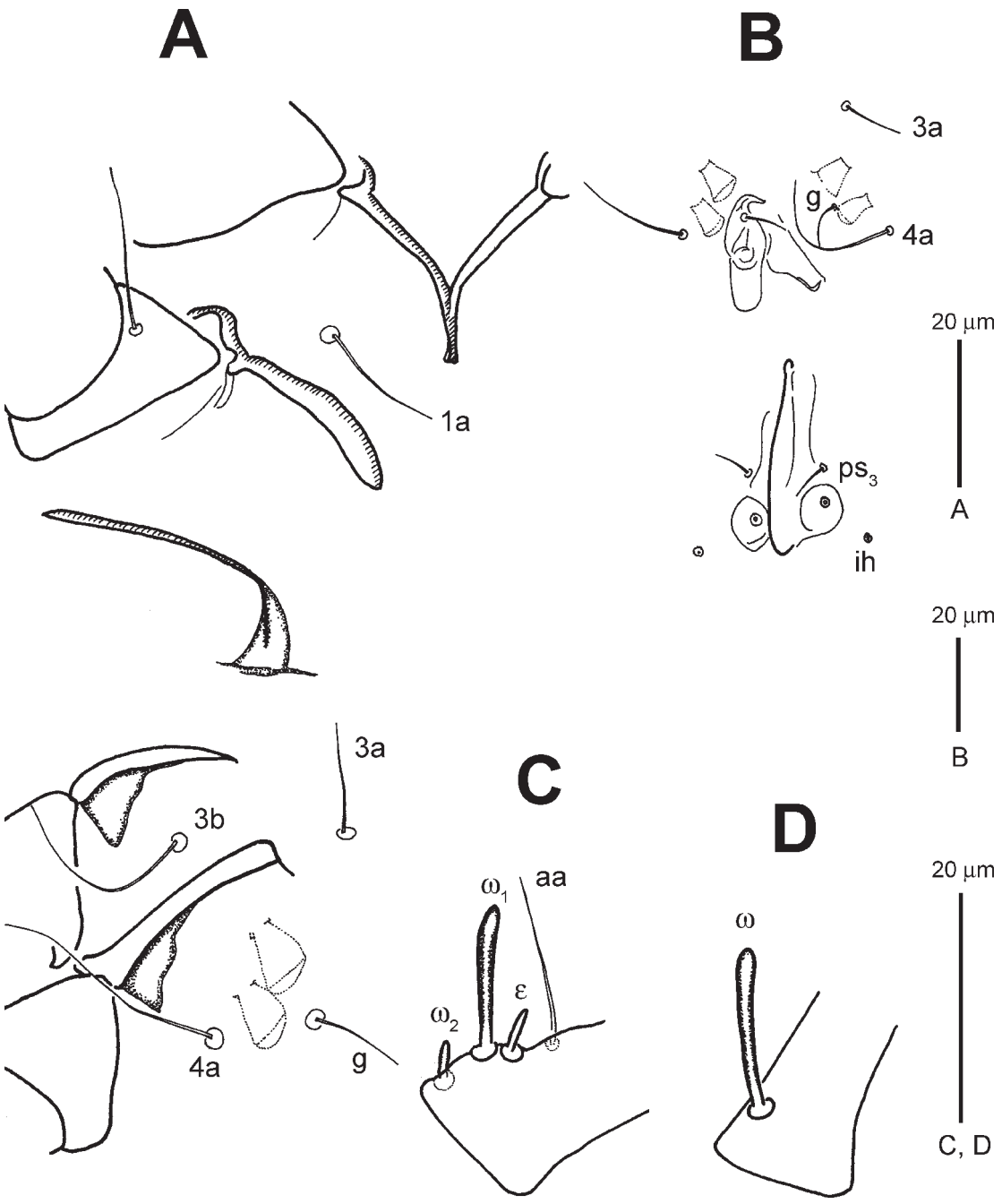


Fig. 127. *Tyrophagus javensis* (Oudemans, 1916) (male). A, coxae I–IV; B, genital opening and anus; C, solenidia, famulus, and seta of tarsus I; D, solenidion of tarsus II.

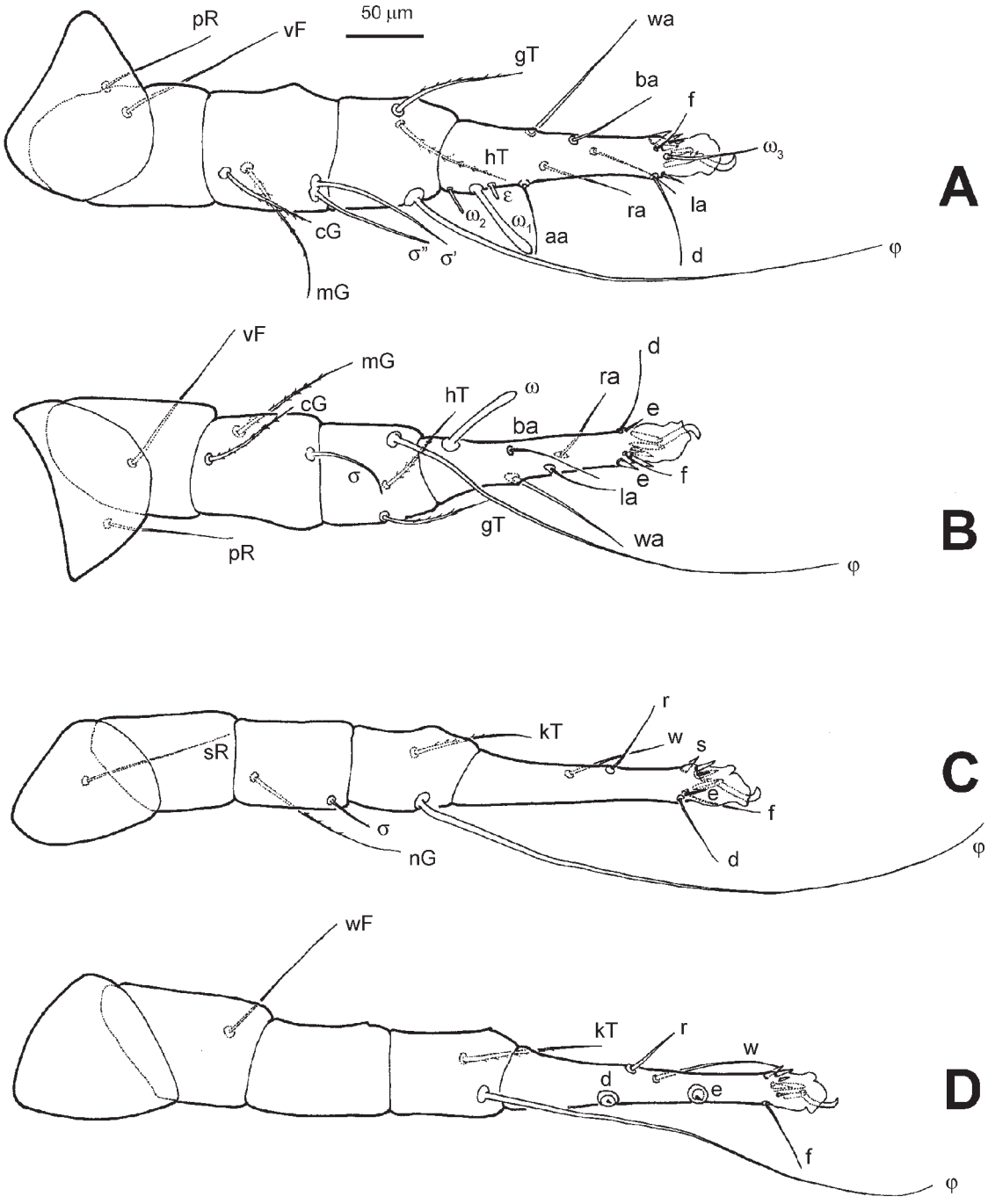


Fig. 128. *Tyrophagus javensis* (Oudemans, 1916) (male). A, leg I; B, leg II; C, leg III; D, leg IV.

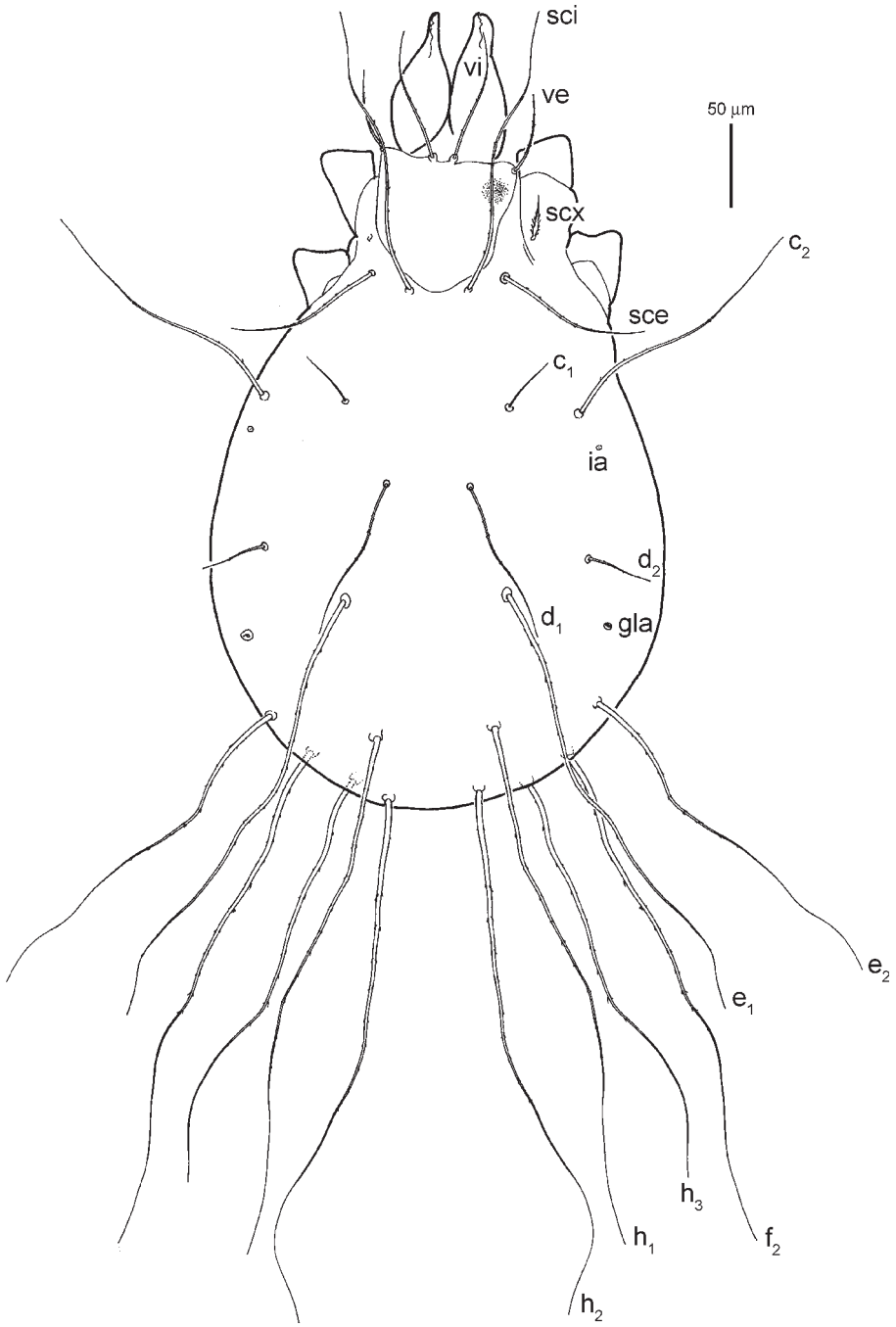


Fig. 129. *Tyrophagus pacificus* **sp. n.** (female). Dorsal view of idiosoma.

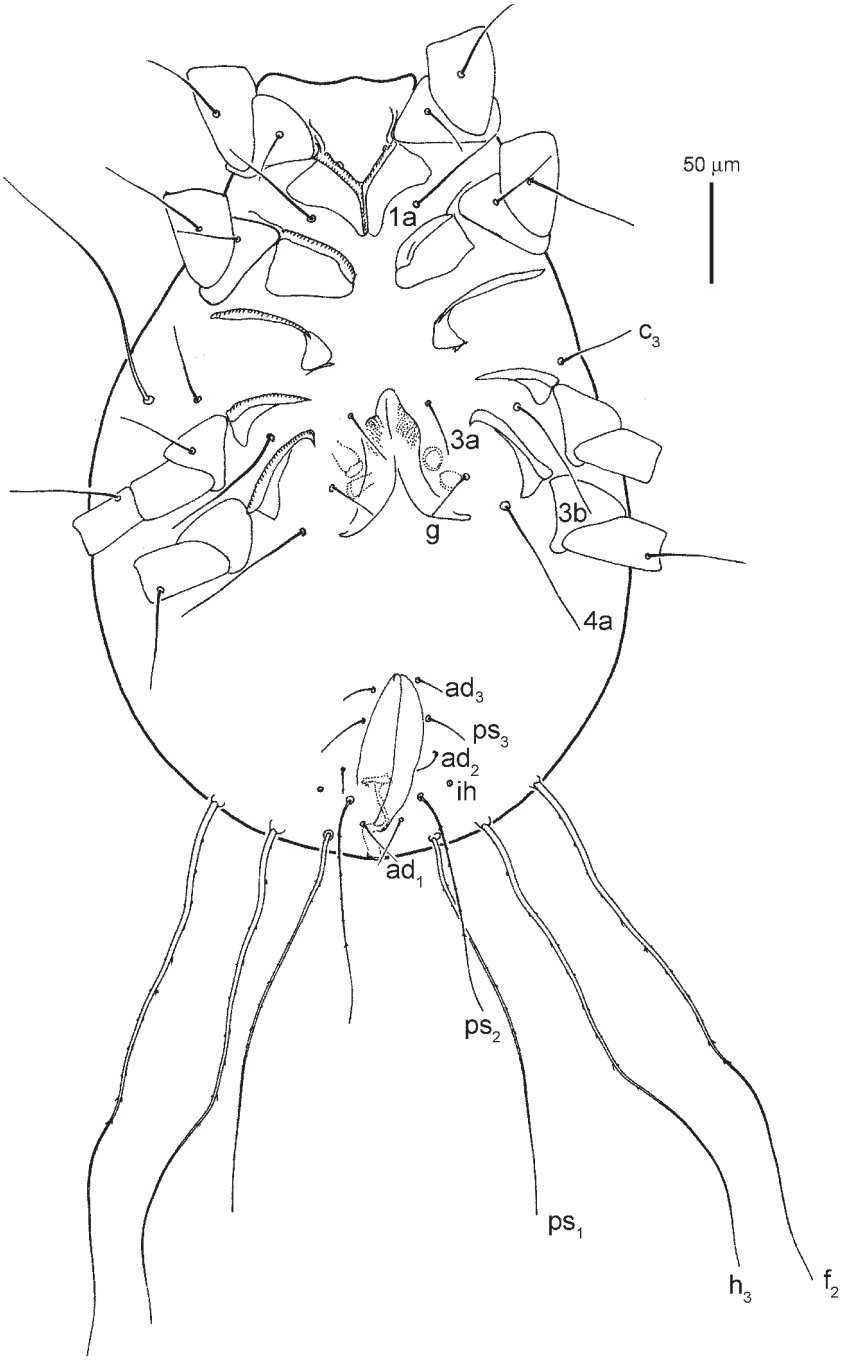


Fig. 130. *Tyrophagus pacificus* **sp. n.** (female). Ventral view of idiosoma.

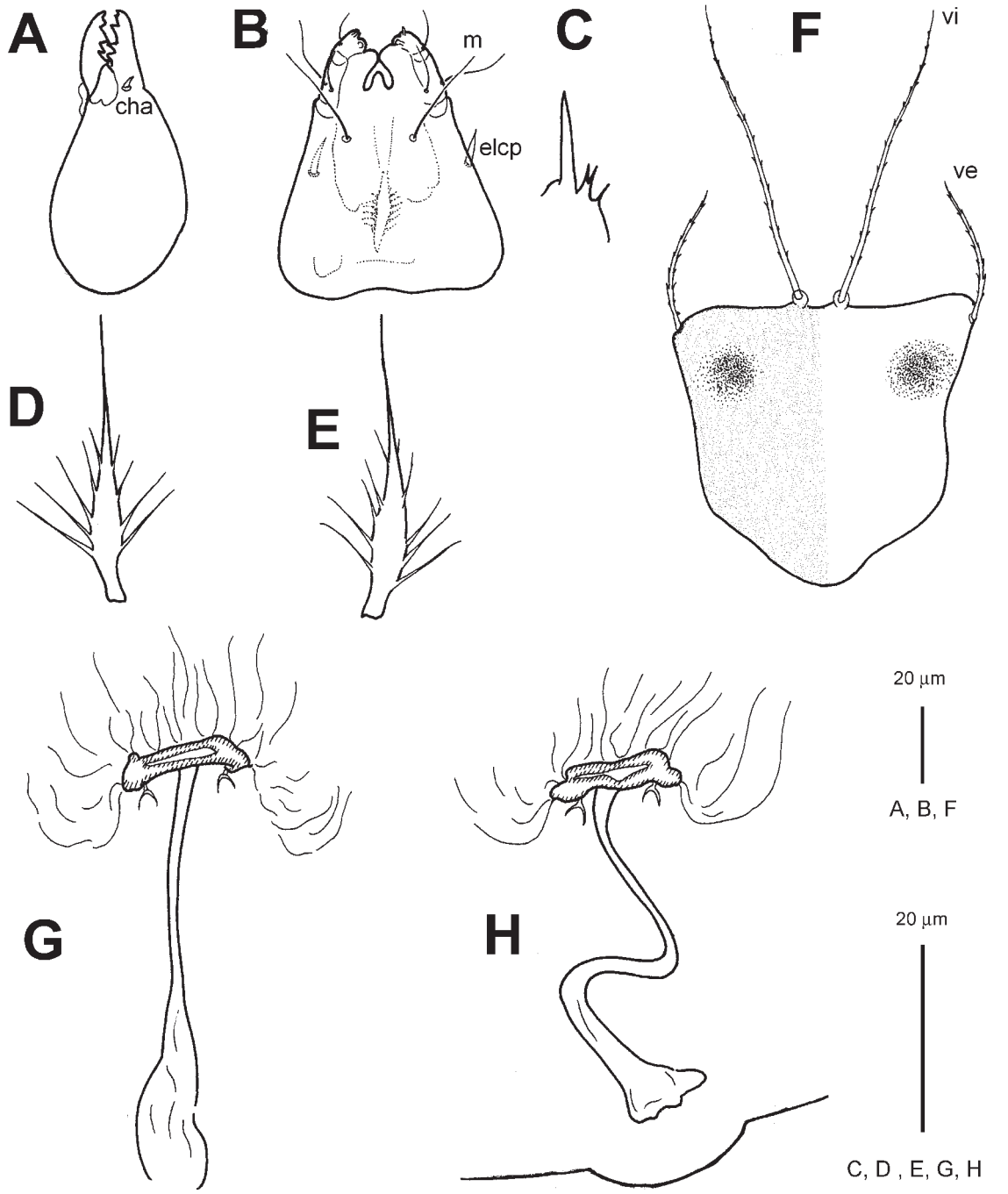


Fig. 131. *Tyrophagus pacificus* **sp. n.** (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, supracoxal seta; F, prodorsal shield; G, copulatory opening and spermatheca; H, copulatory opening and spermatheca.

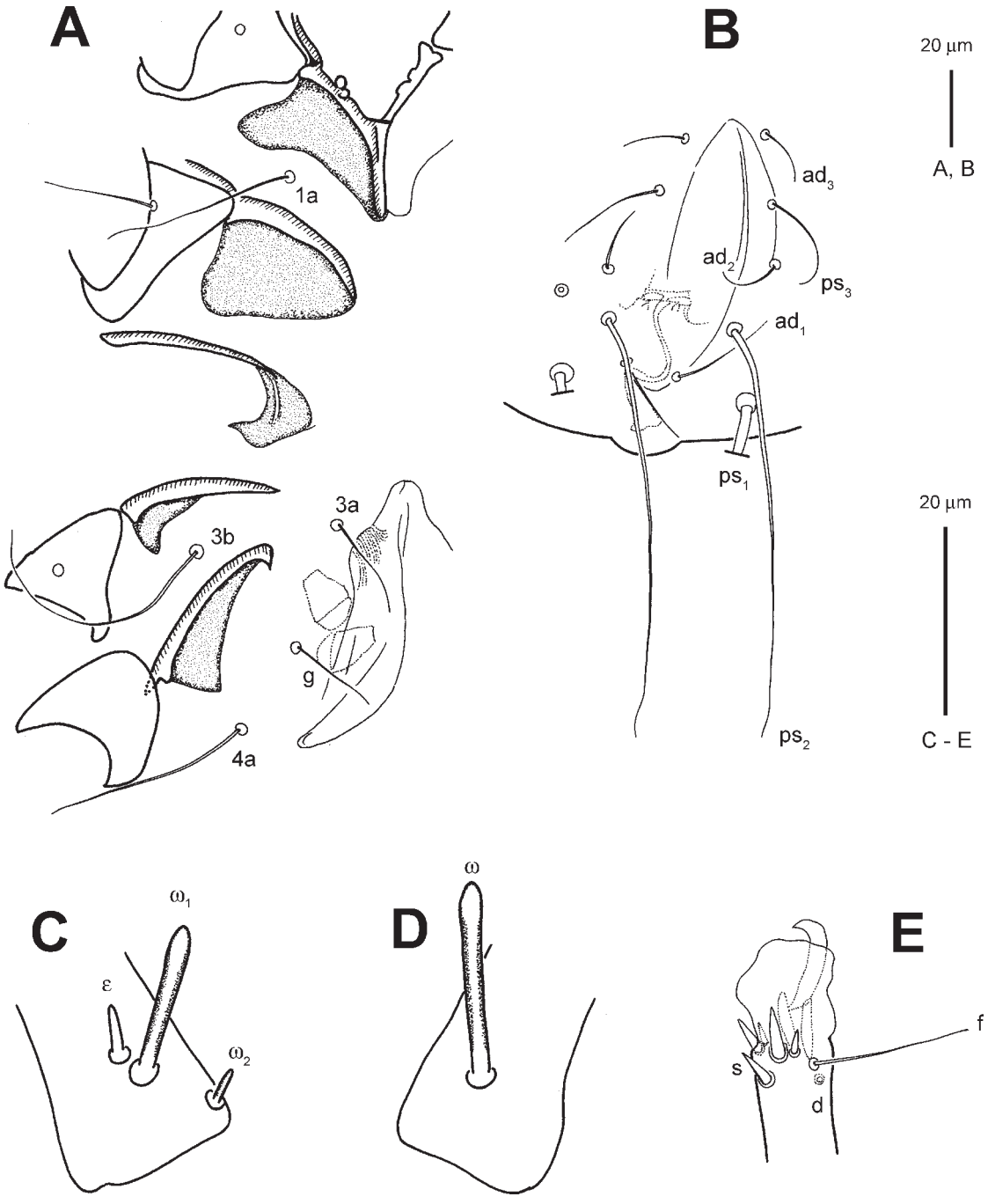


Fig. 132. *Tyrophagus pacificus* **sp. n.** (female). A, coxae I–IV; B, anus; C, solenidia and famulus of tarsus I; D, solenidion of tarsus II; E, ventral view of distal part of tarsus IV.

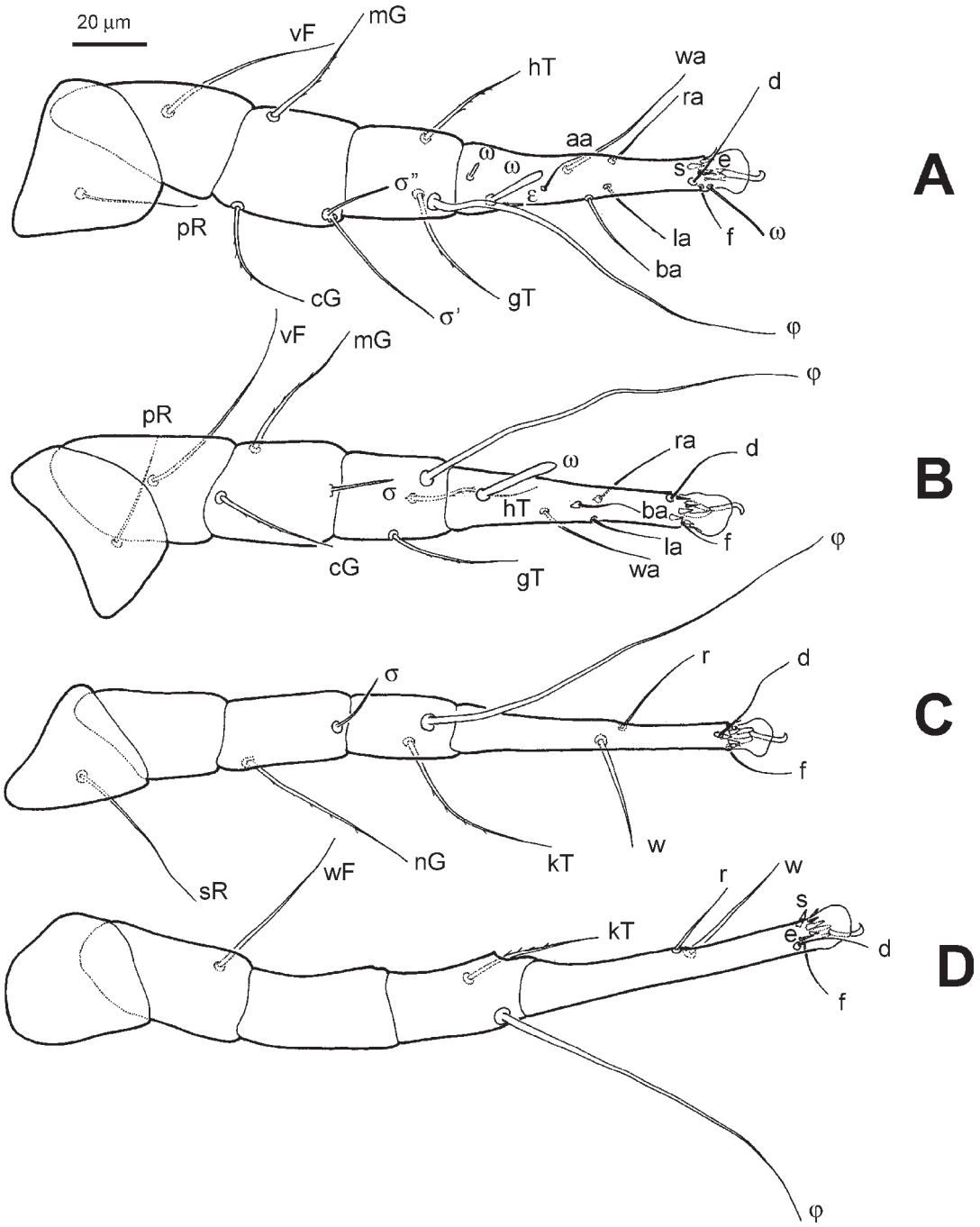


Fig. 133. *Tyrophagus pacificus* **sp. n.** (female). A, leg I; B, leg II; C, leg III; D, leg IV.

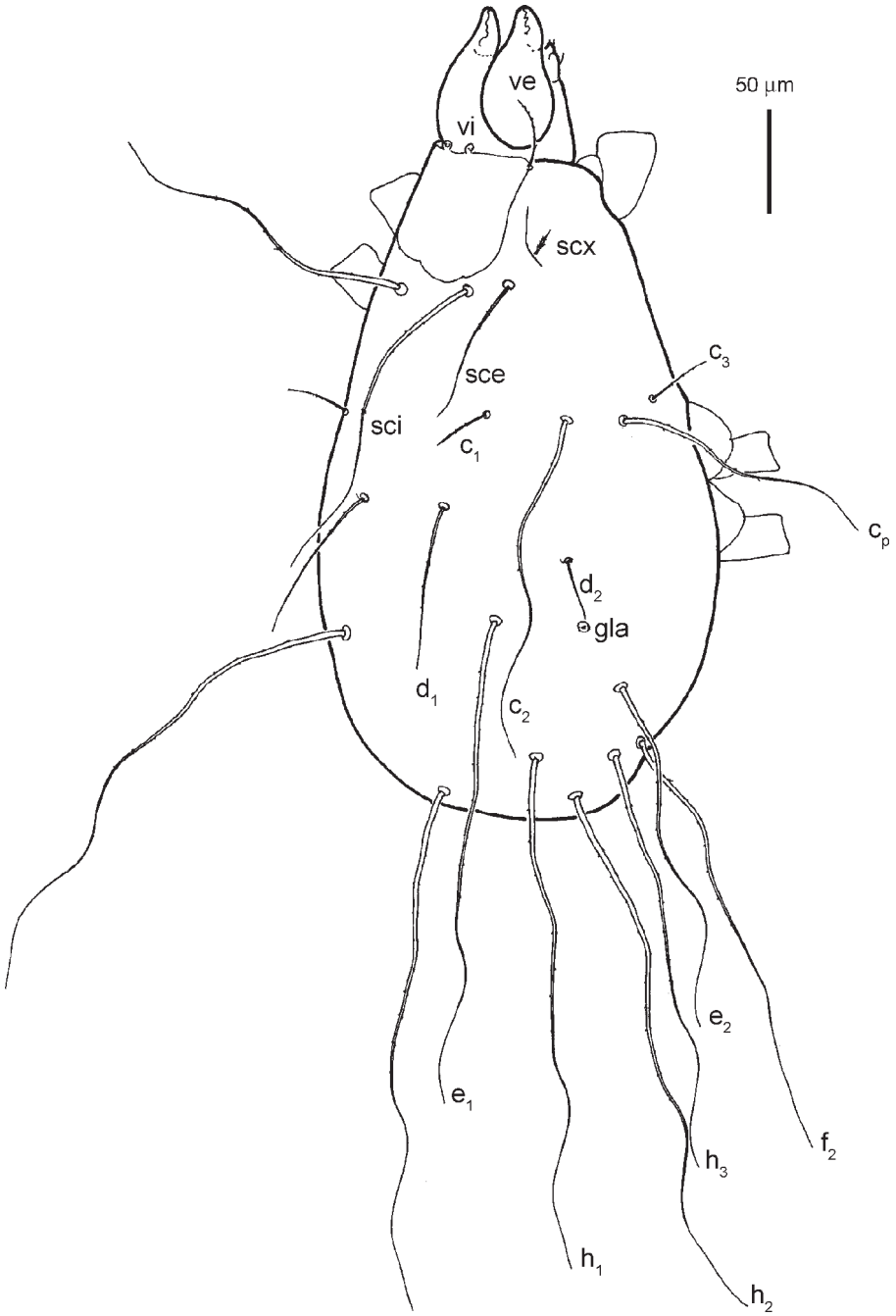


Fig. 134. *Tyrophagus pacificus* **sp. n.** (male). Dorsal view of idiosoma.

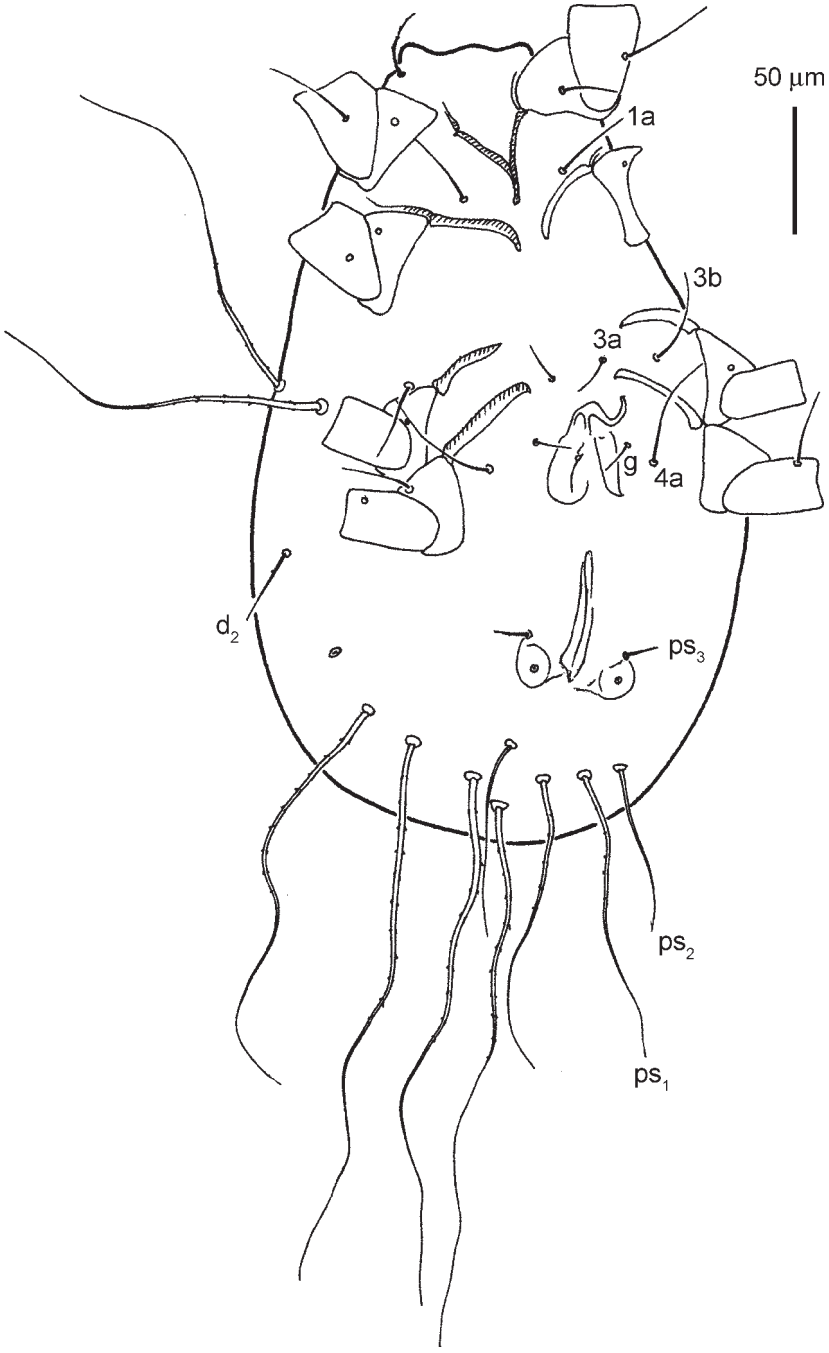


Fig. 135. *Tyrophagus pacificus* **sp. n.** (male). Ventral view of idiosoma.

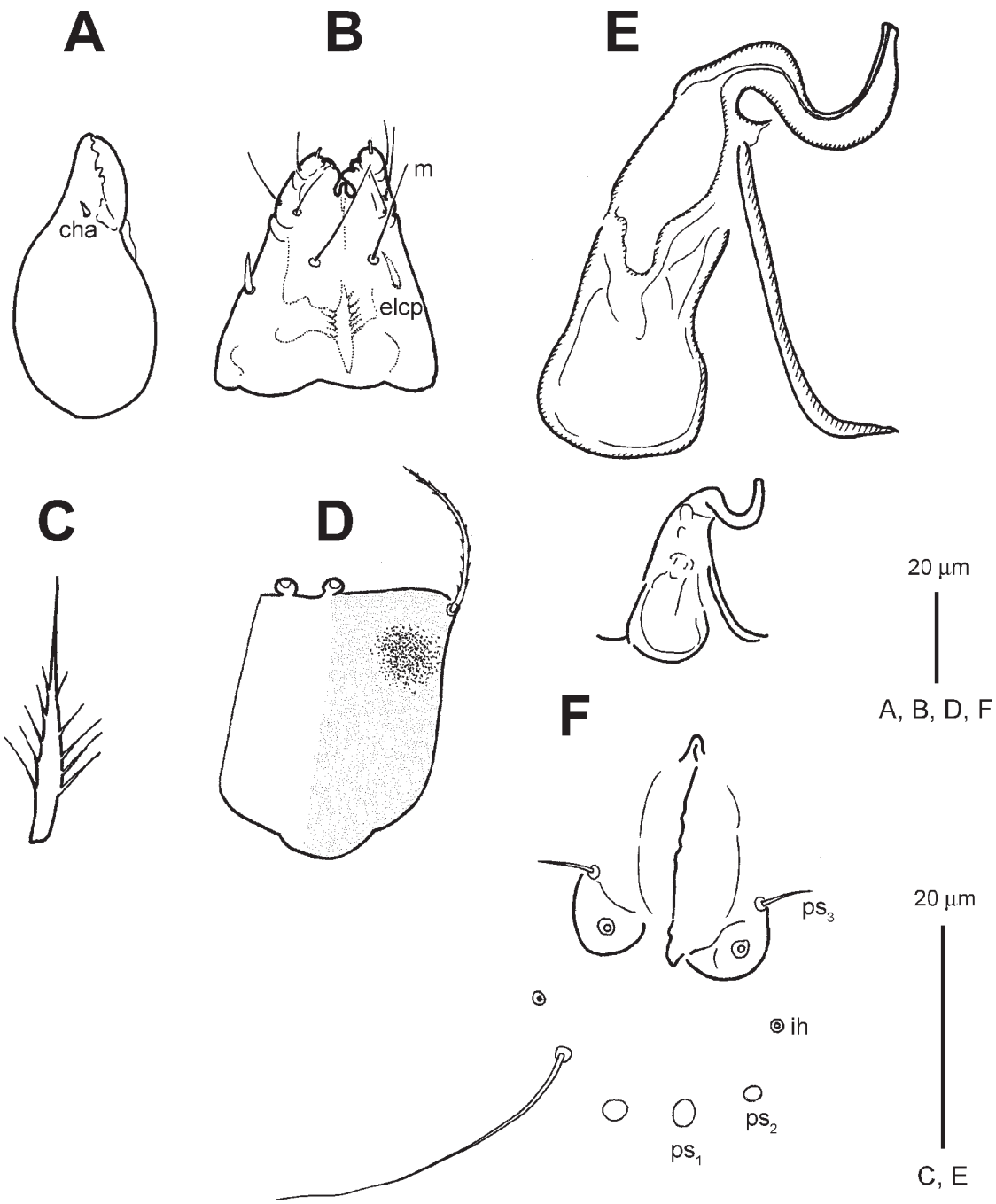


Fig. 136. *Tyrophagus pacificus* **sp. n.** (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, supracoxal seta; D, prodorsal shield; E, lateral view of aedeagus; F, aedeagus and anus.

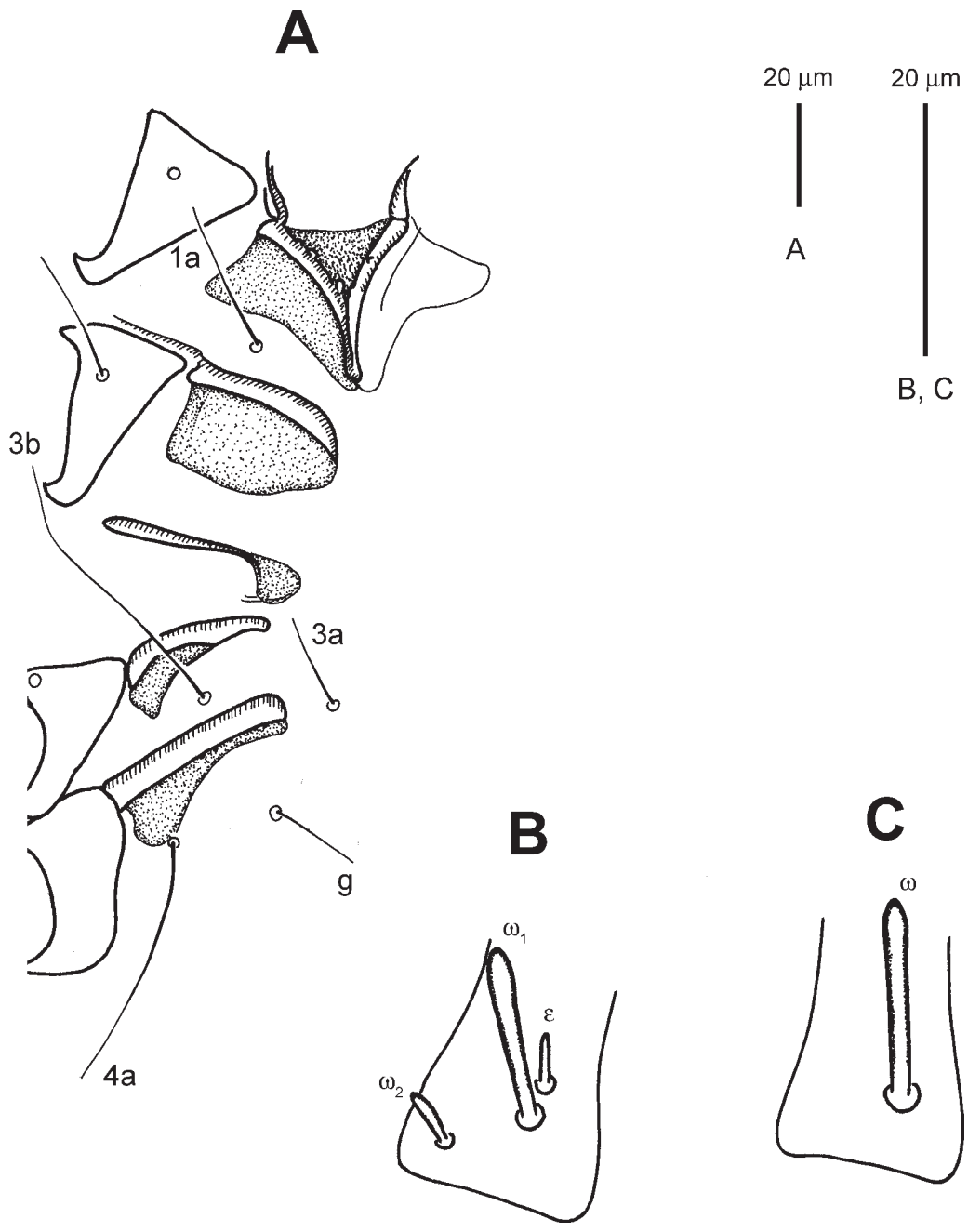


Fig. 137. *Tyrophagus pacificus* **sp. n.** (male). A, coxae I–IV; B, solenidia and famulus of tarsus I; C, solenidion of tarsus II.

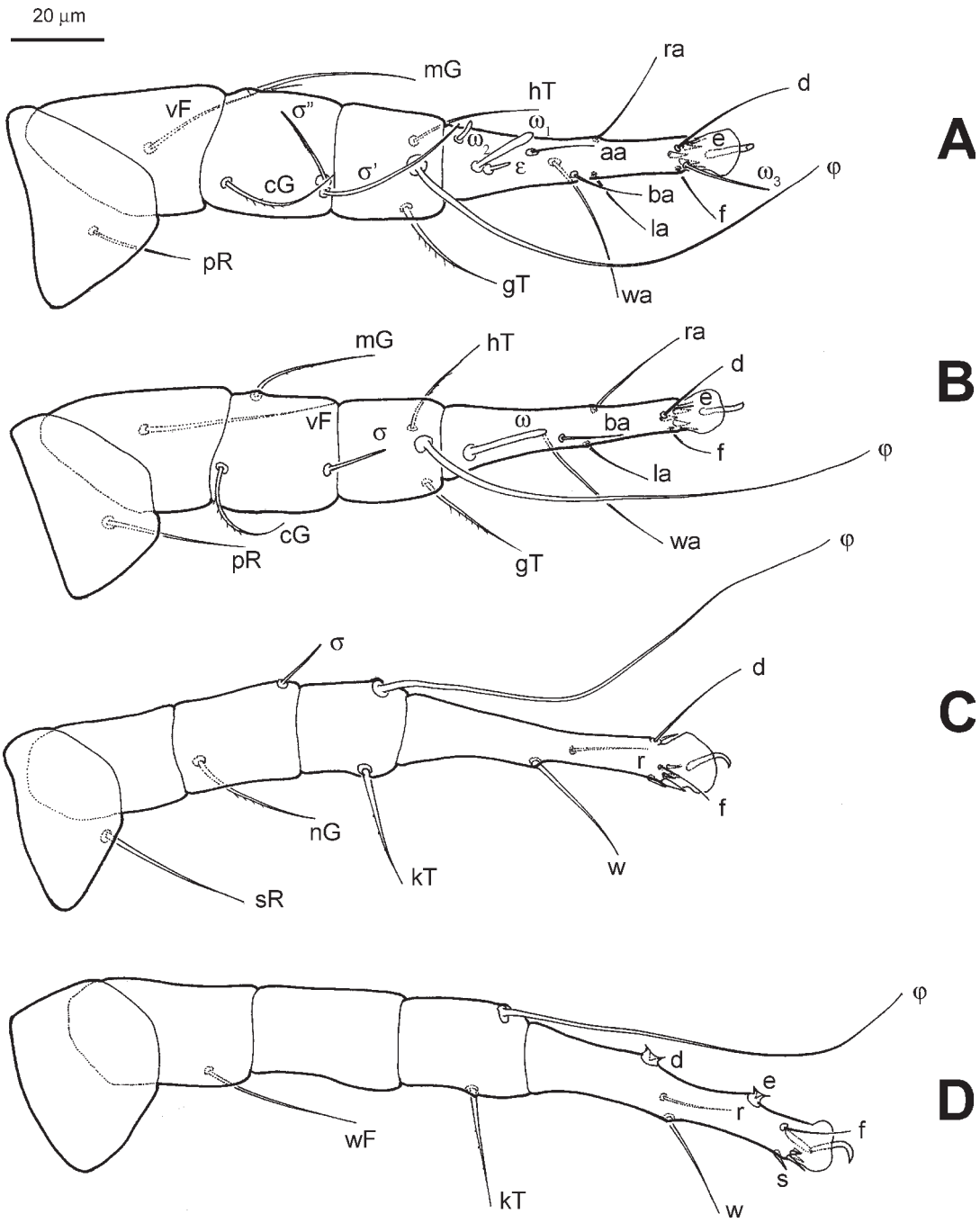


Fig. 138. *Tyrophagus pacificus* **sp. n.** (male). A, leg I; B, leg II; C, leg III; D, leg IV.

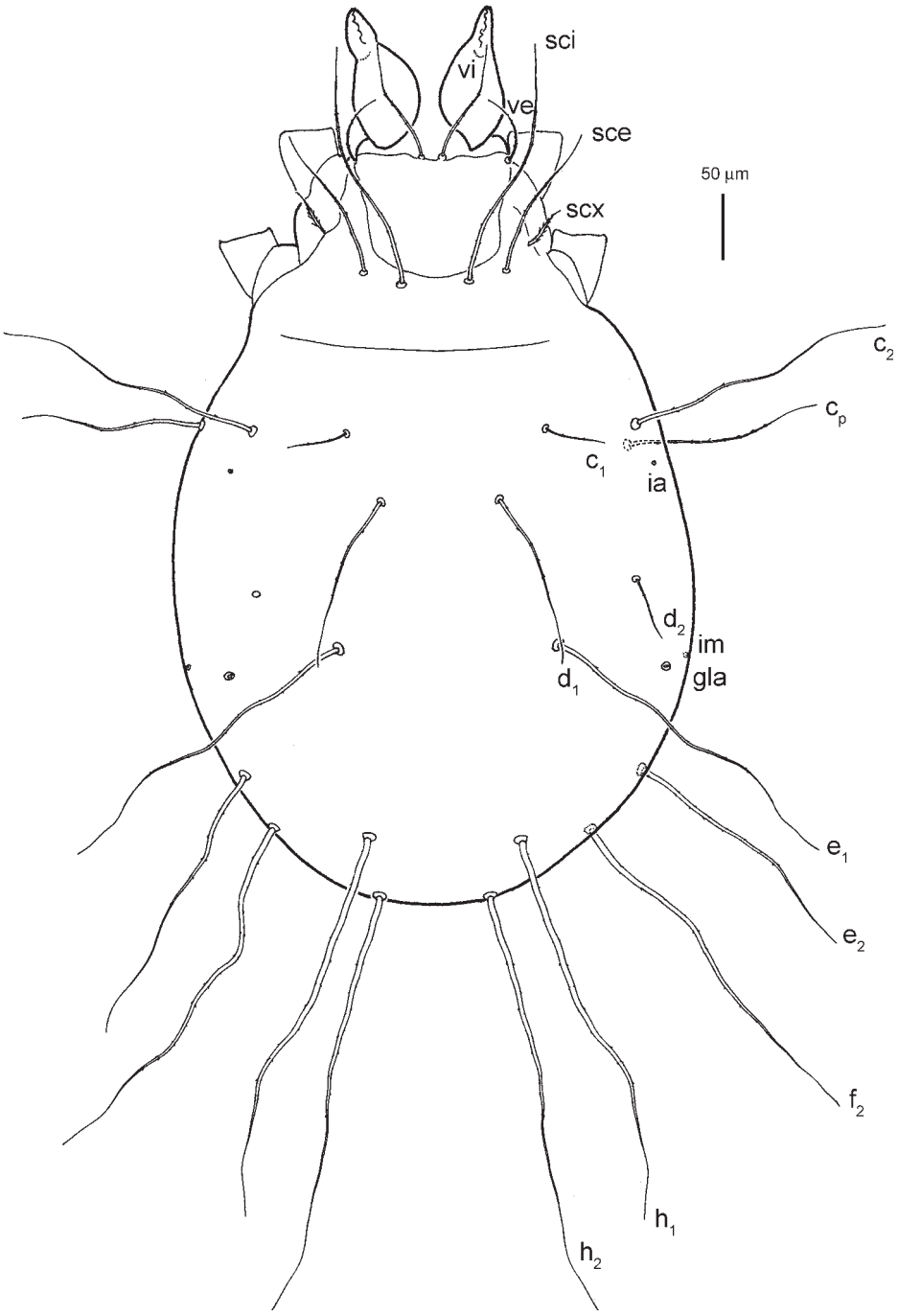


Fig. 139. *Tyrophagus perniciosus* Zakhvatkin, 1941 (female). Dorsal view of idiosoma.

Fig. 140. *Tyrophagus perniciosus* Zakhvatkin, 1941 (female). Ventral view of idiosoma.

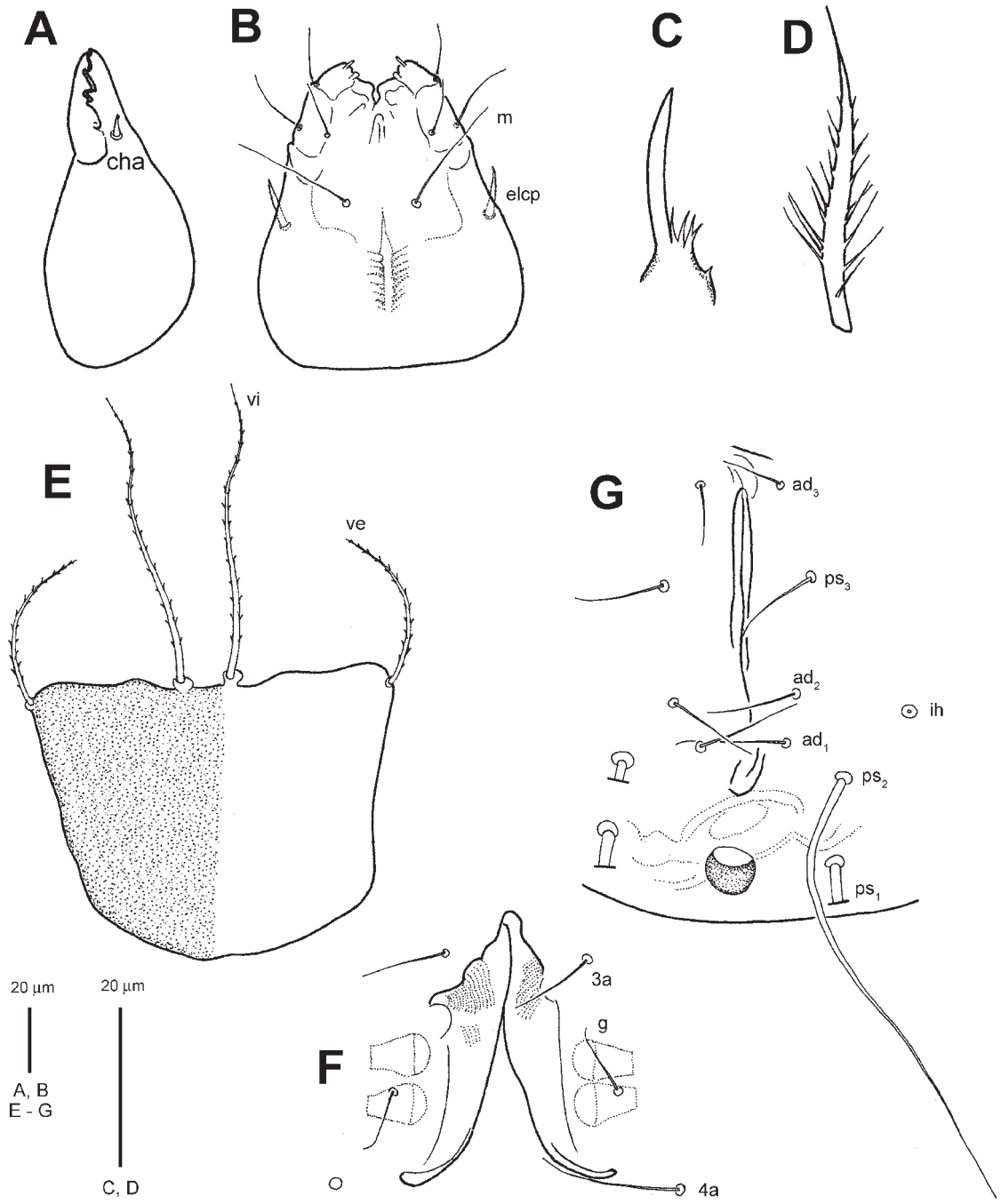


Fig. 141. *Tyrophagus perniciosus* Zakhvatkin, 1941 (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, prodorsal shield; F, genital opening; G, anus.

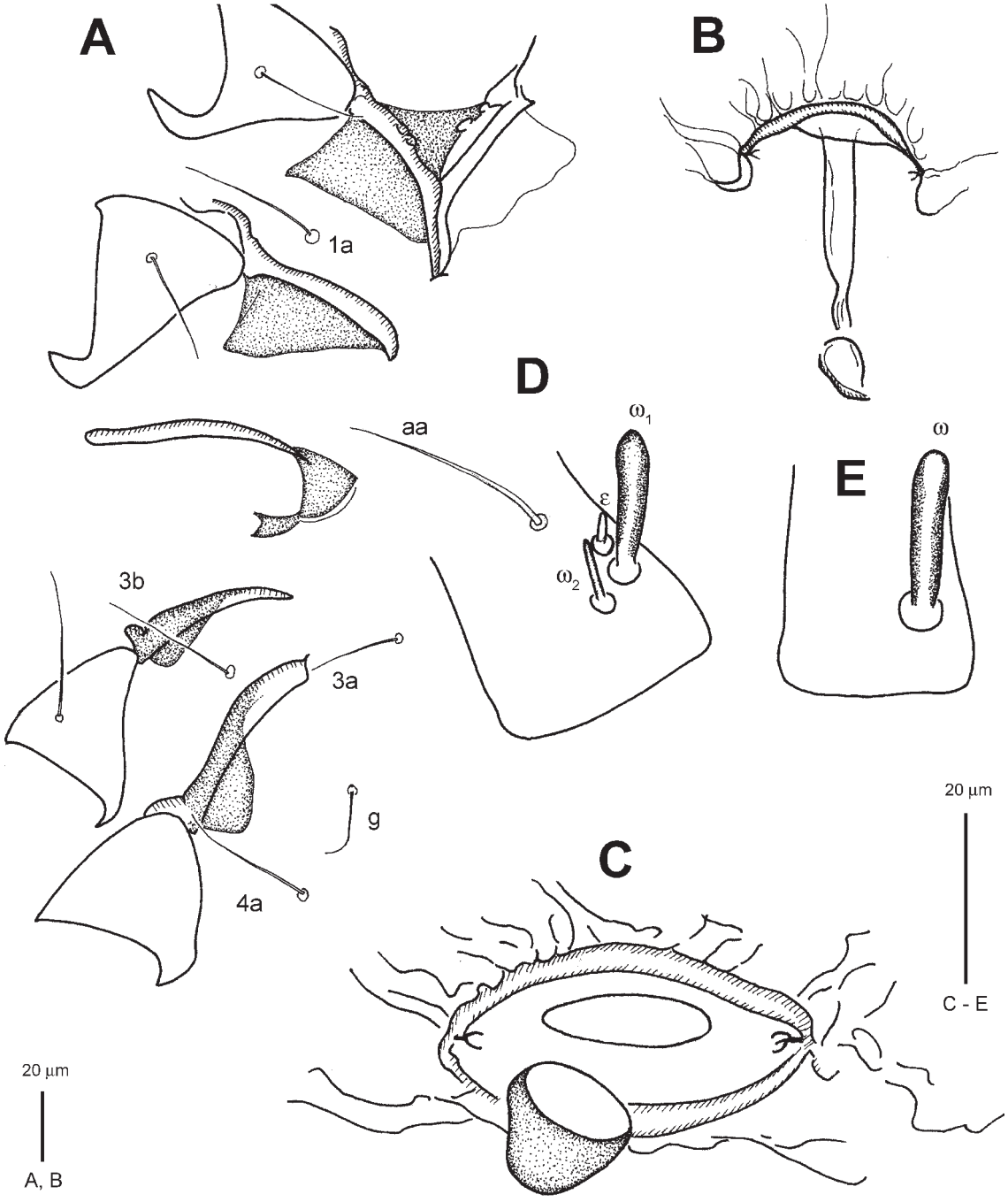


Fig. 142. *Tyrophagus perniciosus* Zakhvatkin, 1941 (female). A, coxae I–IV; B, copulatory opening and spermatheca; C, copulatory opening and folded spermatheca; D, solenidia, famulus, and seta of tarsus I; E, solenidion of tarsus II.

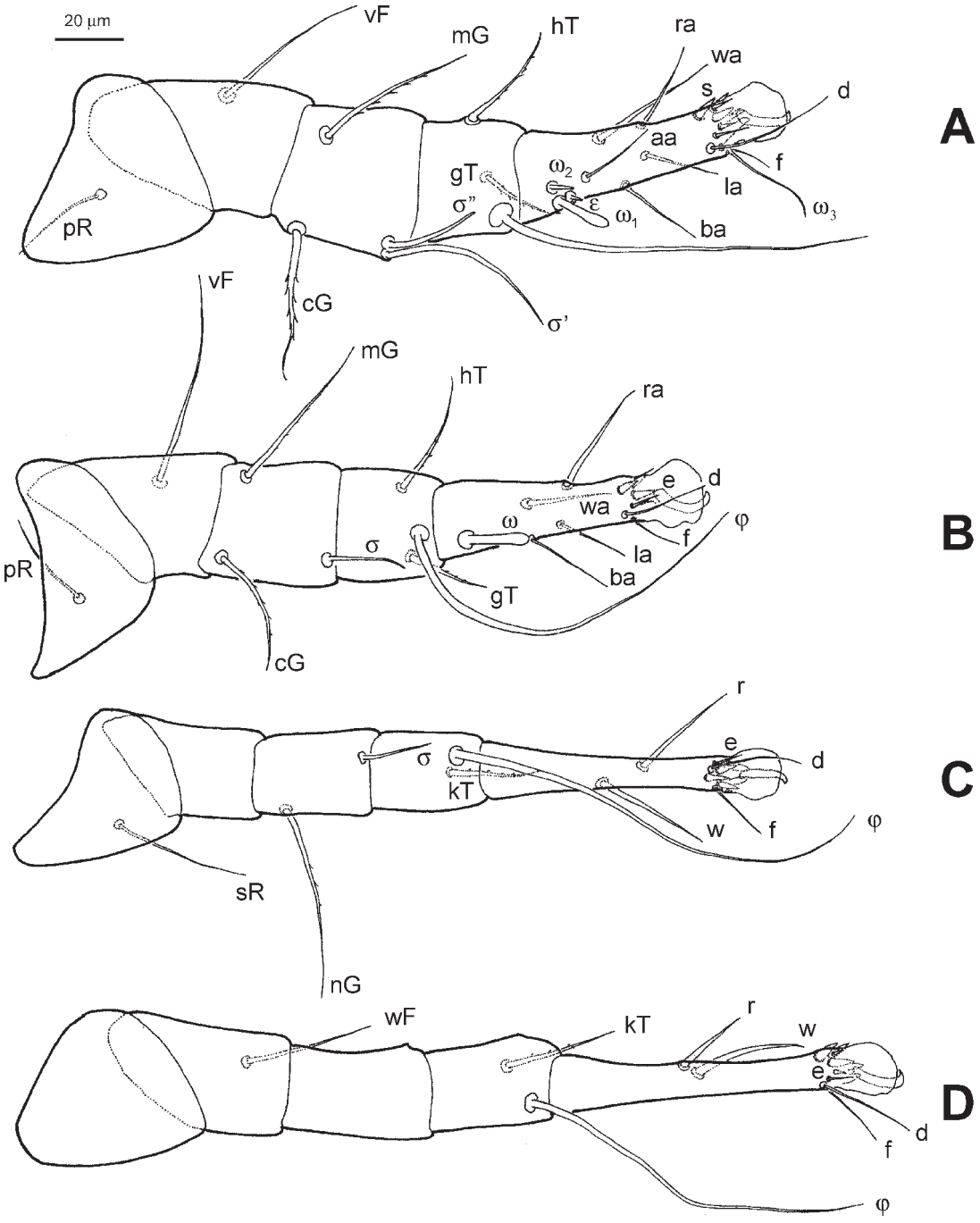


Fig. 143. *Tyrophagus perniciosus* Zakhvatkin, 1941 (female). A, leg I; B, leg II; C, leg III; D, leg IV.

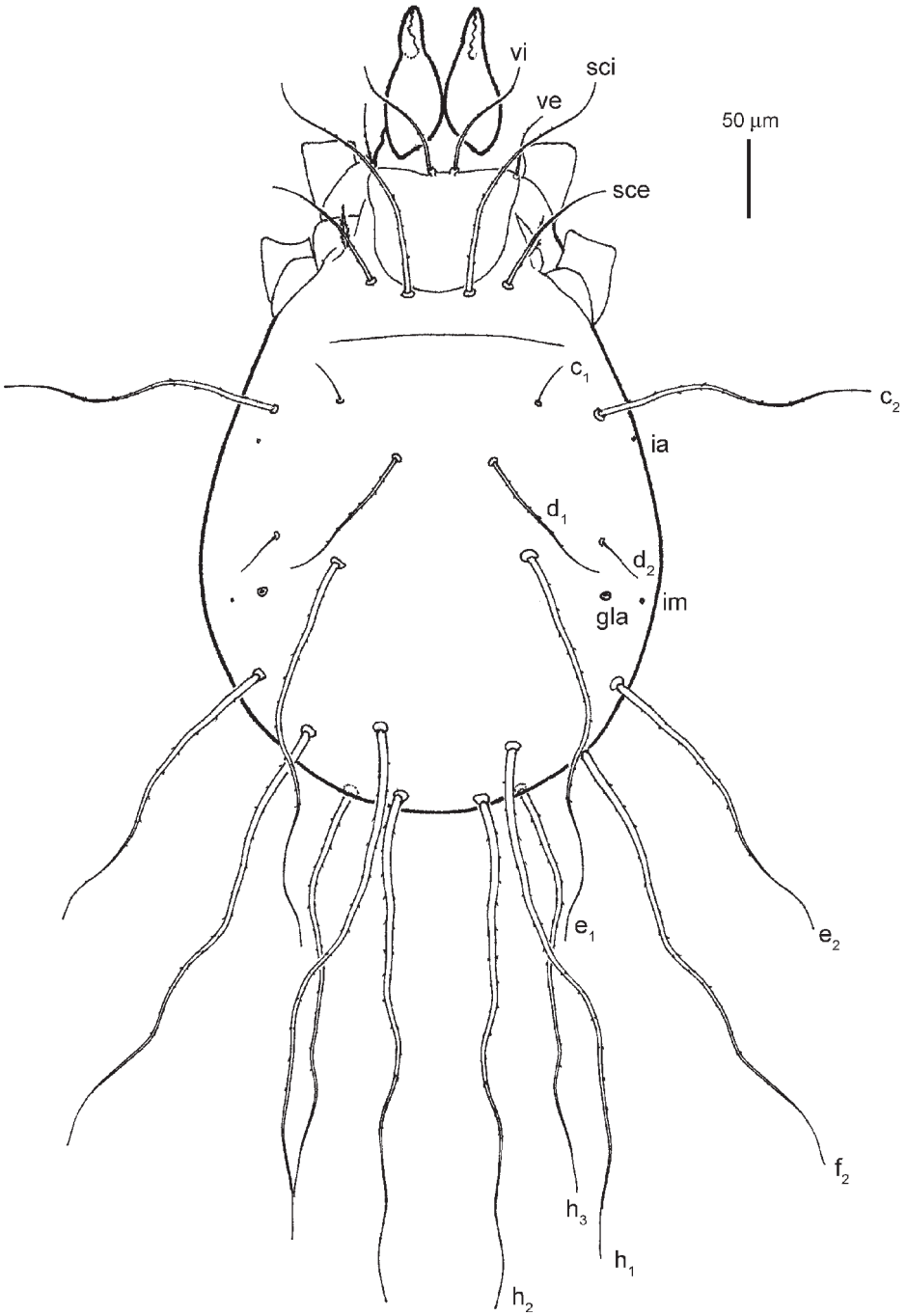


Fig. 144. *Tyrophagus perniciosus* Zakhvatkin, 1941 (male). Dorsal view of idiosoma.

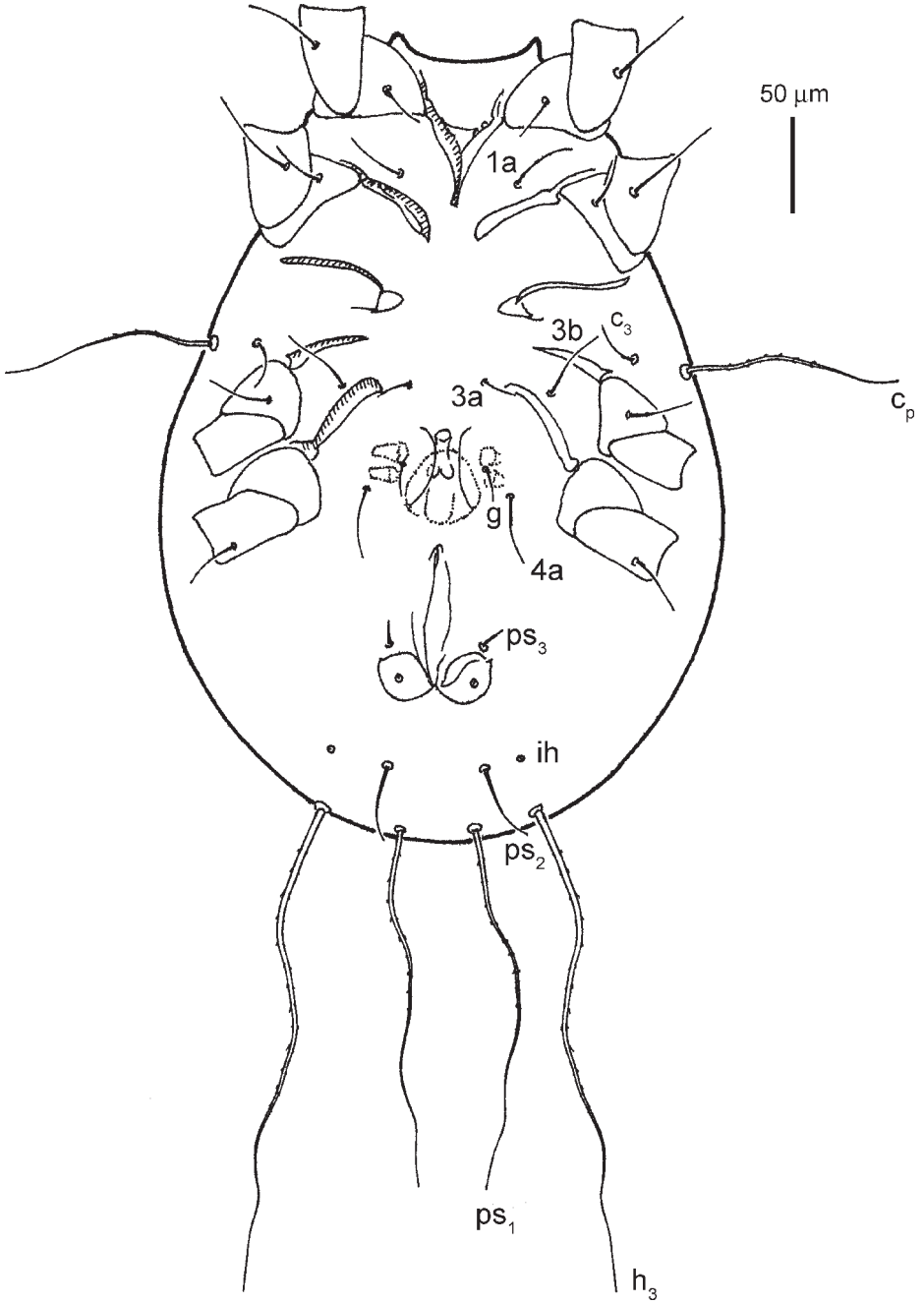


Fig. 145. *Tyrophagus perniciosus* Zakhvatkin, 1941 (male). Ventral view of idiosoma.

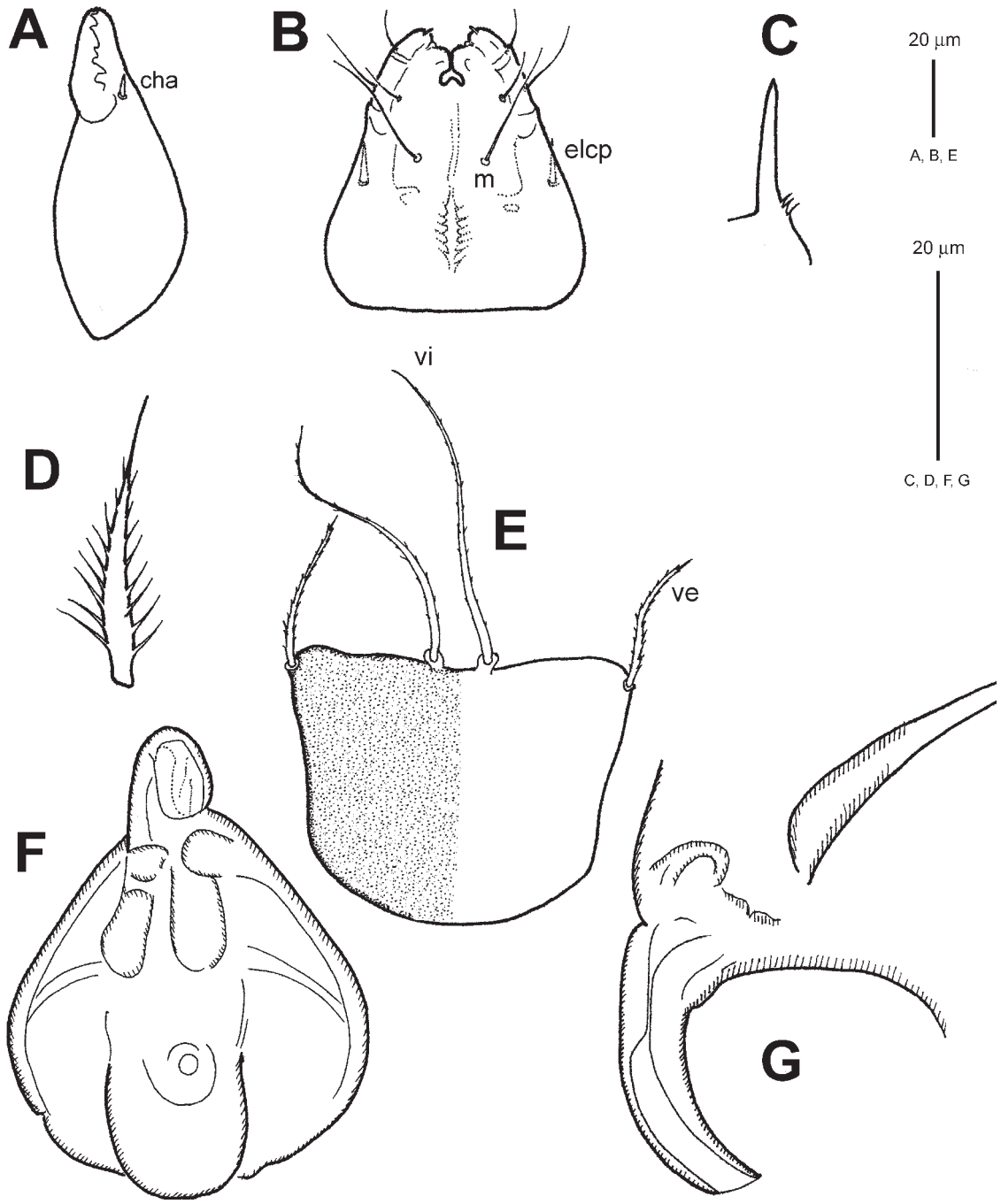


Fig. 146. *Tyrophagus perniciosus* Zakhvatkin, 1941 (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, supracoxal seta; E, prodorsal shield; F, ventral view of aedeagus; G, lateral view of aedeagus.

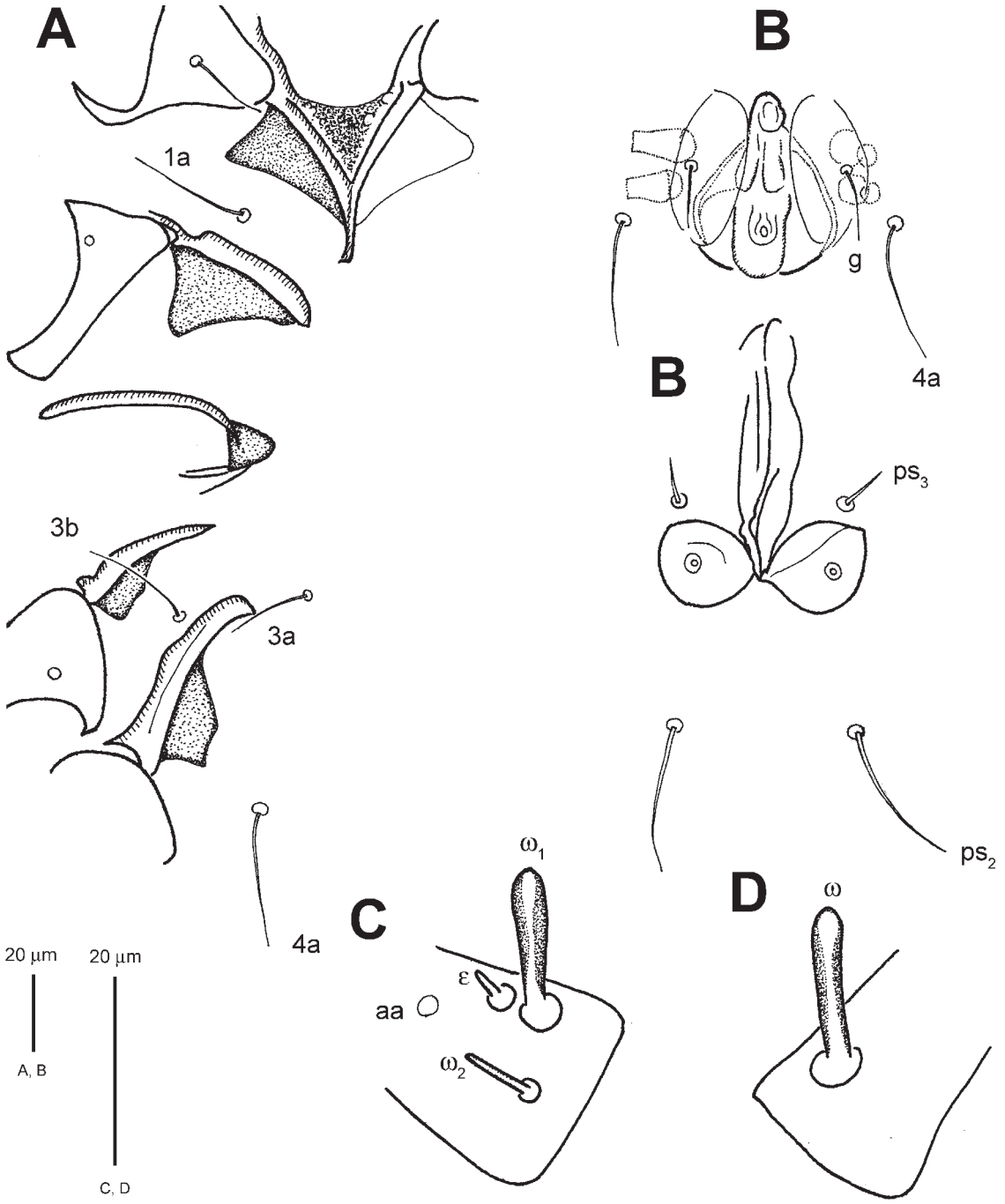


Fig. 147. *Tyrophagus perniciosus* Zakhvatkin, 1941 (male). A, coxae I–IV; B, genital opening and anus; C, solenidia, famulus, and seta of tarsus I; D, solenidion of tarsus II.

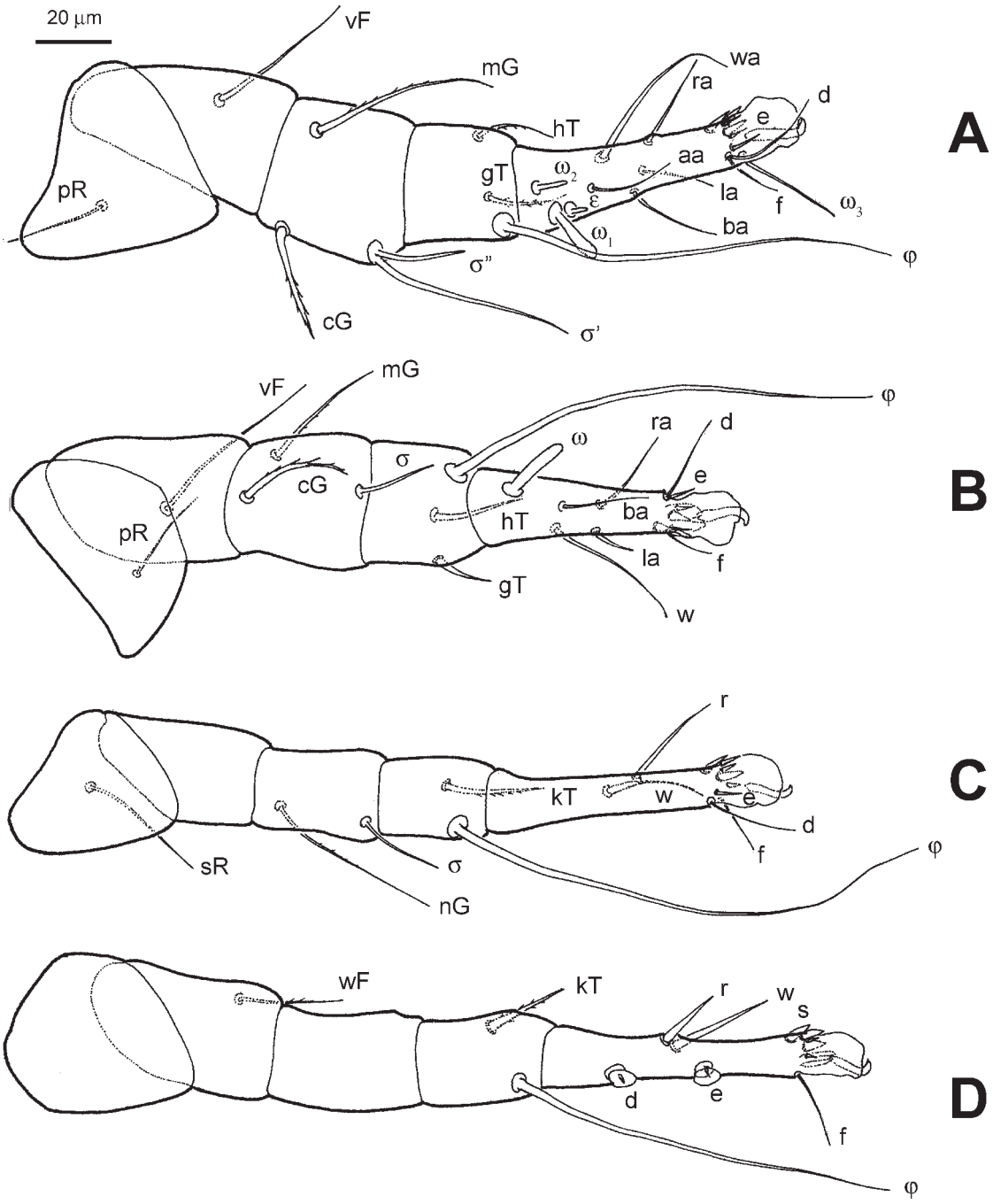


Fig. 148. *Tyrophagus perniciosus* Zakhvatkin, 1941 (male). A, leg I; B, leg II; C, leg III; D, leg IV.

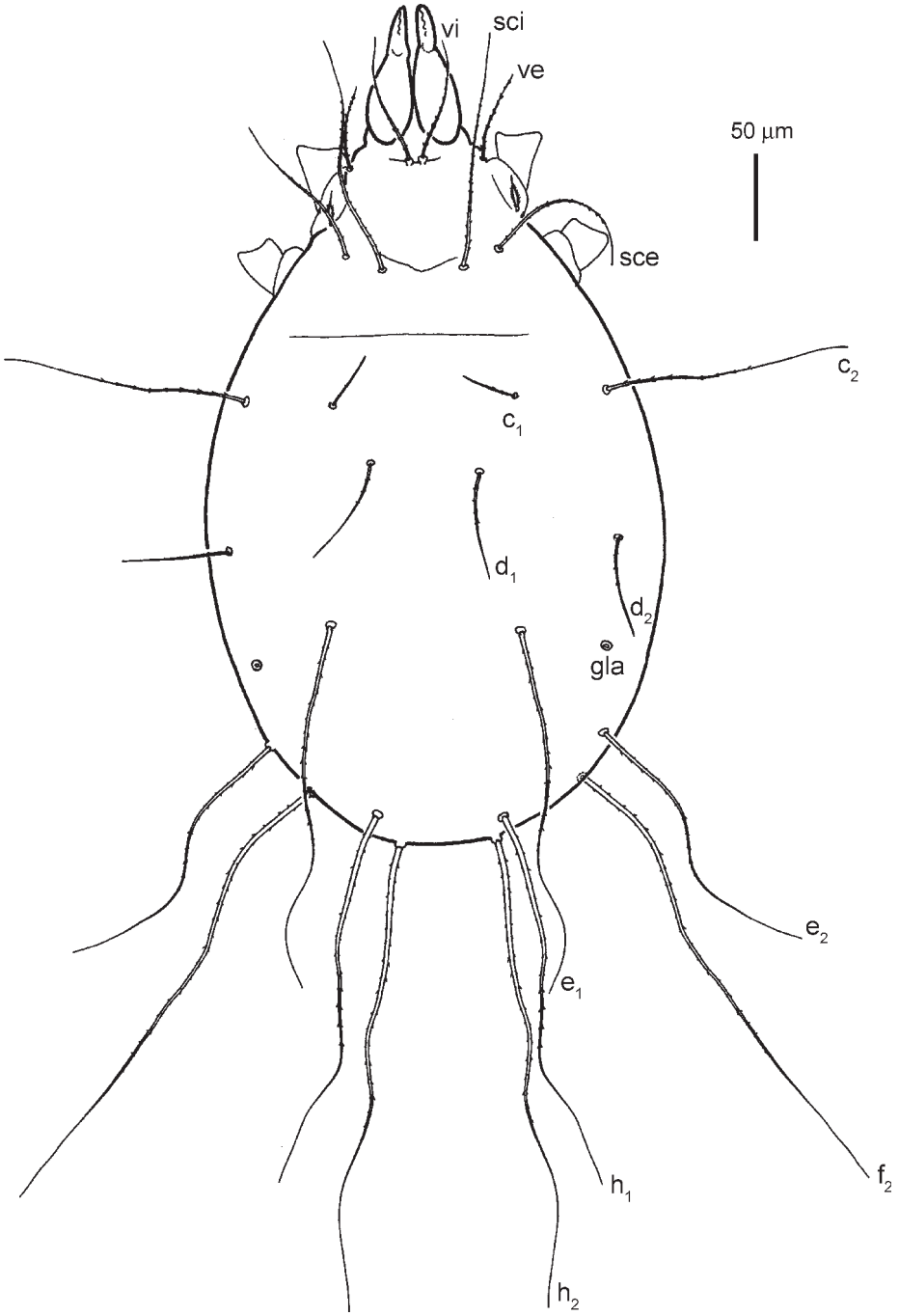


Fig. 149. *Tyrophagus tropicus* Robertson, 1959 (female). Dorsal view of idiosoma.

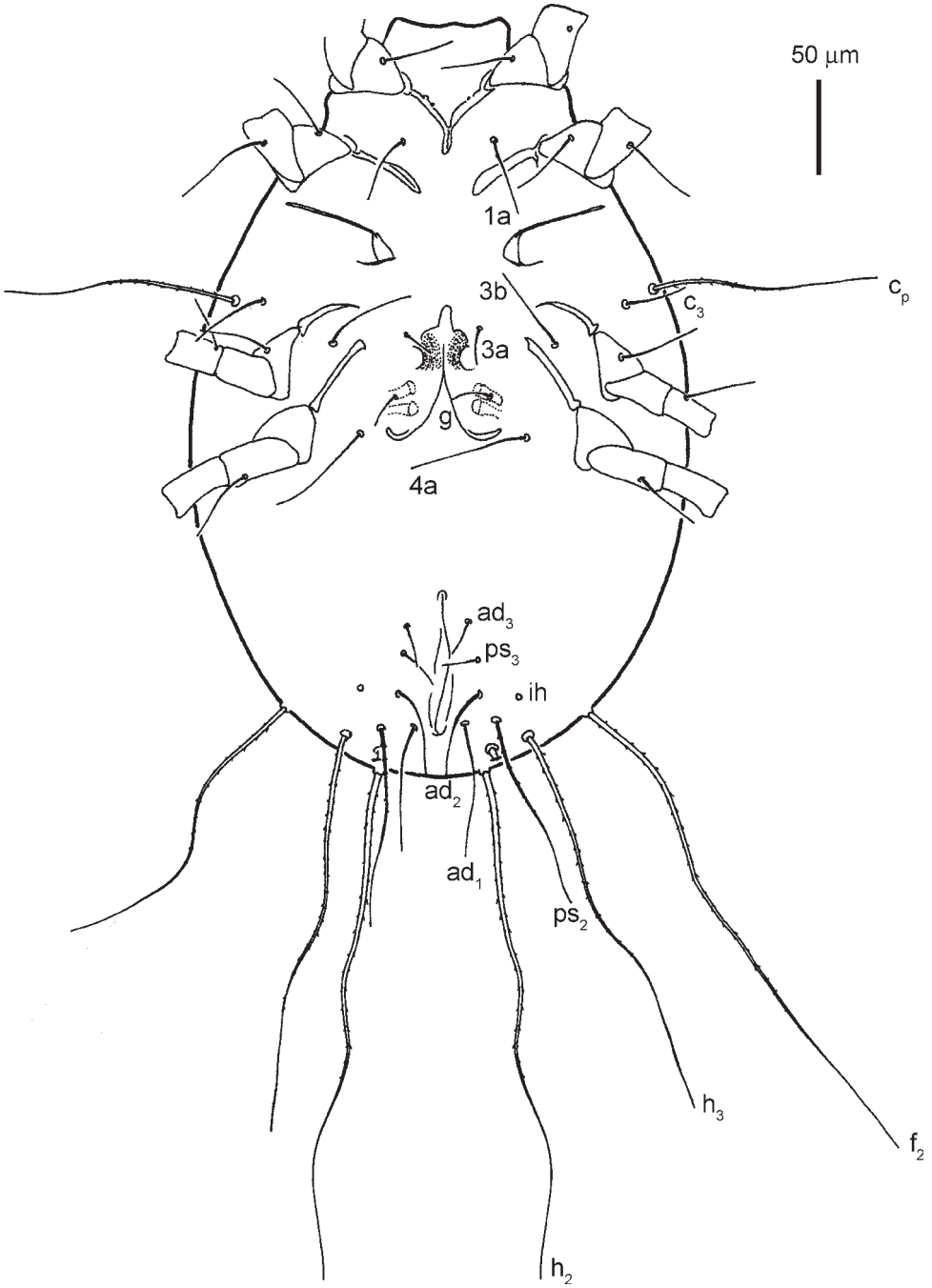


Fig. 150. *Tyrophagus tropicus* Robertson, 1959 (female). Ventral view of idiosoma.

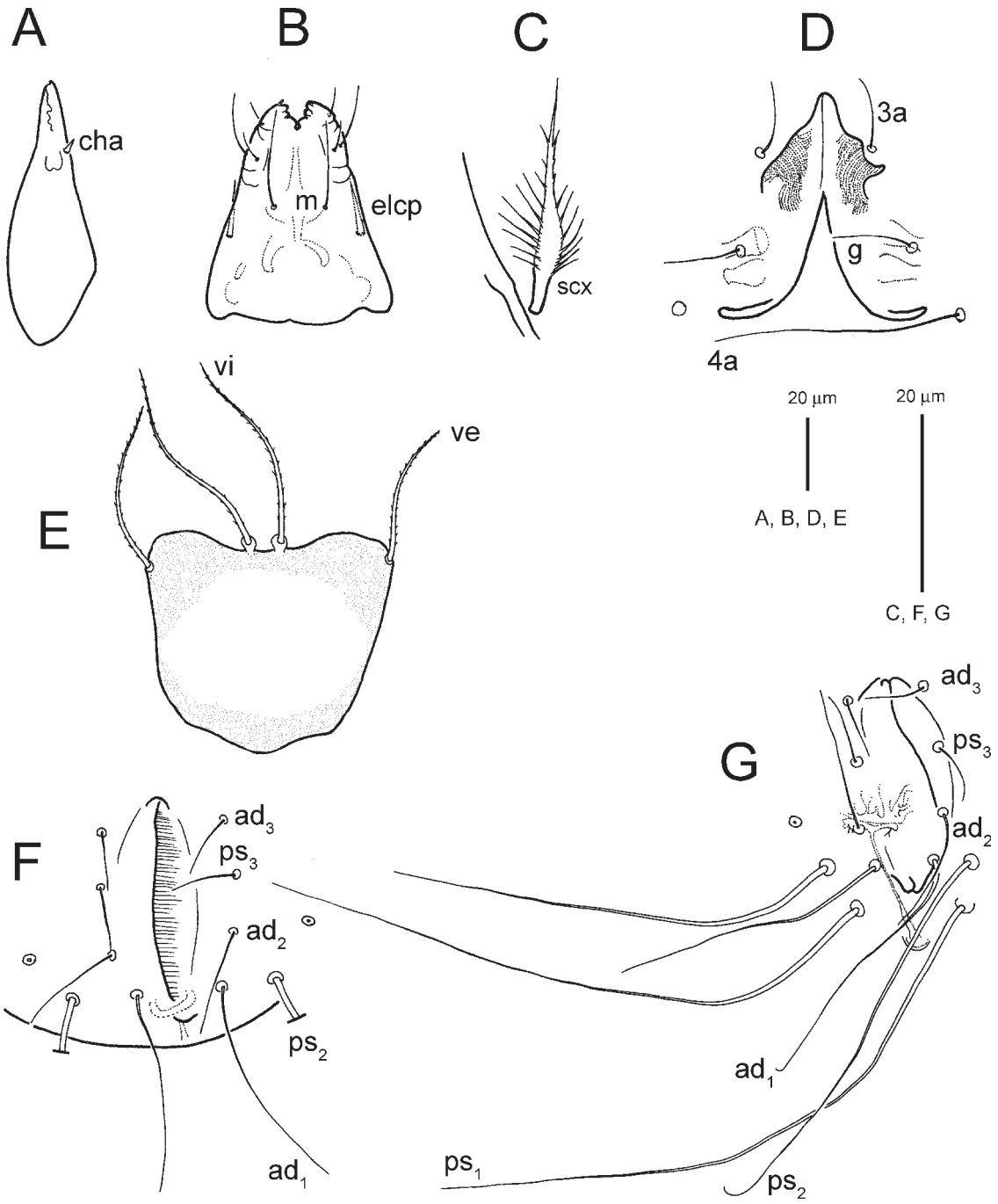


Fig. 151. *Tyrophagus tropicus* Robertson, 1959 (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, supracoxal seta; D, genital opening; E, prodorsal shield; F, anus; G, anus.

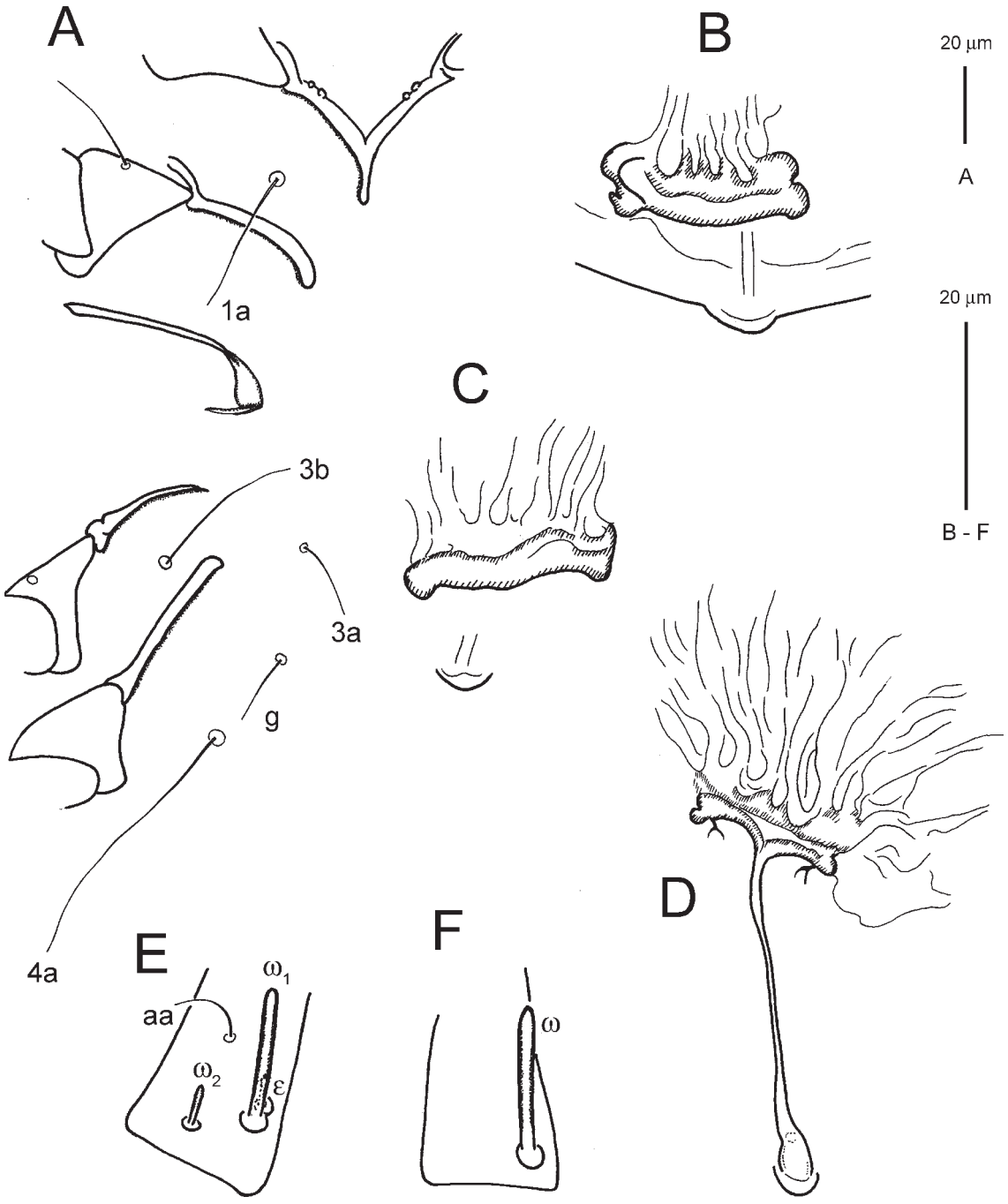


Fig. 152. *Tyrophagus tropicus* Robertson, 1959 (female). A, coxae I–IV; B, copulatory opening and folded spermatheca; C, copulatory opening and folded spermatheca; D, copulatory opening and spermatheca; E, solenidia, famulus, and seta of tarsus I; F, solenidion of tarsus II.

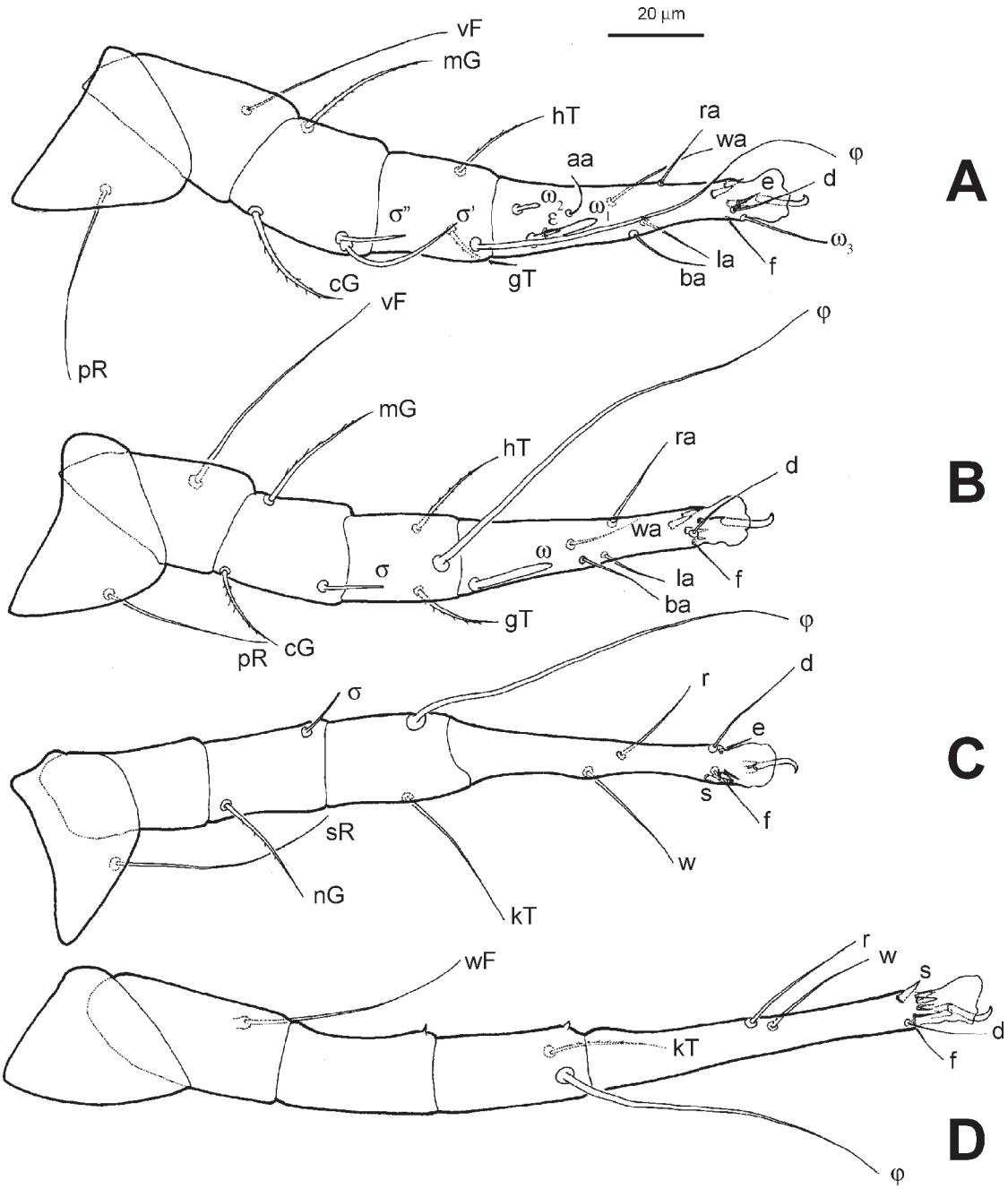


Fig. 153. *Tyrophagus tropicus* Robertson, 1959 (female). A, leg I; B, leg II; C, leg III; D, leg IV.

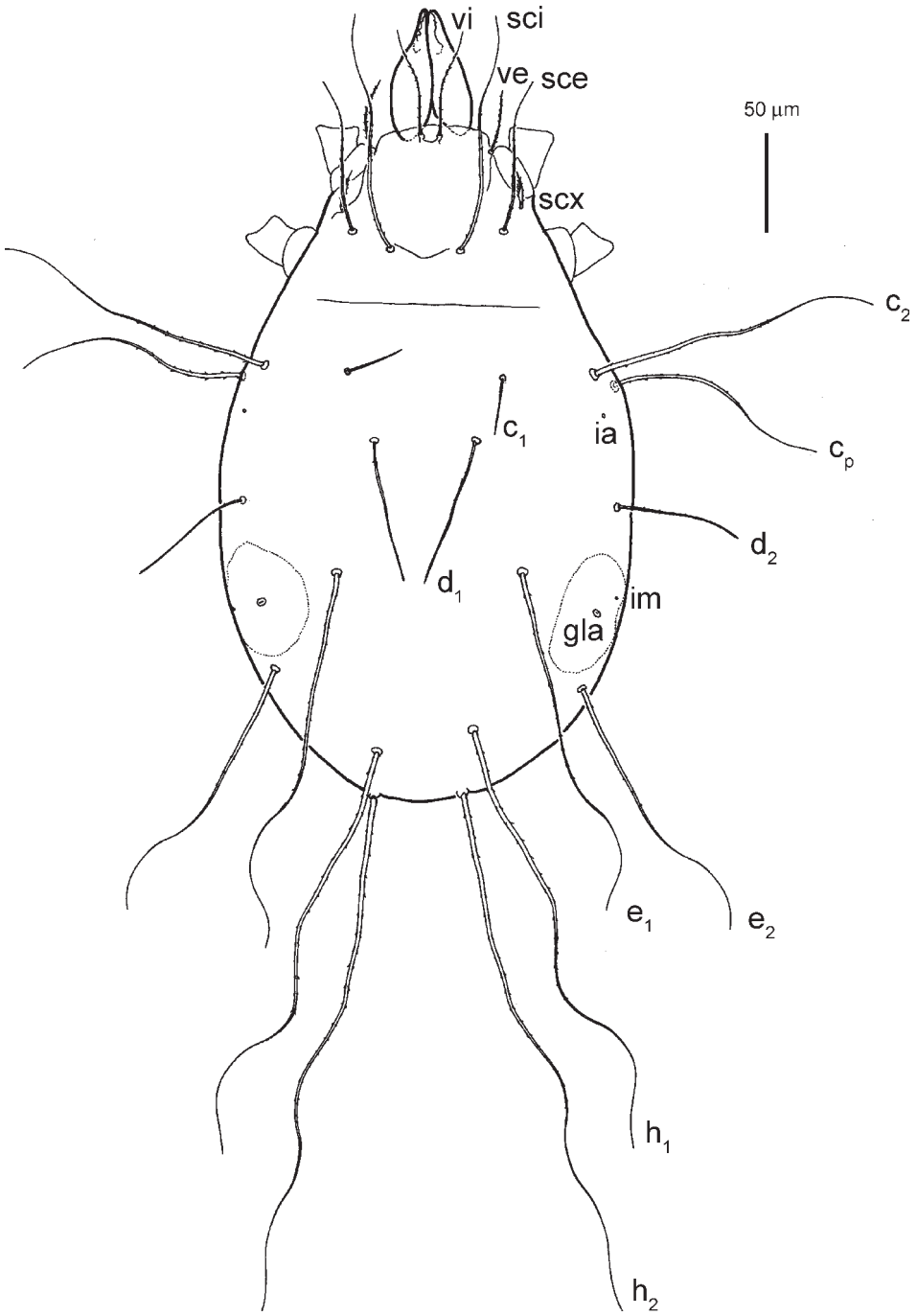


Fig. 154. *Tyrophagus tropicus* Robertson, 1959 (male). Dorsal view of idiosoma.

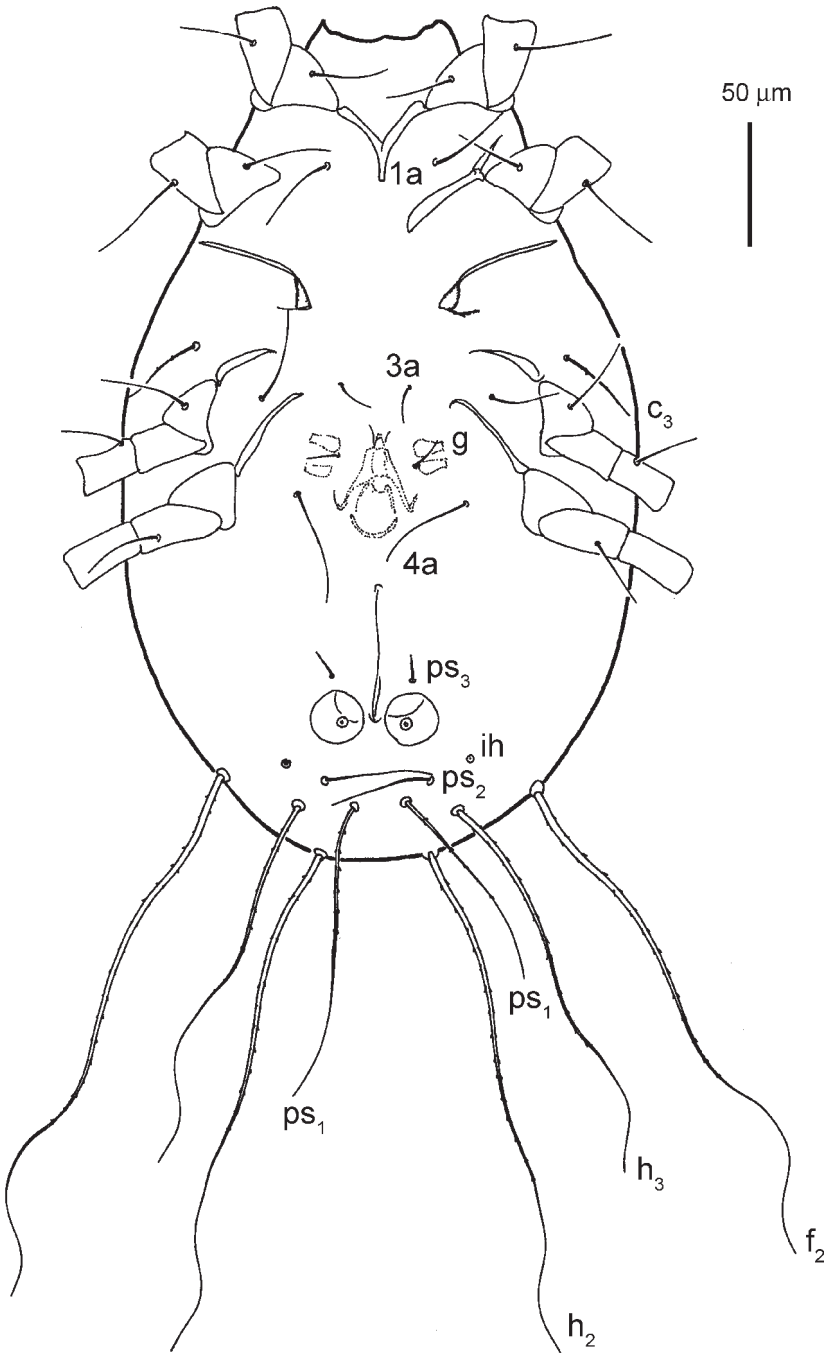


Fig. 155. *Tyrophagus tropicus* Robertson, 1959 (male). Ventral view of idiosoma.

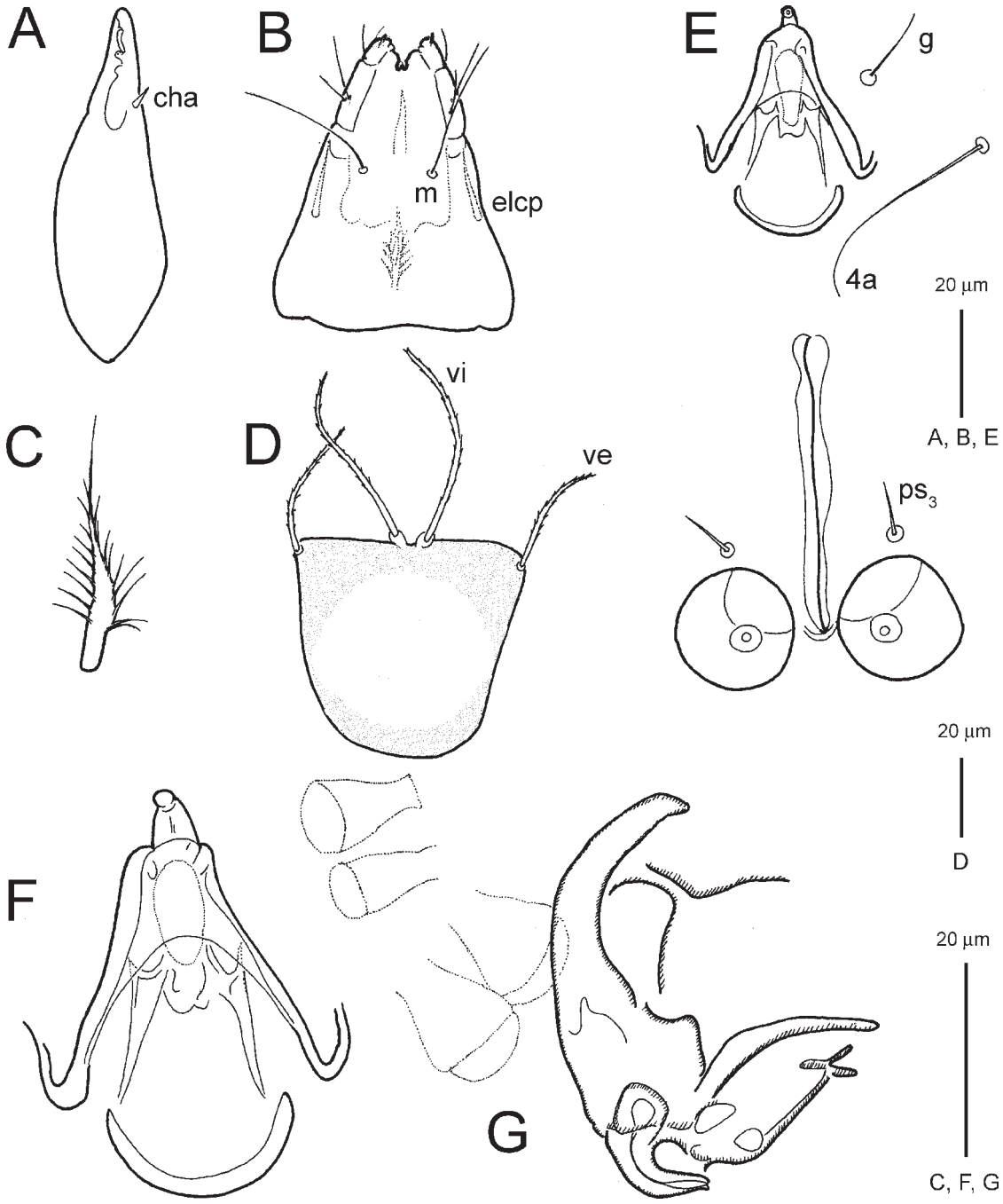


Fig. 156. *Tyrophagus tropicus* Robertson, 1959 (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, supracoxal seta; D, prodorsal shield; E, aedeagus and anus; F, ventral view of aedeagus; G, lateral view of aedeagus.

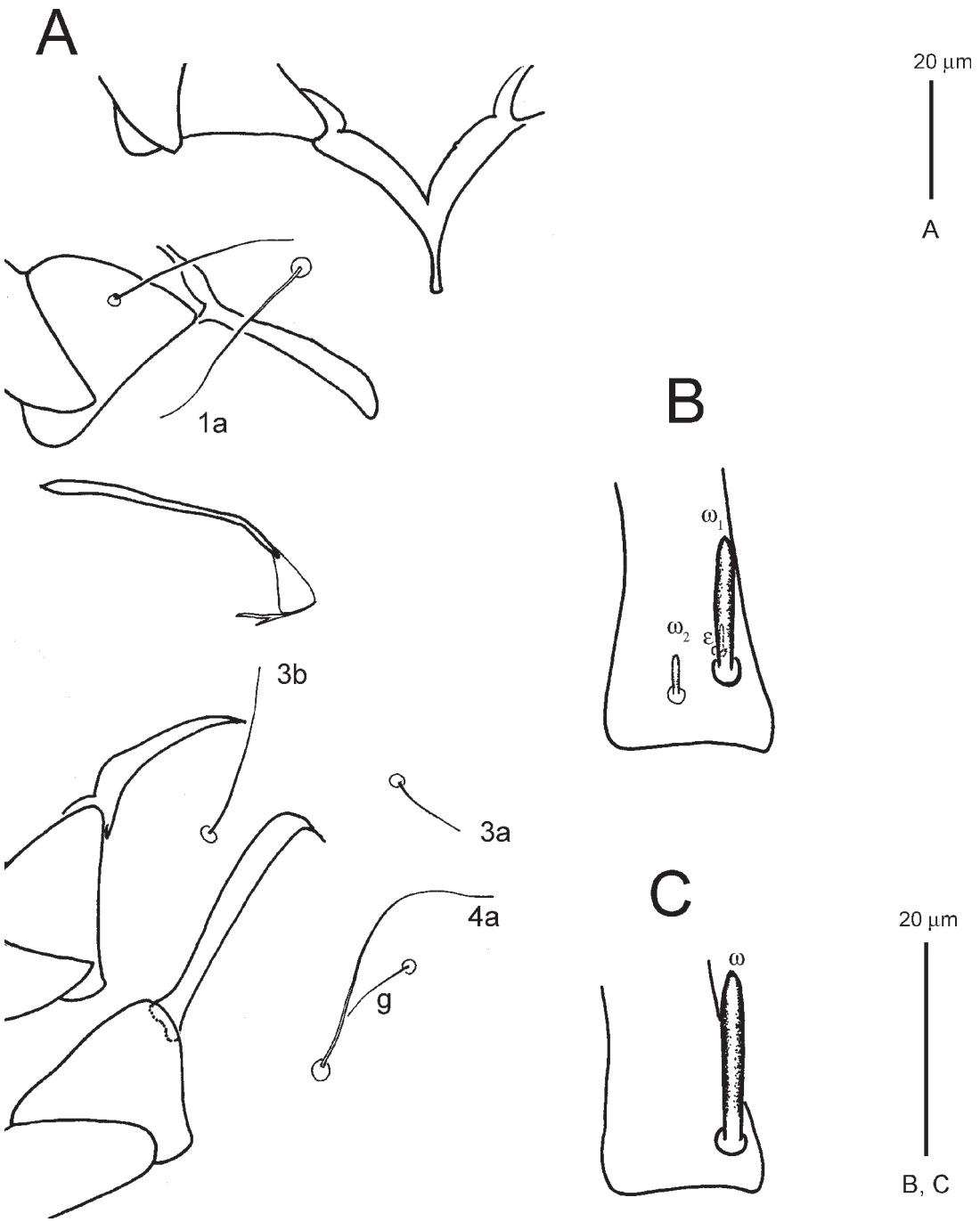


Fig. 157. *Tyrophagus tropicus* Robertson, 1959 (male). A, coxae I–IV; B, solenidia and famulus of tarsus I; C, solenidion of tarsus II.

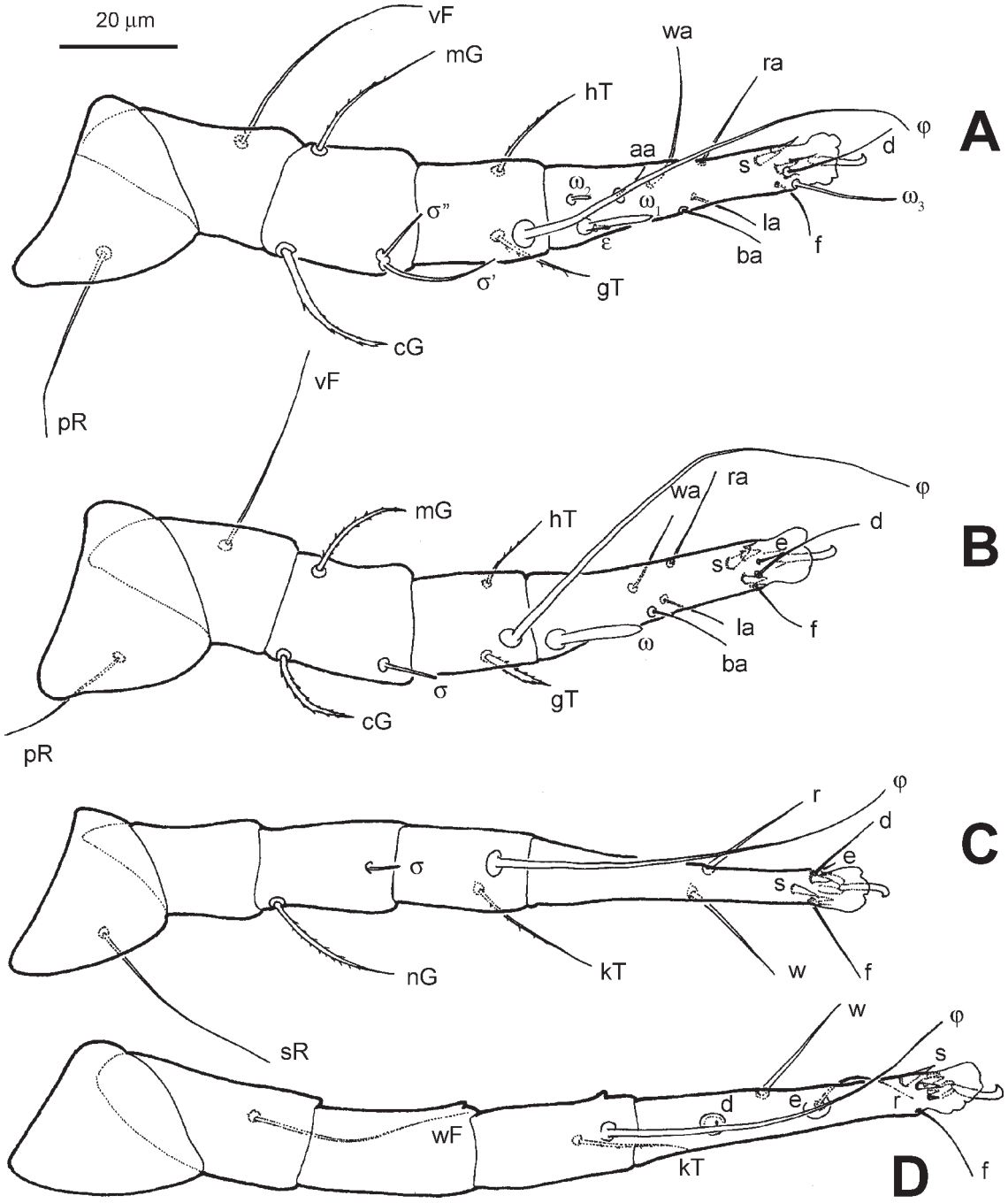


Fig. 158. *Tyrophagus tropicus* Robertson, 1959 (male). A, leg I; B, leg II; C, leg III; D, leg IV.

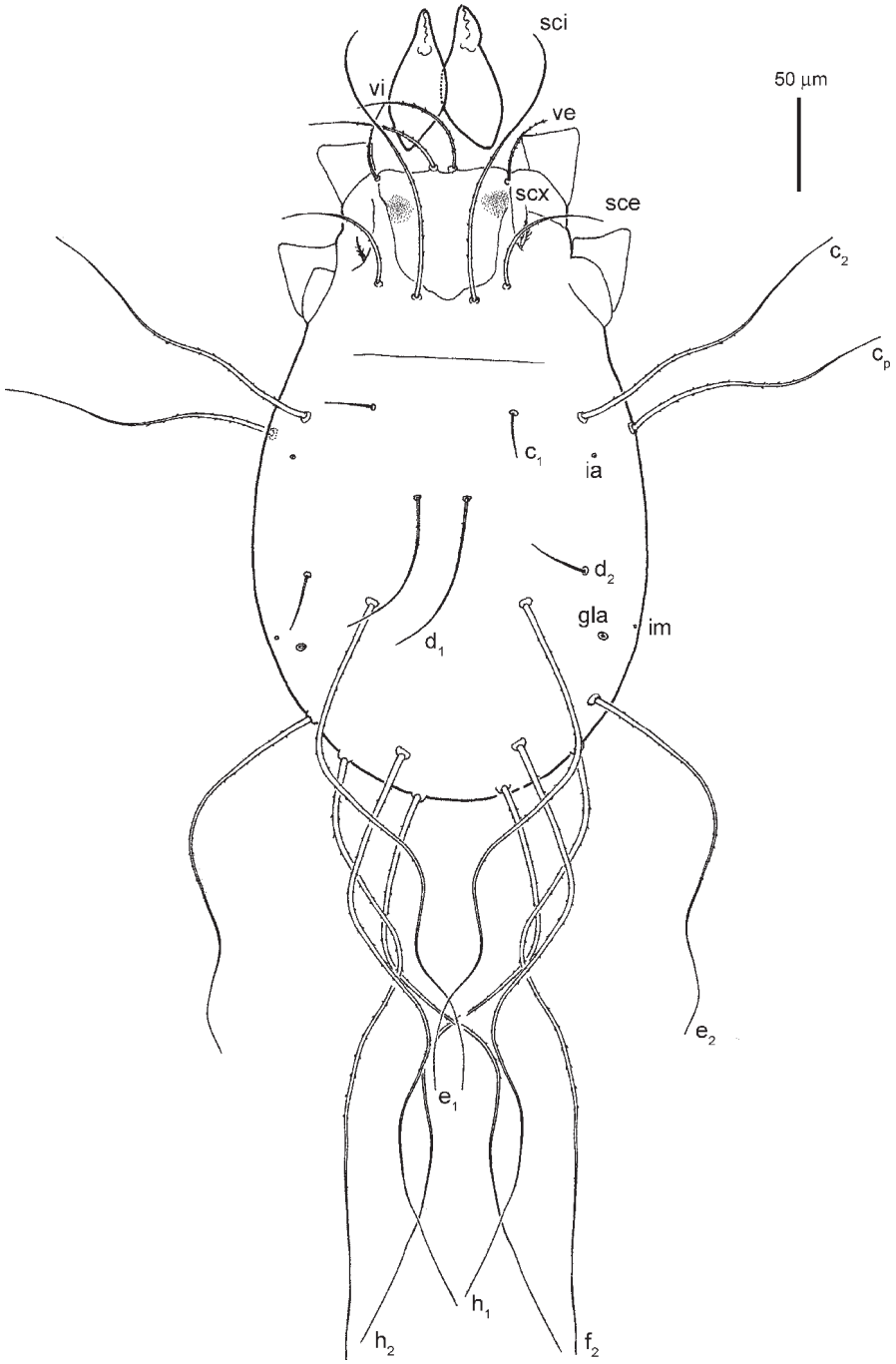


Fig. 159. *Tyrophagus womersleyi* **sp. n.** (female). Dorsal view of idiosoma.

Fig. 160. *Tyrophagus womersleyi* **sp. n.** (female). Ventral view of idiosoma.

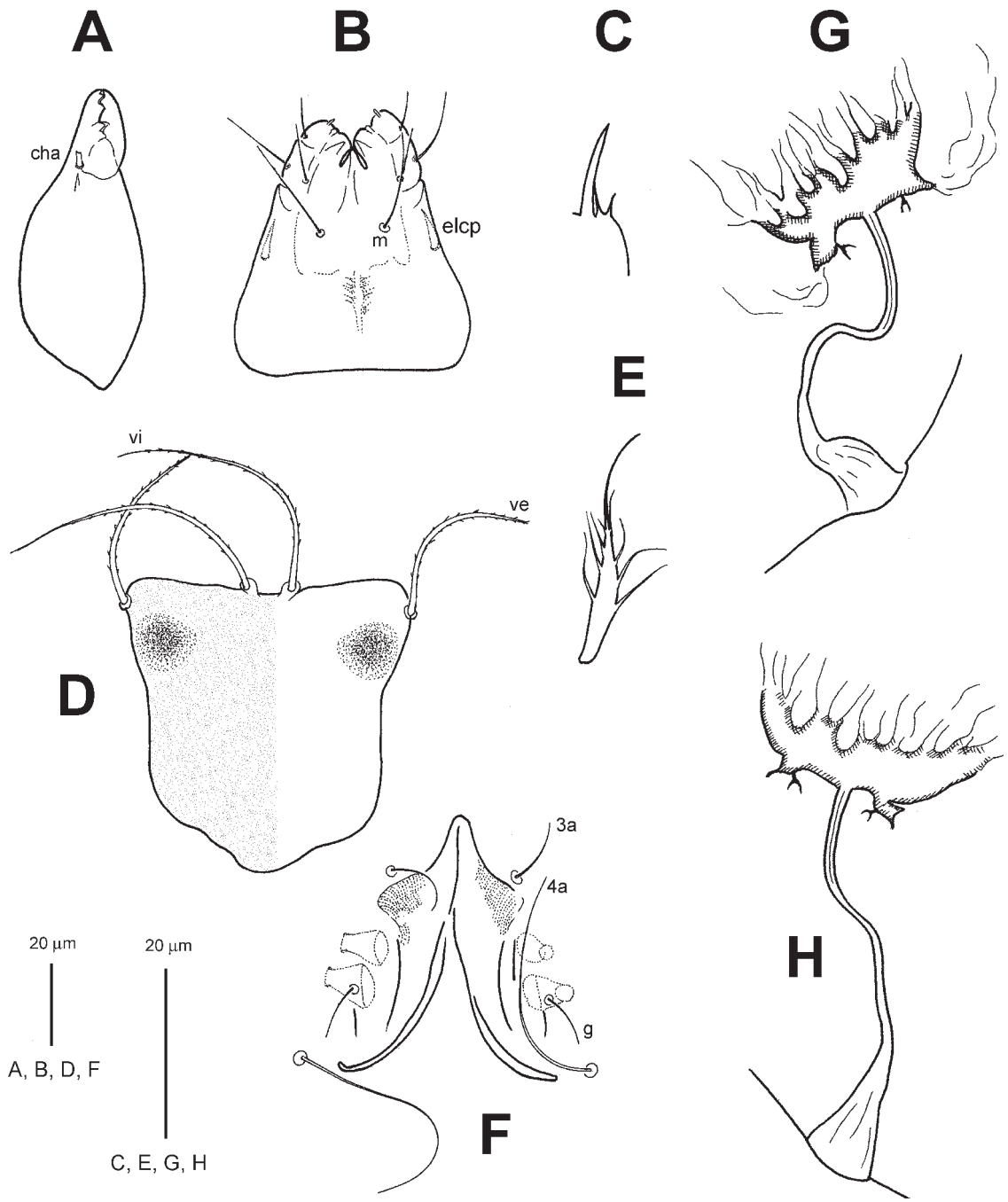


Fig. 161. *Tyrophagus womersleyi* **sp. n.** (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, Grandjean's organ; D, prodorsal shield; E, supracoxal seta; F, genital opening; G, copulatory opening and spermatheca; H, copulatory opening and spermatheca.

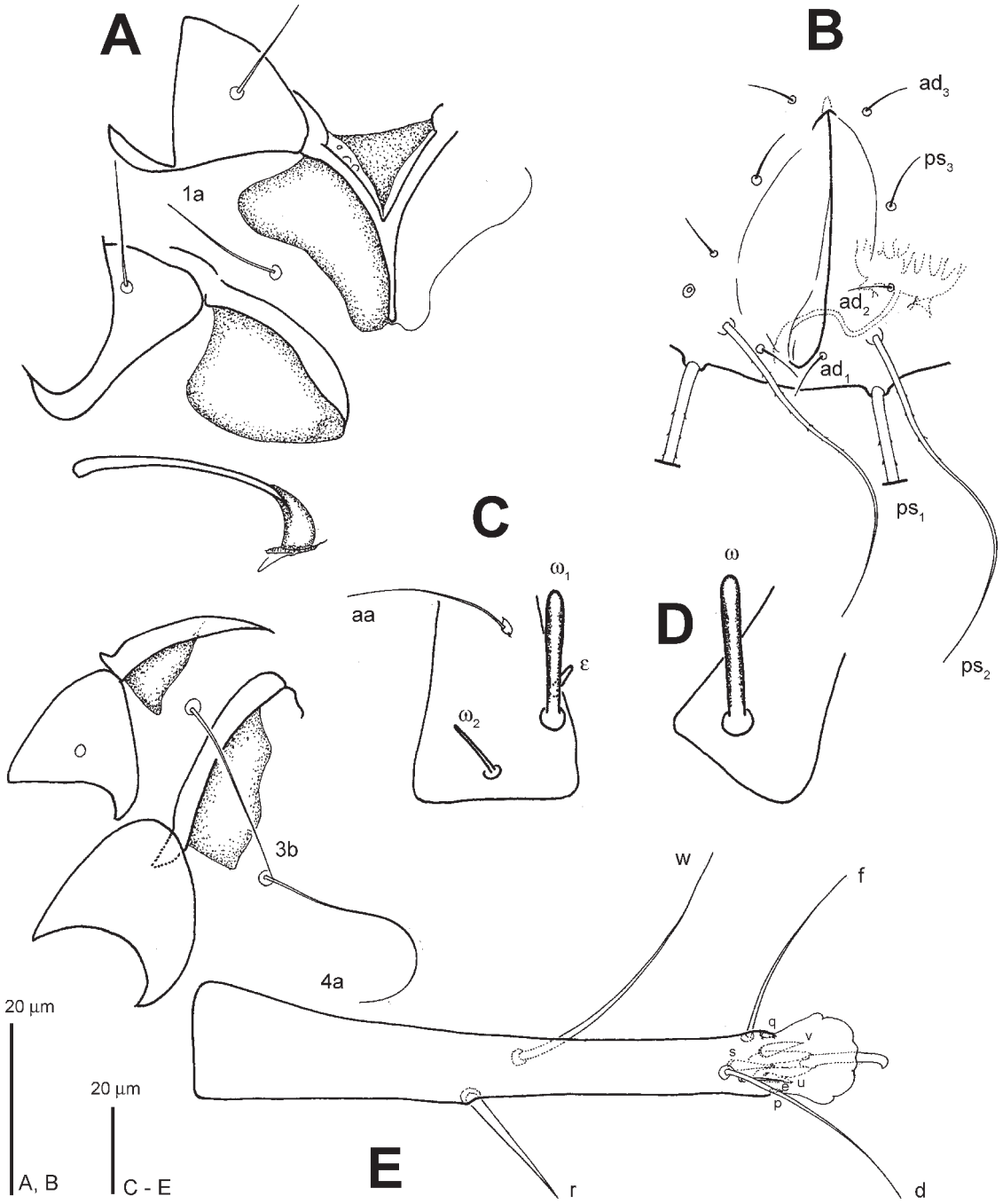


Fig. 162. *Tyrophagus womersleyi* **sp. n.** (female). A, coxae I–IV; B, anus; C, solenidia, famulus, and seta of tarsus I; D, solenidion of tarsus II; E, tarsus IV.

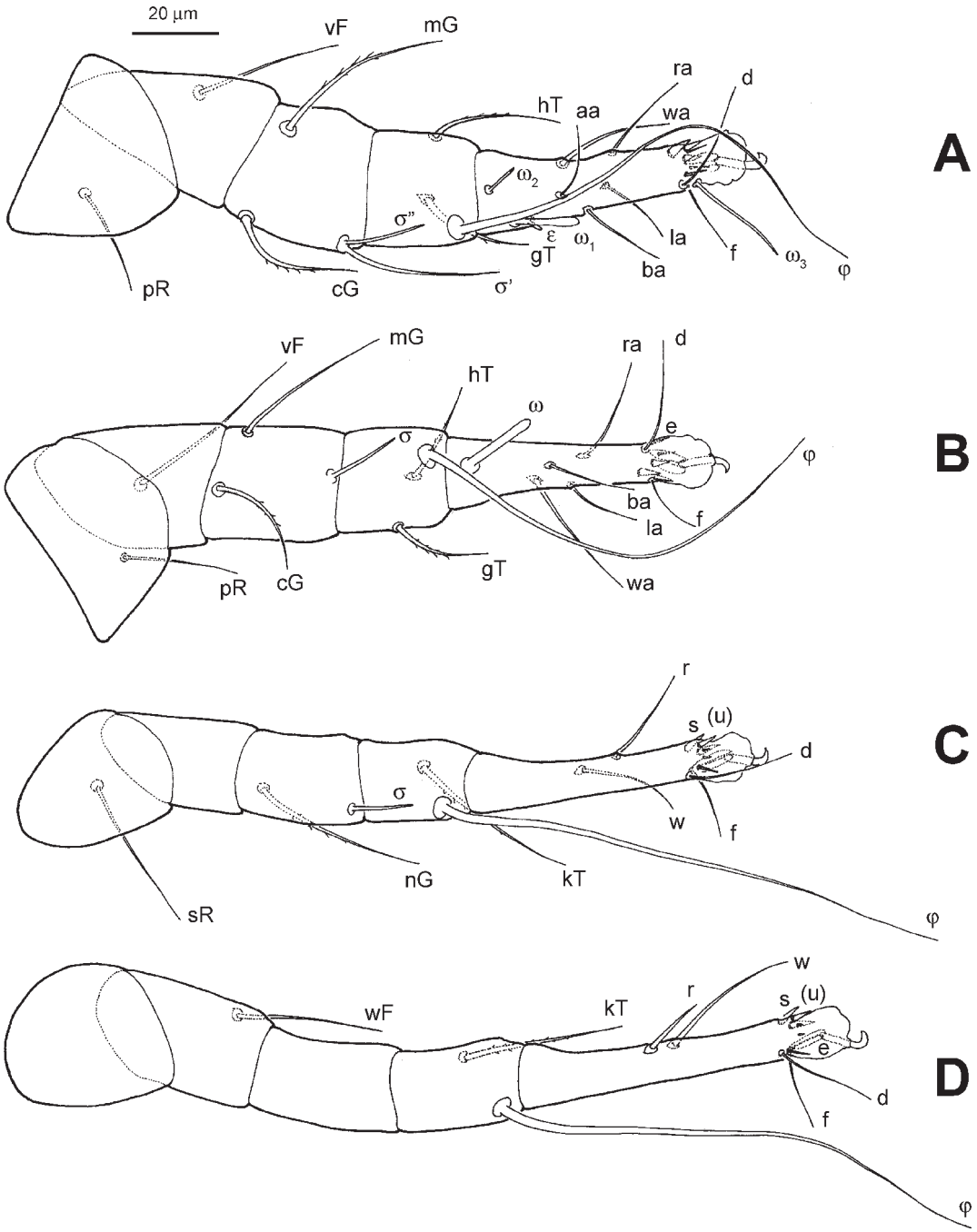


Fig. 163. *Tyrophagus womersleyi* sp. n. (female). A, leg I; B, leg II; C, leg III; D, leg IV.

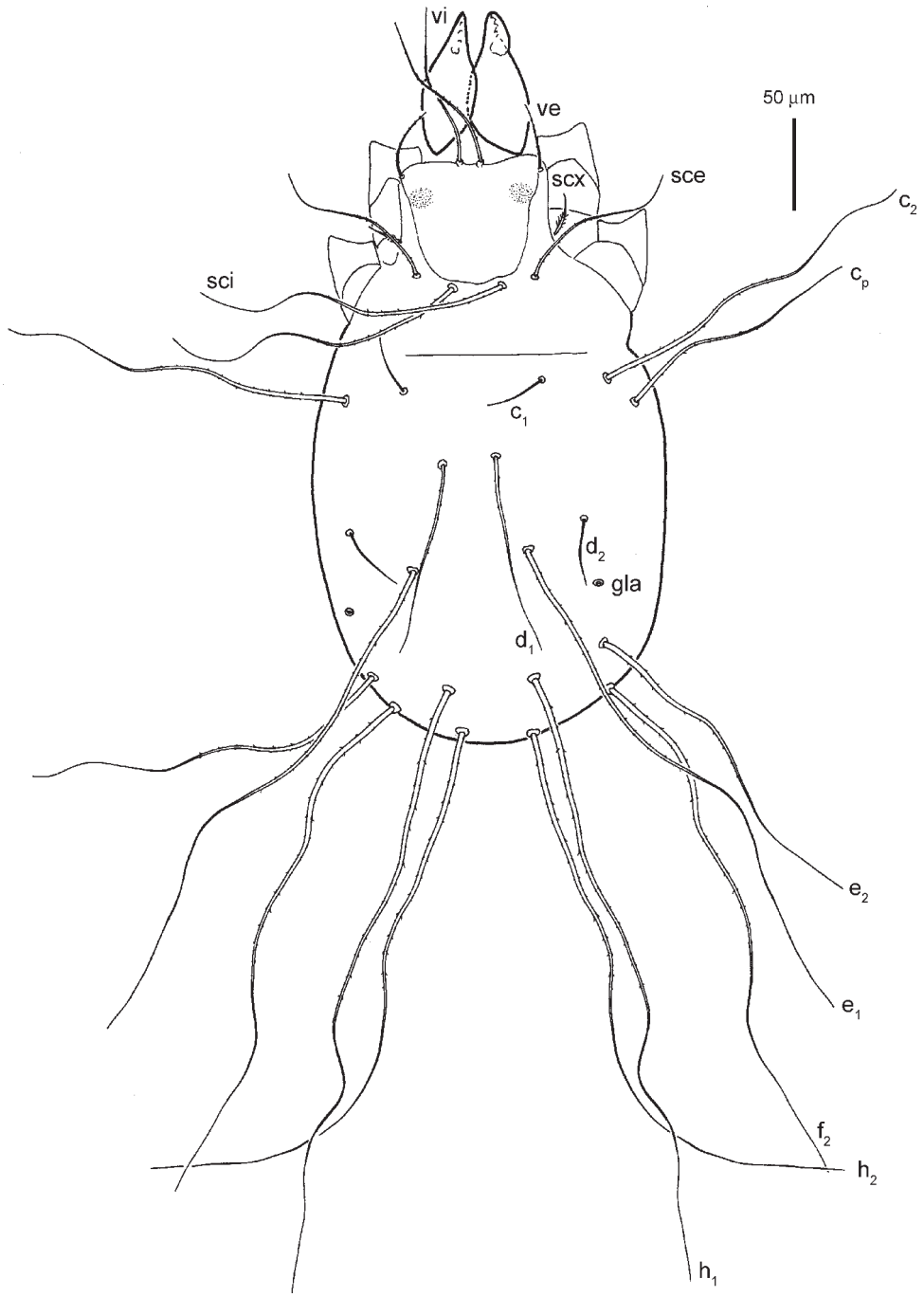


Fig. 164. *Tyrophagus xenoductus* **sp. n.** (female). Dorsal view of idiosoma.

Fig. 165. *Tyrophagus xenoductus* **sp. n.** (female). Ventral view of idiosoma.

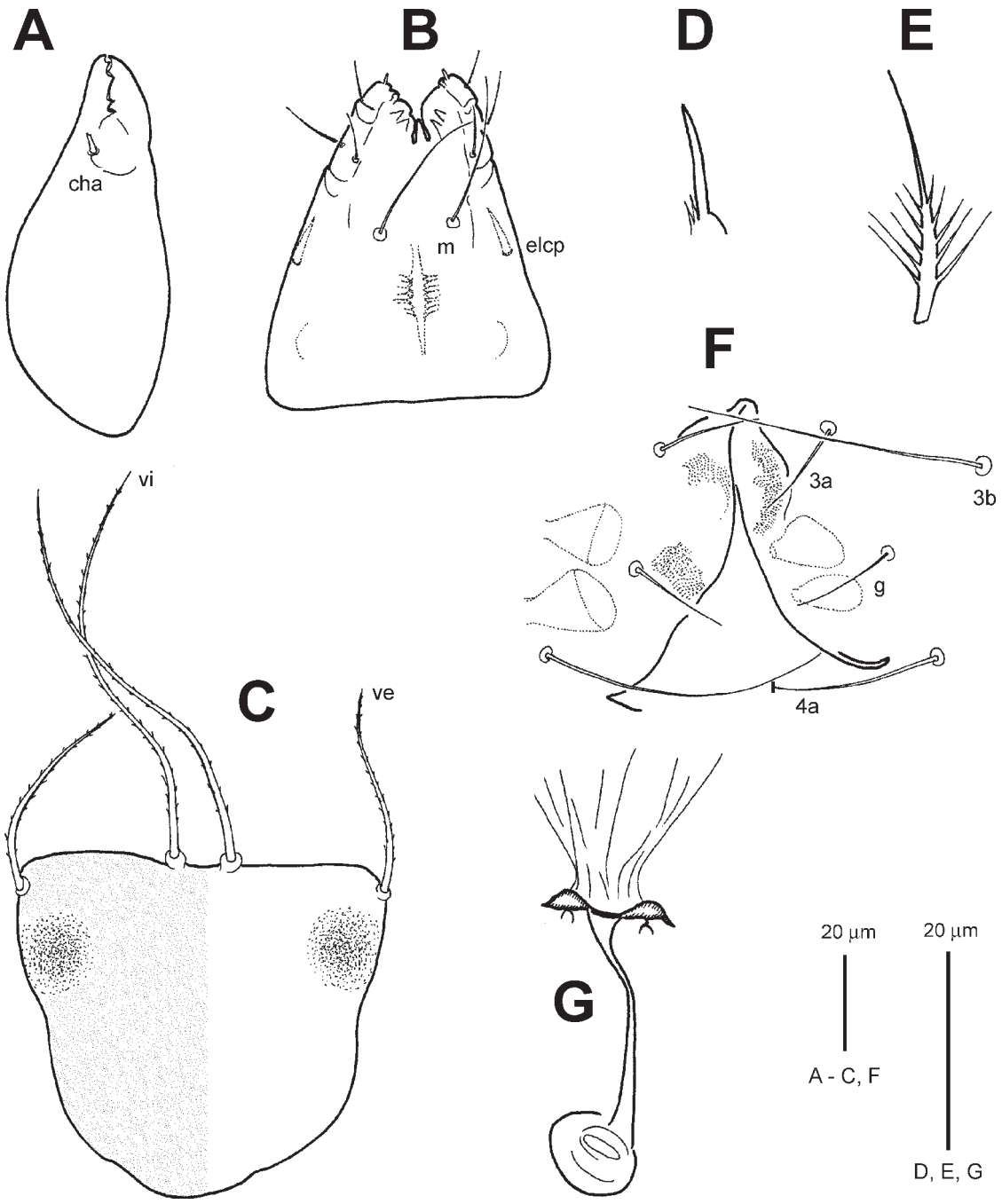


Fig. 166. *Tyrophagus xenoductus* **sp. n.** (female). A, ventral view of chelicera; B, ventral view of subcapitulum; C, prodorsal shield; D, Grandjean's organ; E, supracoxal seta; F, genital opening; G, copulatory opening and spermatheca.

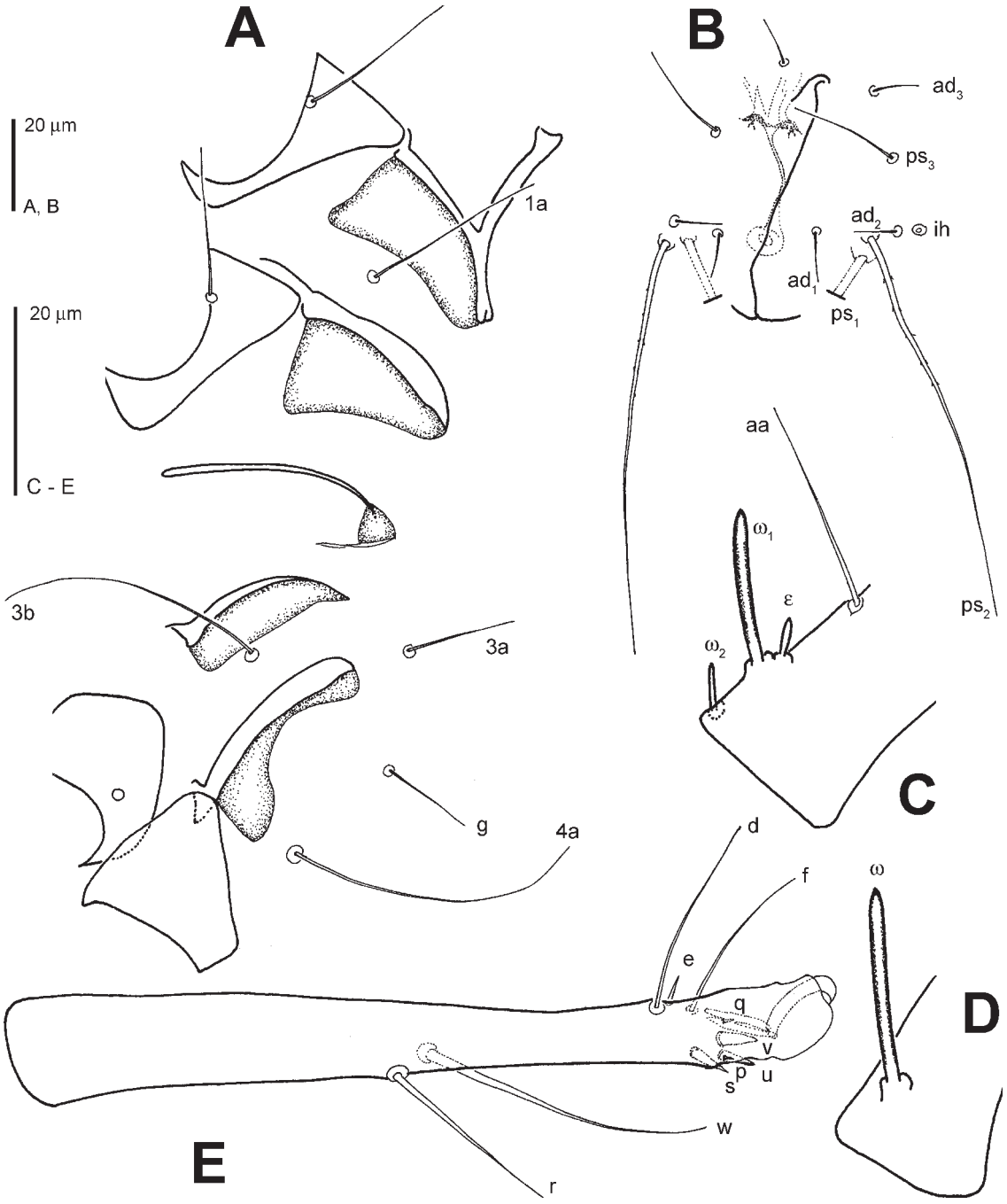


Fig. 167. *Tyrophagus xenoductus* **sp. n.** (female). A, coxae I–IV; B, anus; C, solenidia, famulus, and seta of tarsus I; D, solenidion of tarsus II; E, tarsus IV.

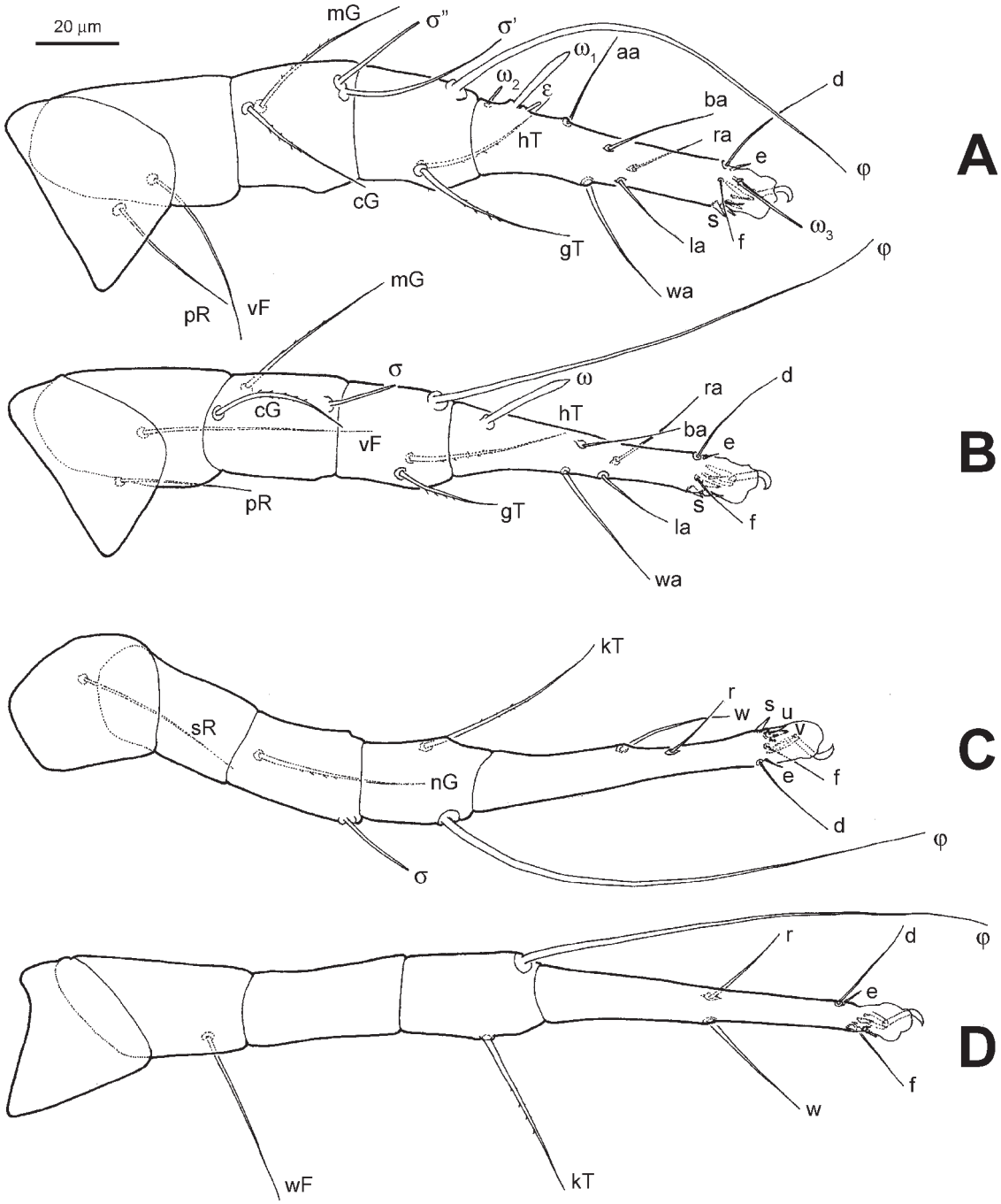


Fig. 168. *Tyrophagus xenoductus* **sp. n.** (female). A, leg I; B, leg II; C, leg III; D, leg IV.

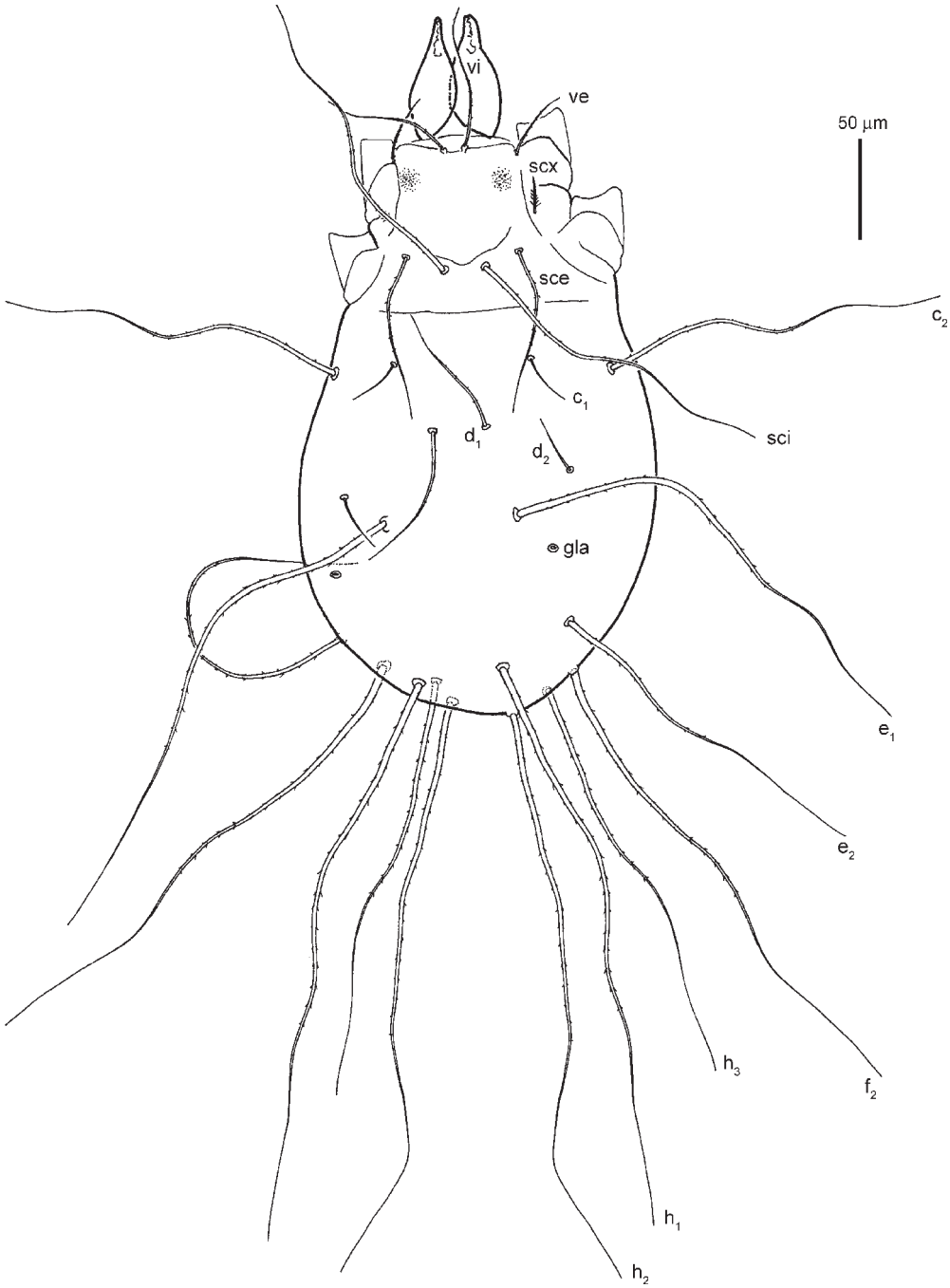


Fig. 169. *Tyrophagus xenoductus* **sp. n.** (male). Dorsal view of idiosoma.

Fig. 170. *Tyrophagus xenoductus* **sp. n.** (male). Ventral view of idiosoma.

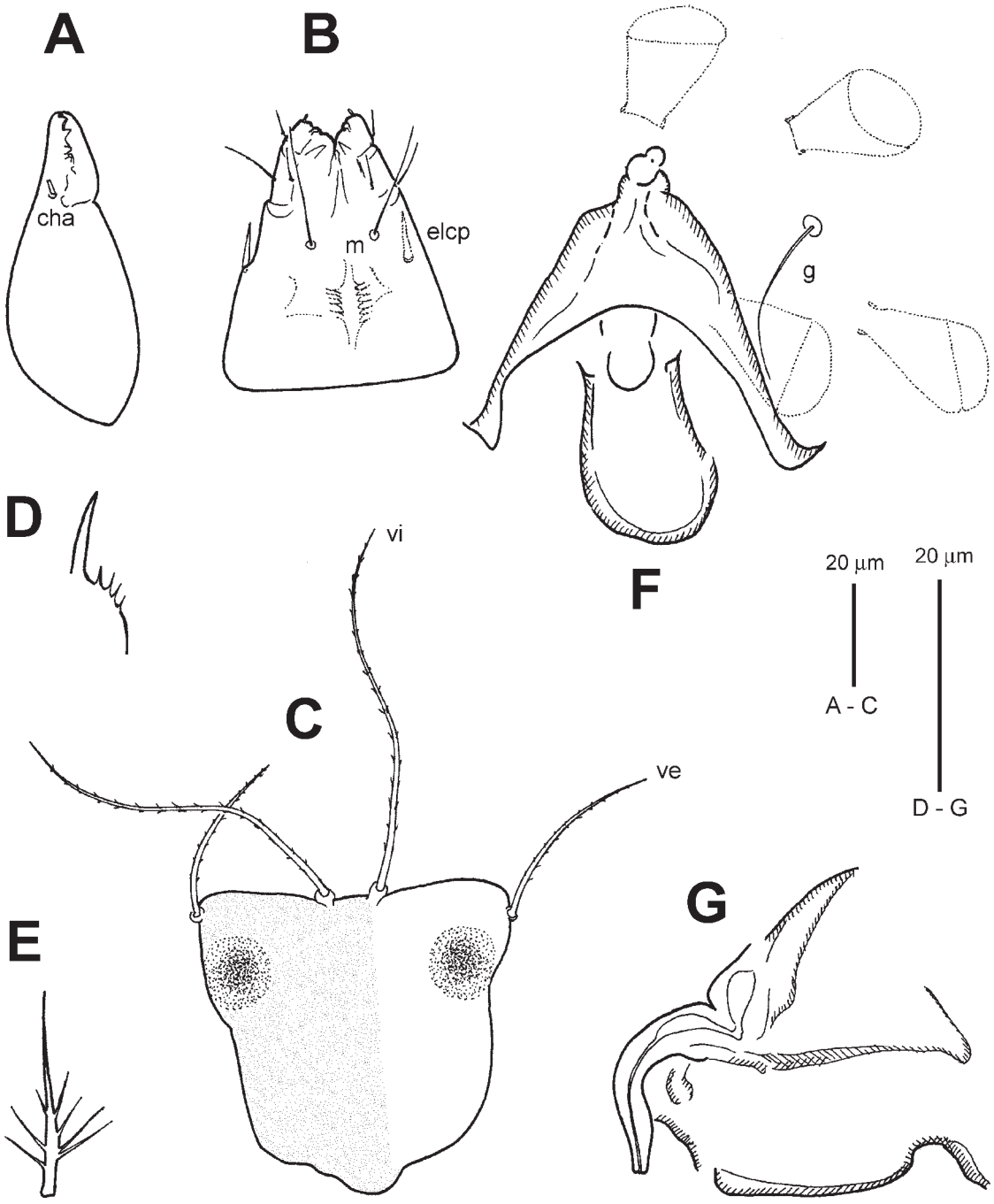


Fig. 171. *Tyrophagus xenoductus* **sp. n.** (male). A, ventral view of chelicera; B, ventral view of subcapitulum; C, prodorsal shield; D, Grandjean's organ; E, supracoxal seta; F, ventral view of aedeagus and genital papillae; G, lateral view of aedeagus.

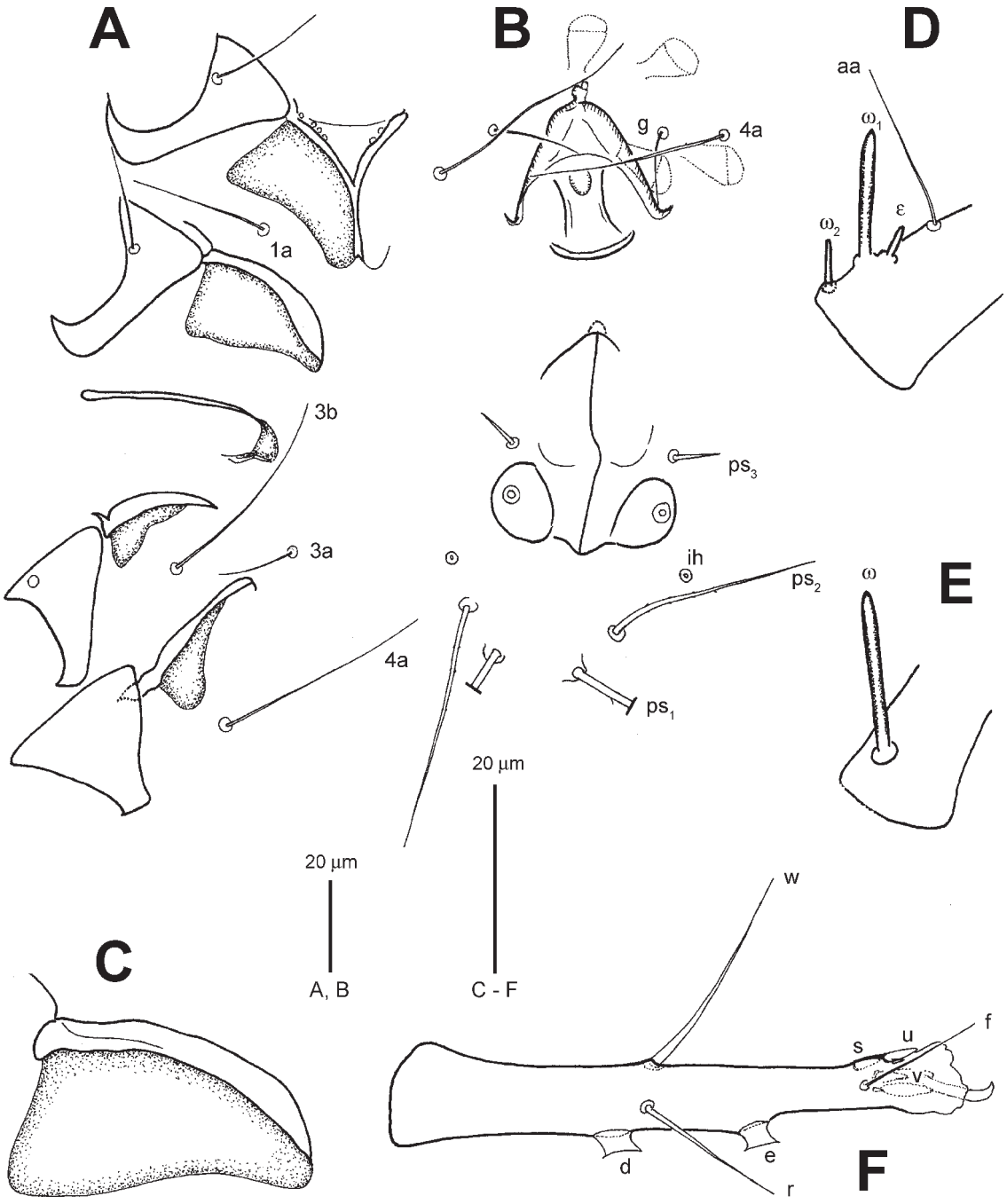


Fig. 172. *Tyrophagus xenoductus* **sp. n.** (male). A, coxae I–IV; B, genital opening and anus; C, coxal plate II; D, solenidia, famulus, and seta of tarsus I; E, solenidion of tarsus II; F, tarsus IV.

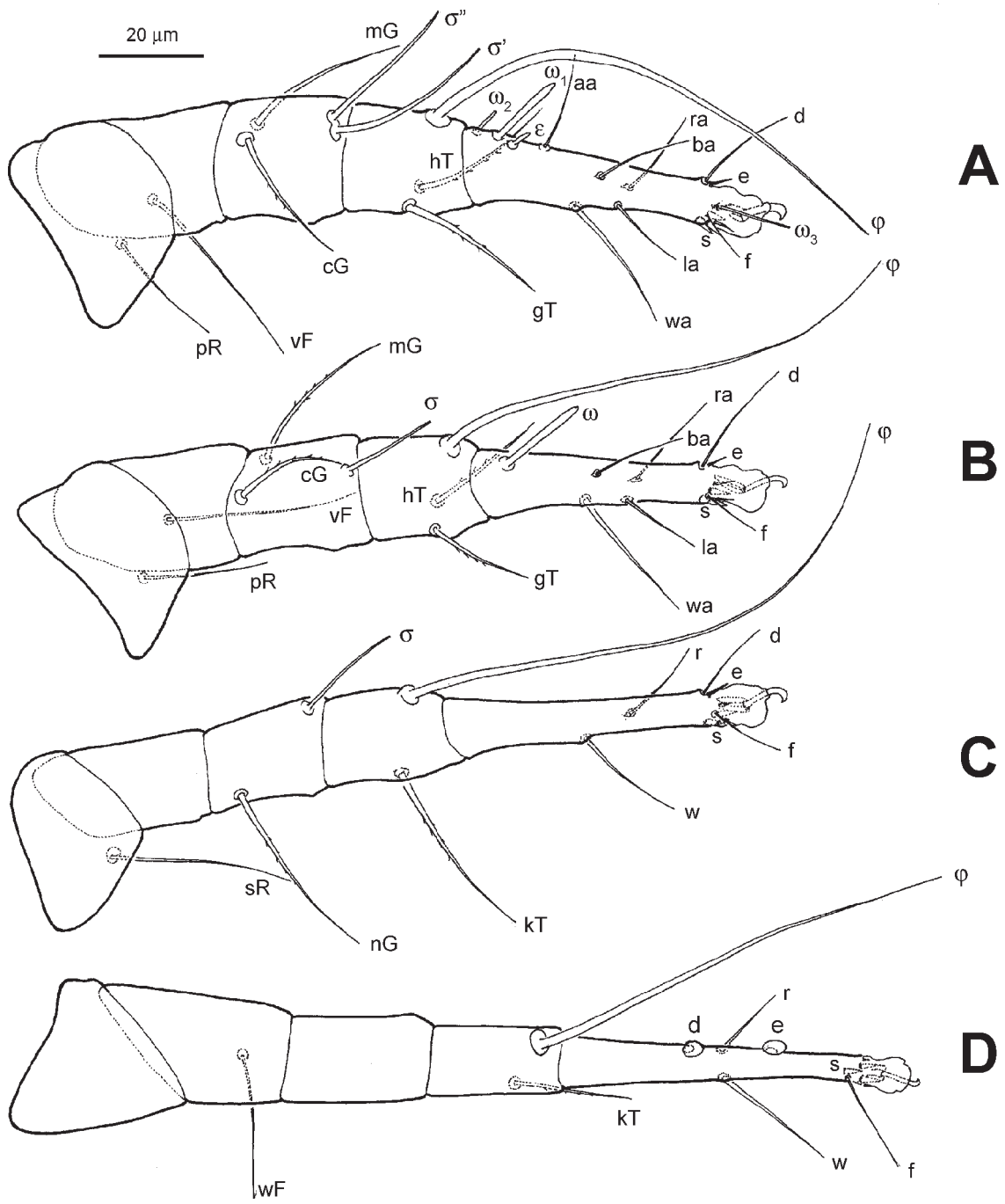


Fig. 173. *Tyrophagus xenoductus* **sp. n.** (male). A, leg I; B, leg II; C, leg III; D, leg IV.

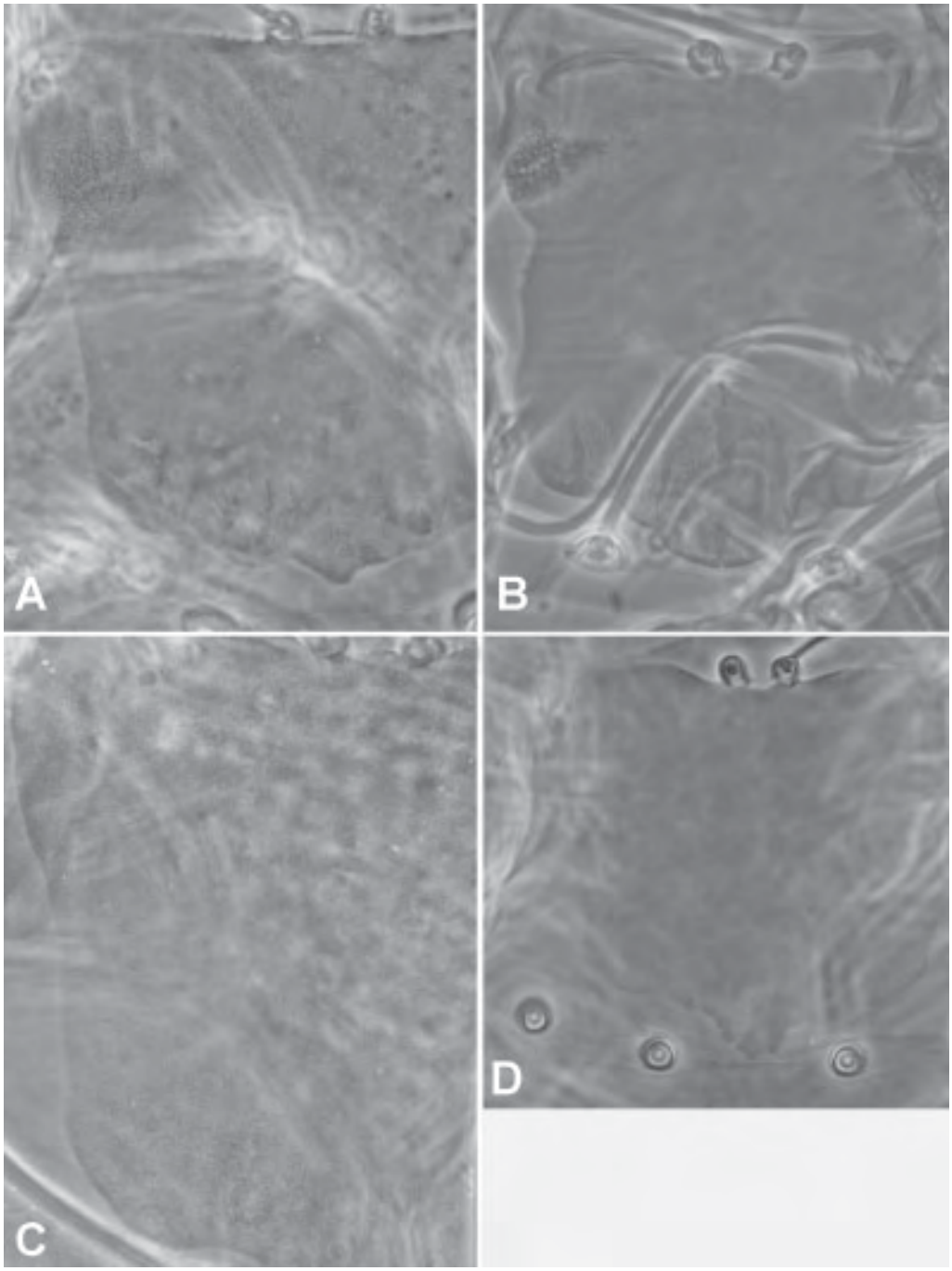


PLATE 1. Prodorsal shield (female). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. macfarlanei* **sp. n.**

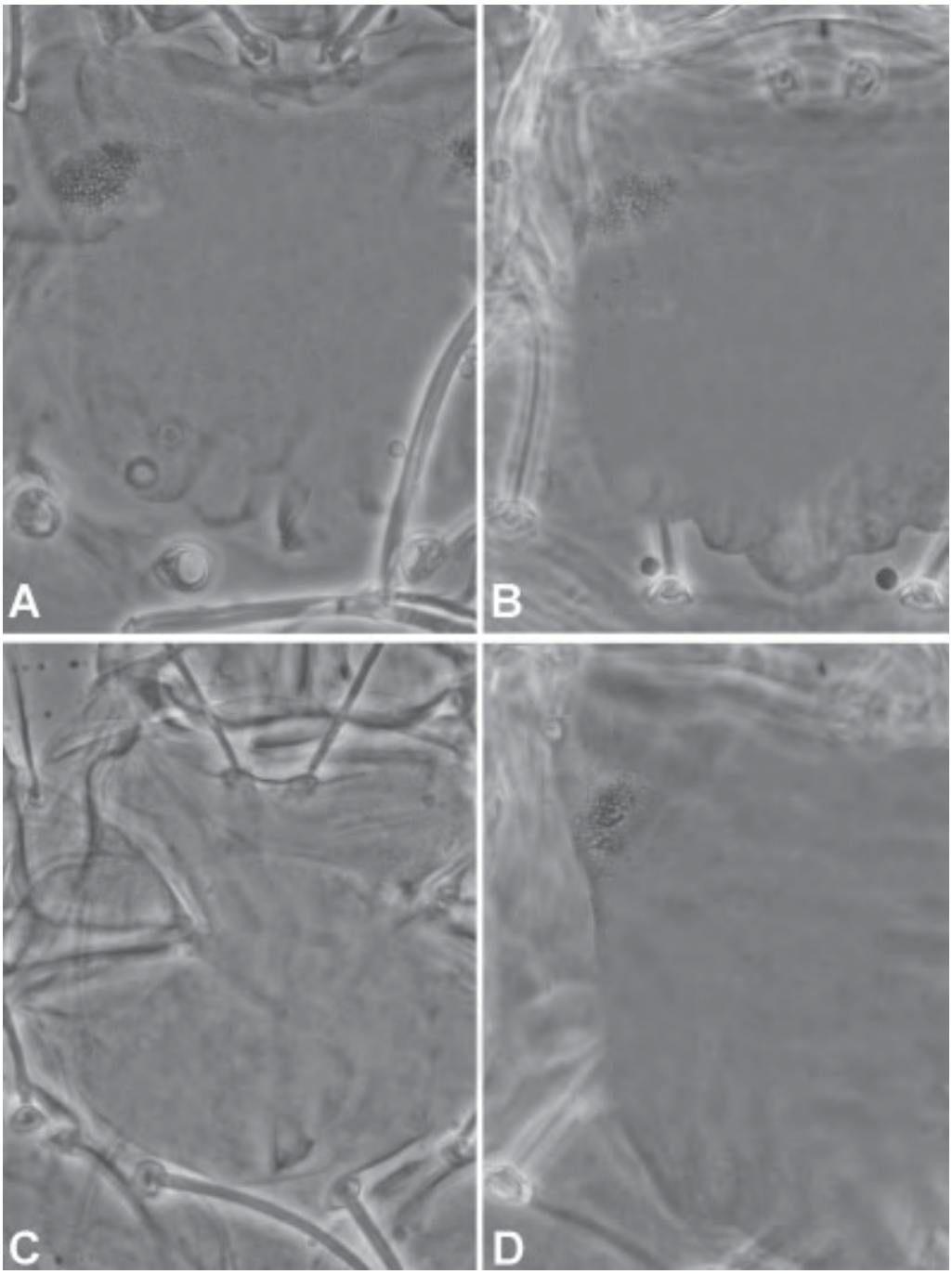


PLATE 2. Prodorsal shield (female). A, *Tyrophagus neiswanderi* Johnston & Bruce; B, *T. putrescentiae* (Schrank); C, *T. robertsonae* Lynch; D, *T. savasi* Lynch.

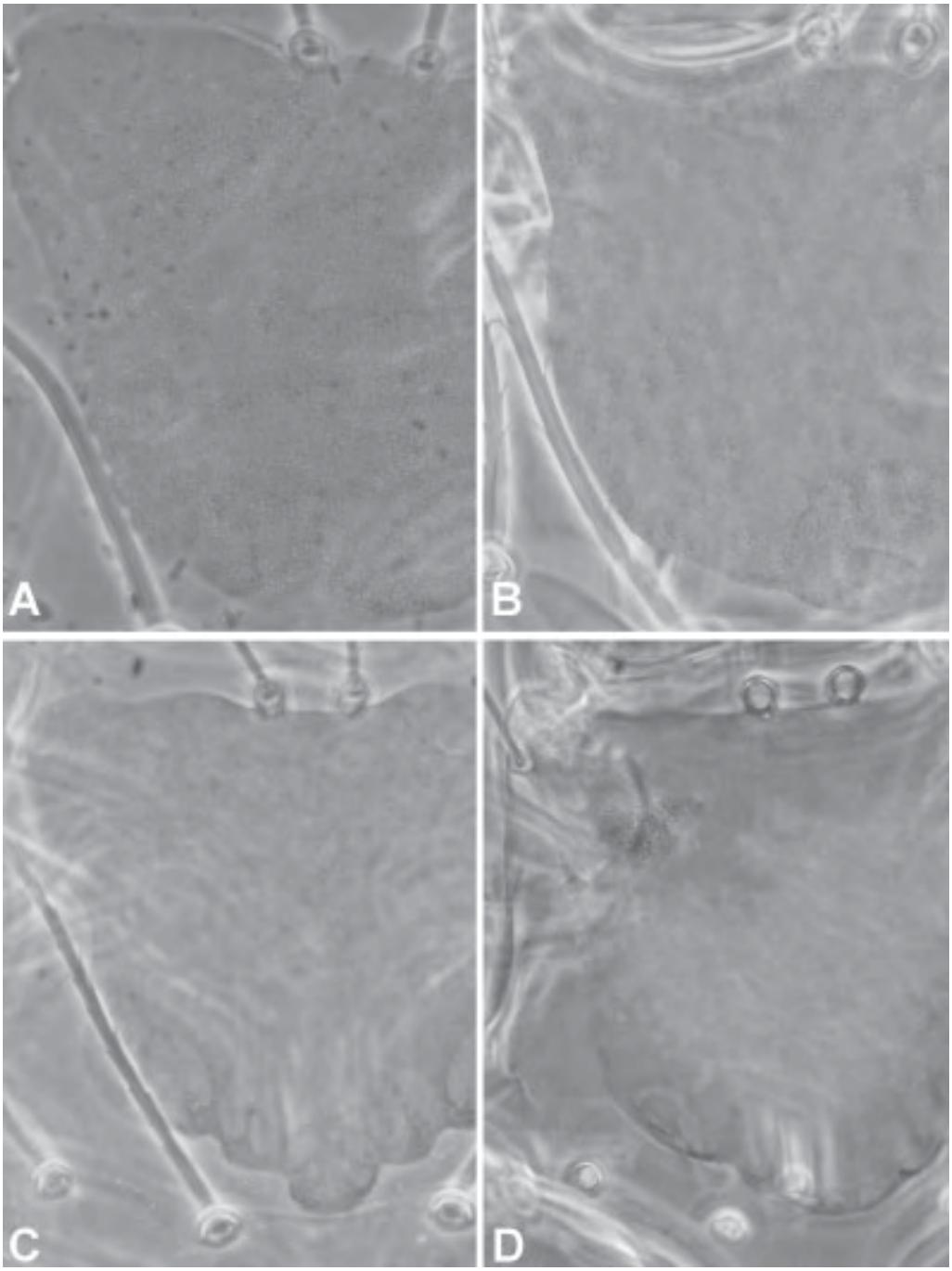


PLATE 3. Prodorsal shield (female). A, *Tyrophagus similis* Volgin; B, *T. vanheurni* Oudemans; C, *T. javensis* (Oudemans); D, *T. pacificus* **sp. n.**.

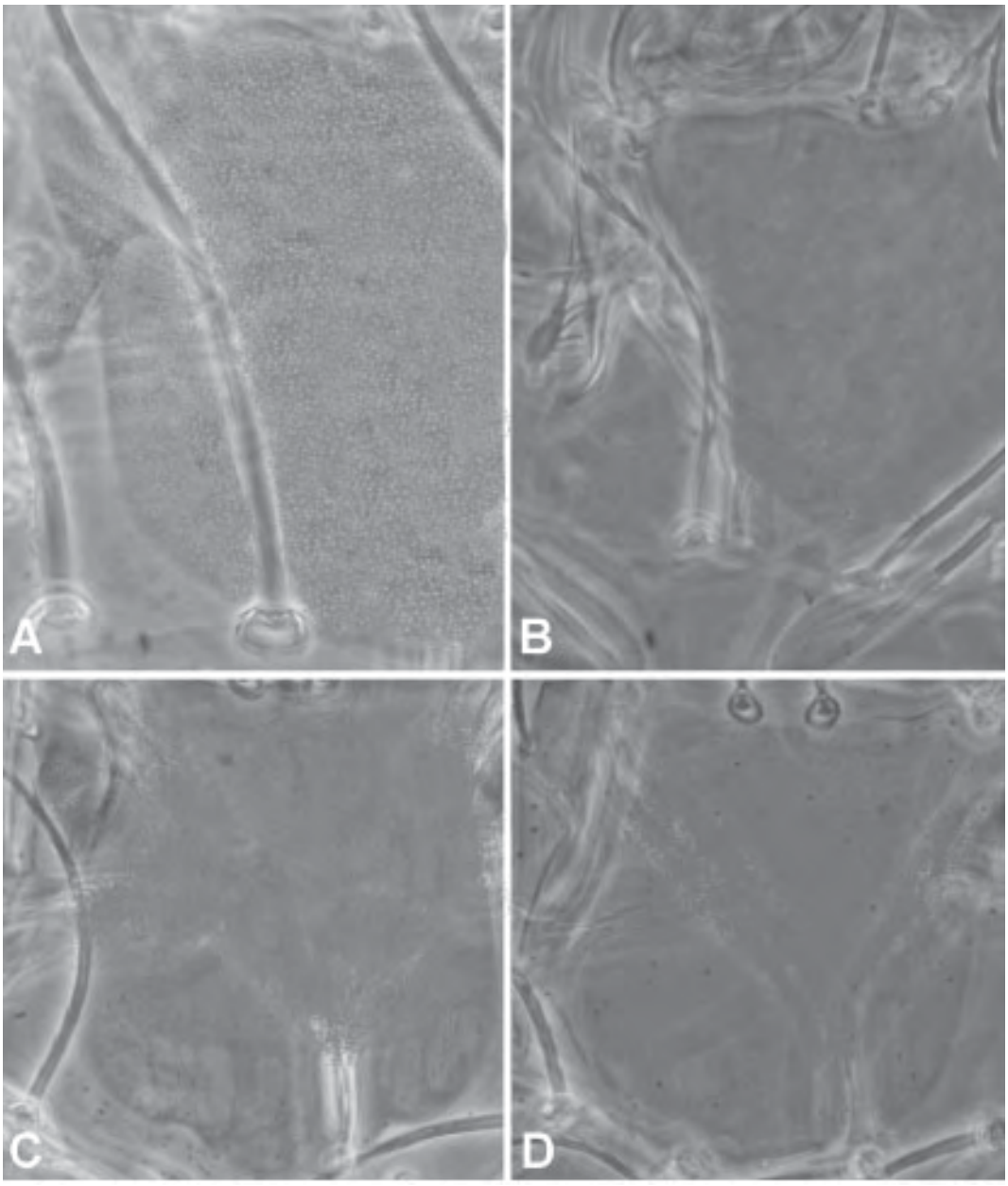


PLATE 4. Prodorsal shield (female). A, *Tyrophagus perniciosus* Zakhvatkin; B, *T. tropicus* Robertson; C, *T. womersleyi* **sp. n.**; D, *T. xenoductus* **sp. n.**

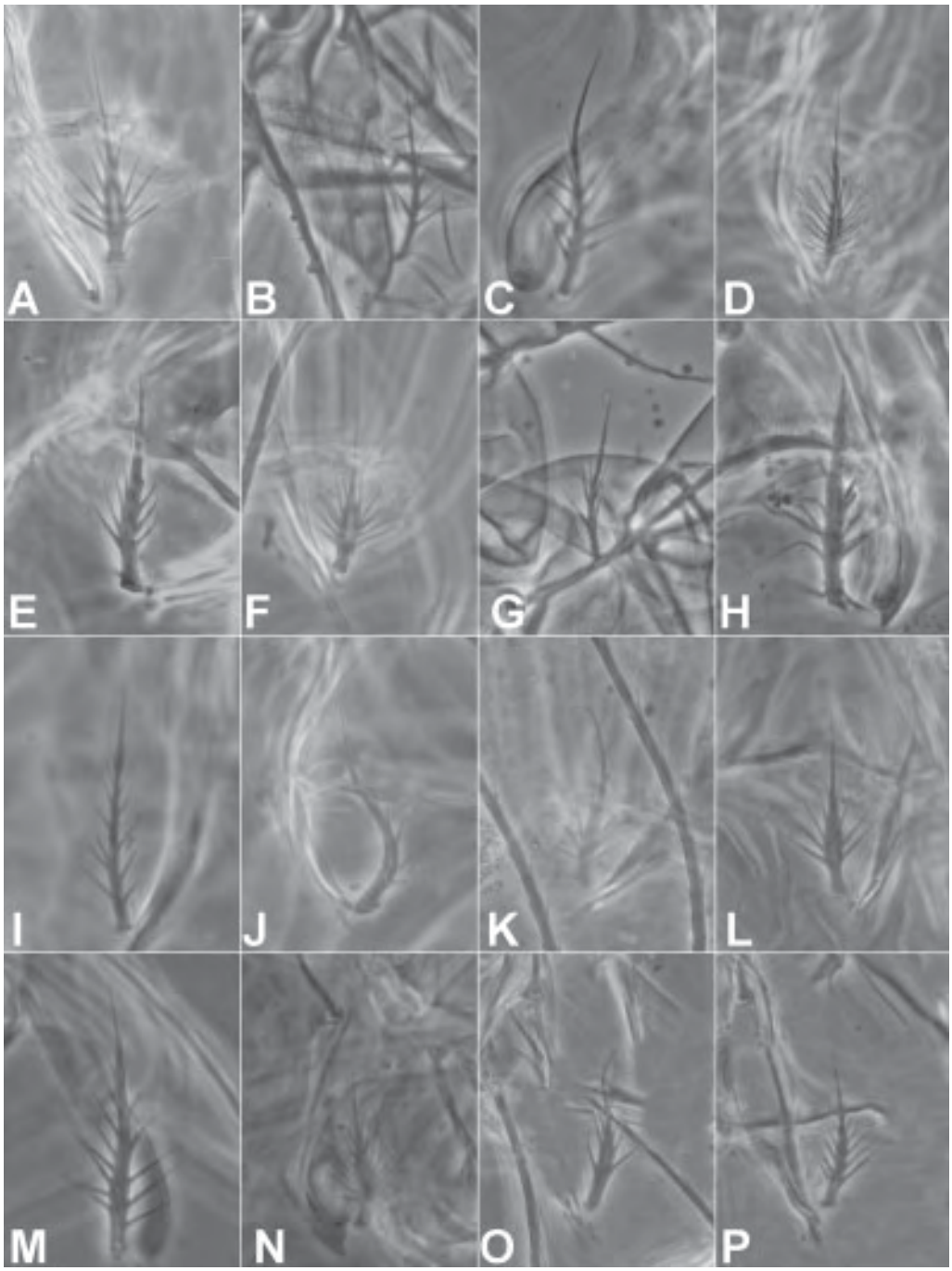


PLATE 5. Supracoxal seta (female). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. macfarlanei* **sp. n.**; E, *T. neiswanderi* Johnston & Bruce; F, *T. putrescentiae* (Schrank); G, *T. robertsonae* Lynch; H, *T. savasi* Lynch; I, *T. similis* Volgin; J, *T. vanheurni* Oudemans; K, *T. javensis* (Oudemans); L, *T. pacificus* **sp. n.**; M, *T. perniciosus* Zakhvatkin; N, *T. tropicus* Robertson; O, *T. womersleyi* **sp. n.**; P, *T. xenoductus* **sp. n.**

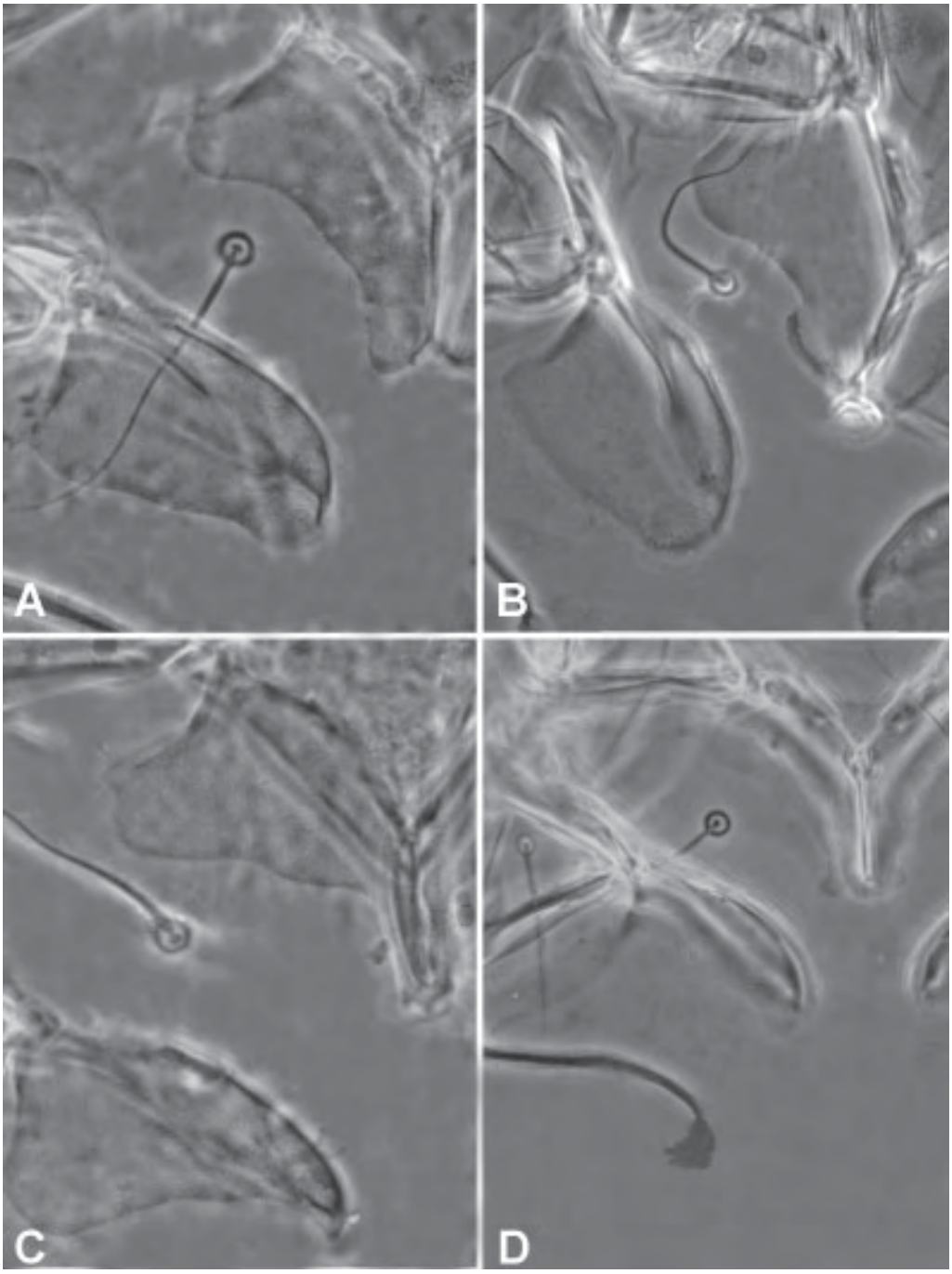


PLATE 6. Coxae I–II (female). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. macfarlanei* **sp. n.**

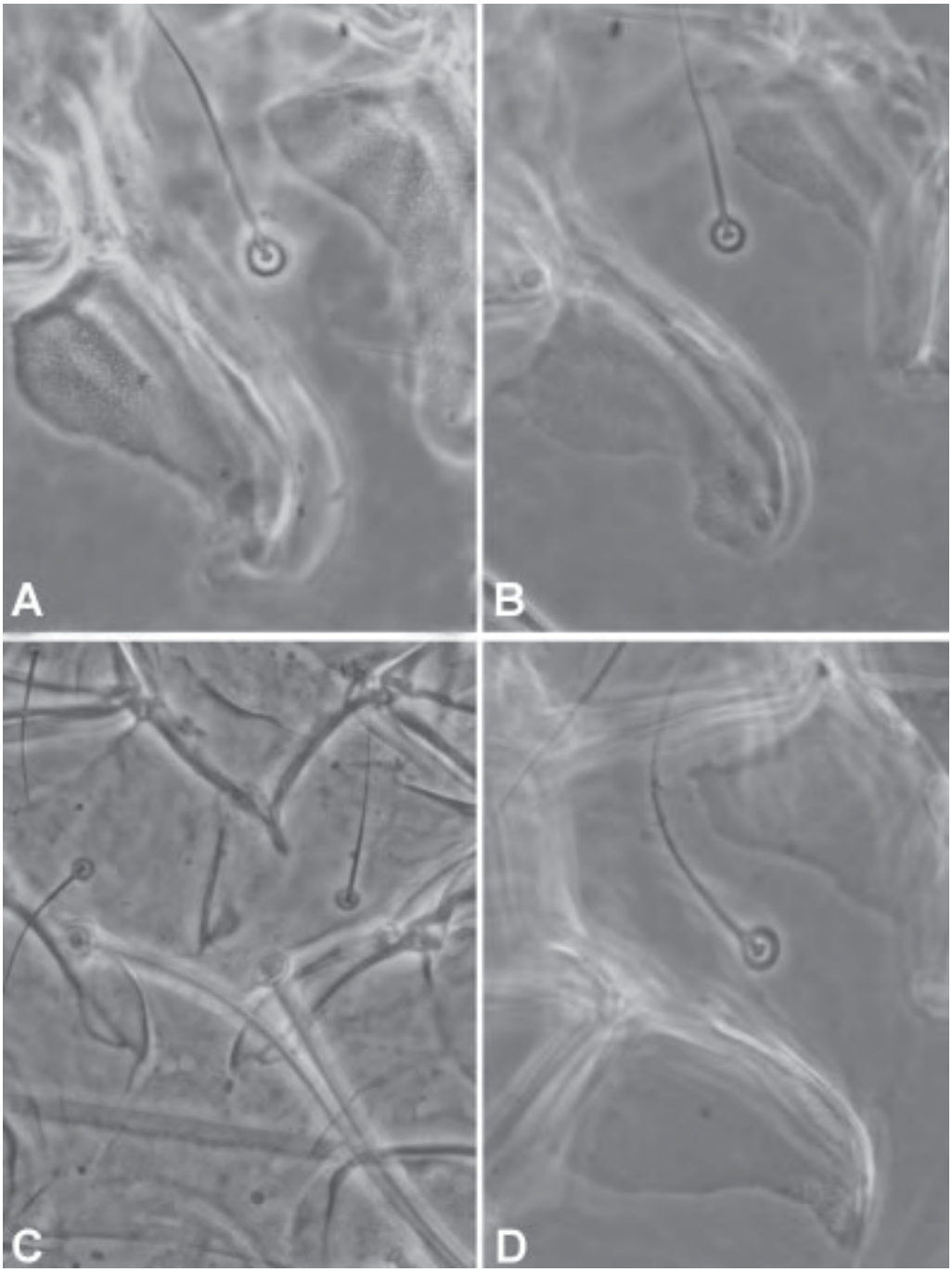


PLATE 7. Coxae I–II (female). A, *Tyrophagus neiswanderi* Johnston & Bruce; B, *T. putrescentiae* (Schrank); C, *T. robertsonae* Lynch; D, *T. savasi* Lynch.

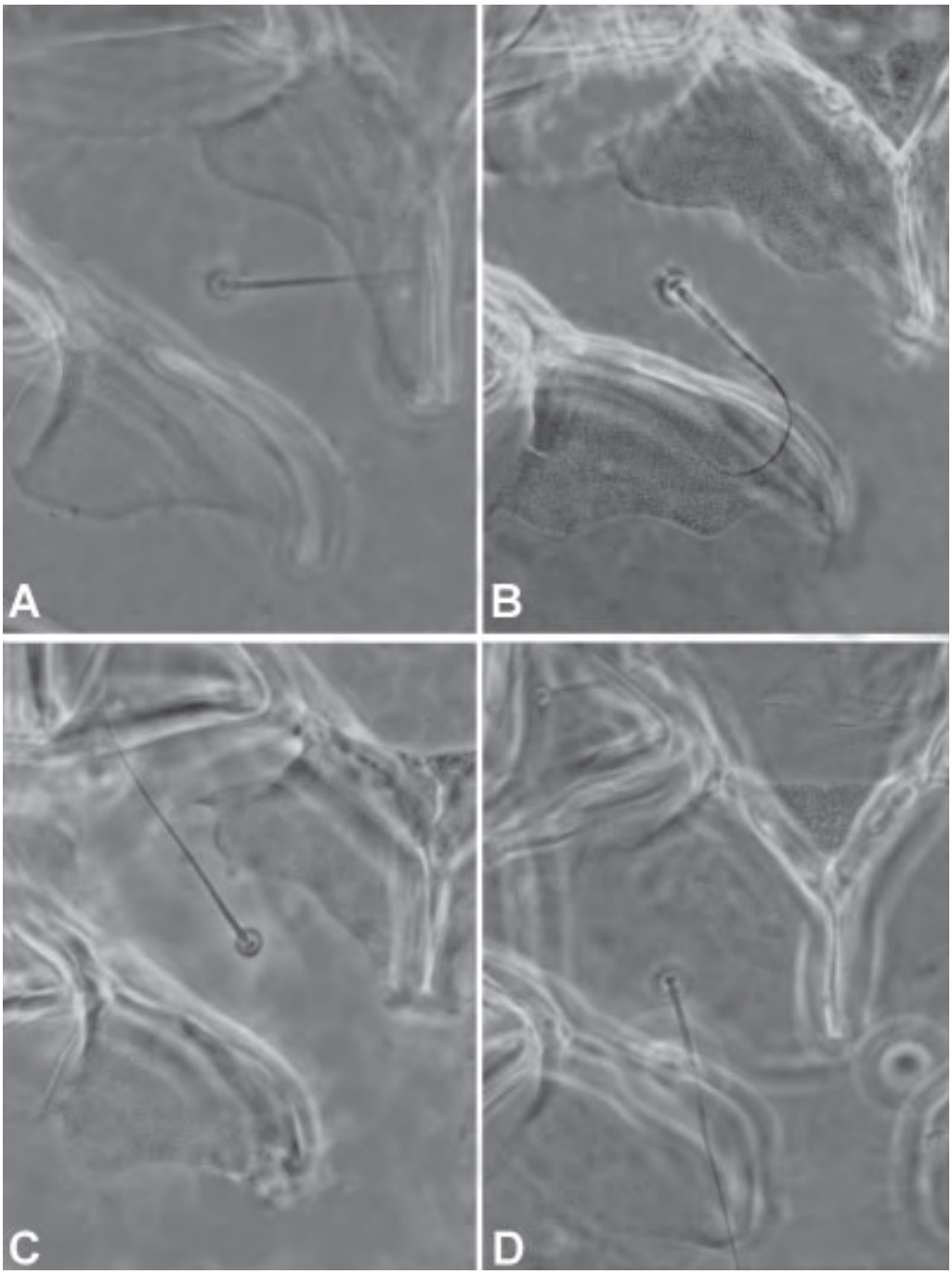


PLATE 8. Coxae I–II (female). A, *Tyrophagus similis* Volgin; B, *T. vanheurni* Oudemans; C, *T. javensis* (Oudemans); D, *T. pacificus* **sp. n.**.

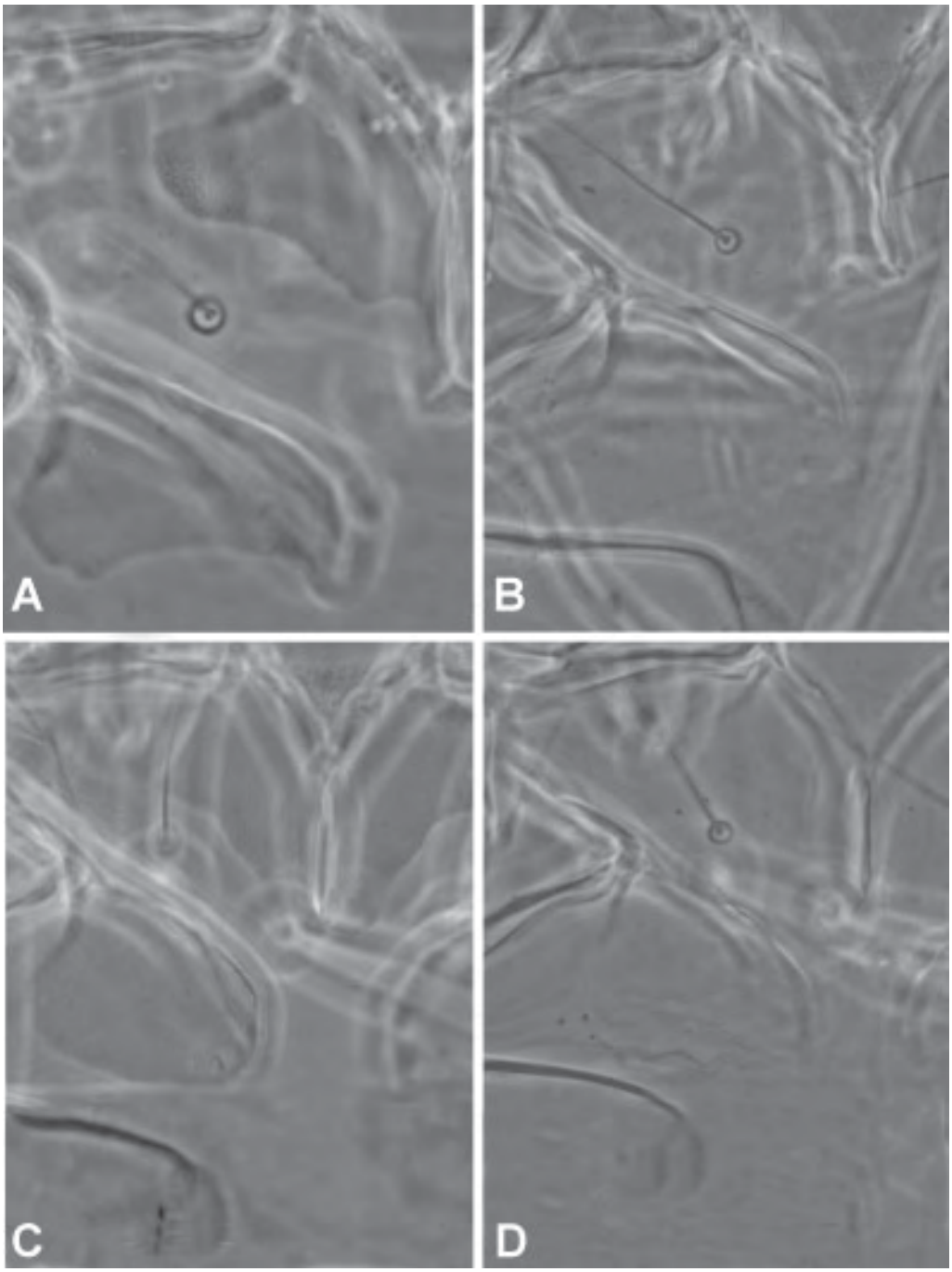


PLATE 9. Coxae I–II (female). A, *Tyrophagus perniciosus* Zakhvatkin; B, *T. tropicus* Robertson; C, *T. womersleyi* **sp. n.**; D, *T. xenoductus* **sp. n.**

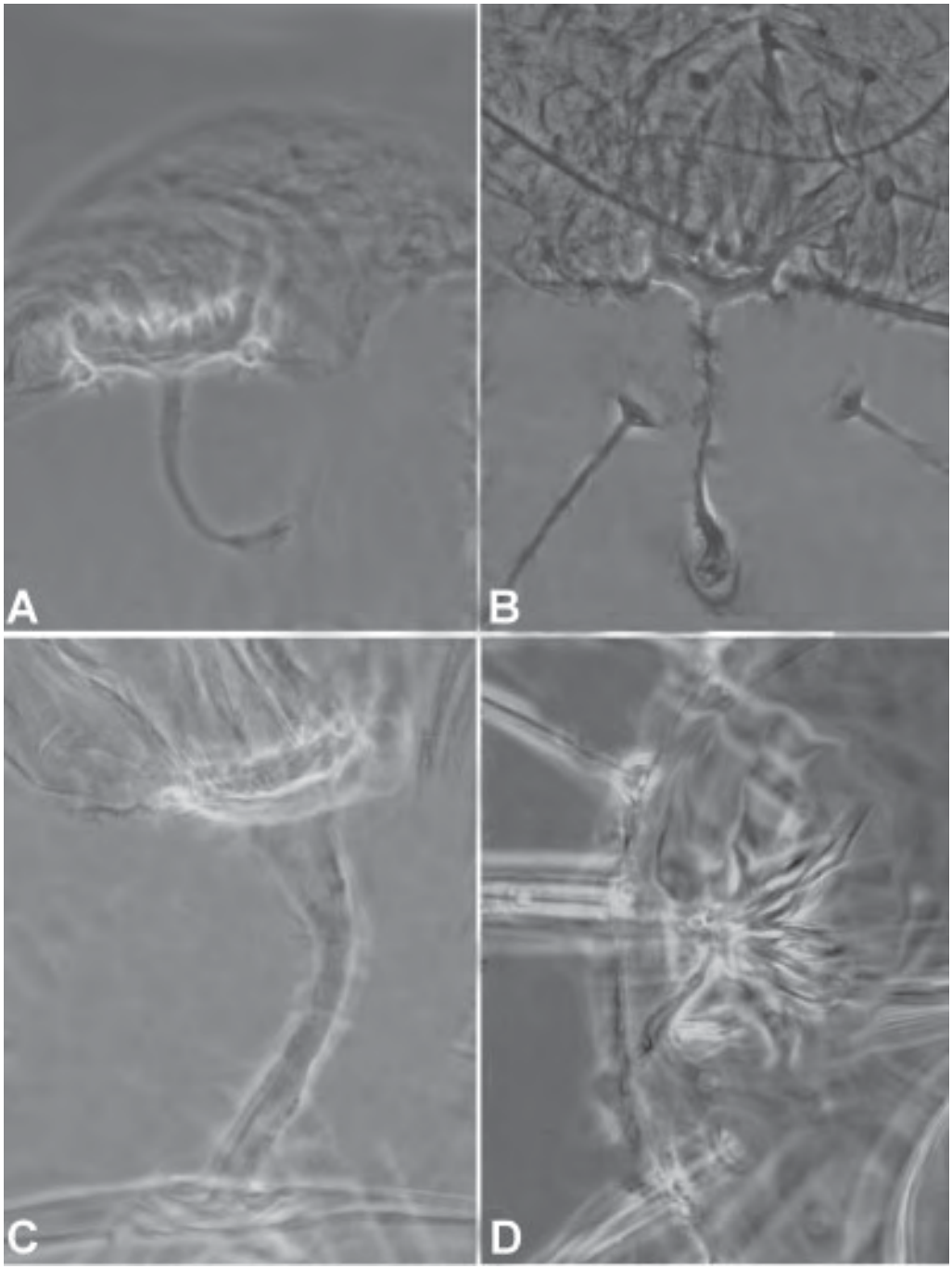


PLATE 10. Spermatheca (female). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. macfarlanei* **sp. n.**

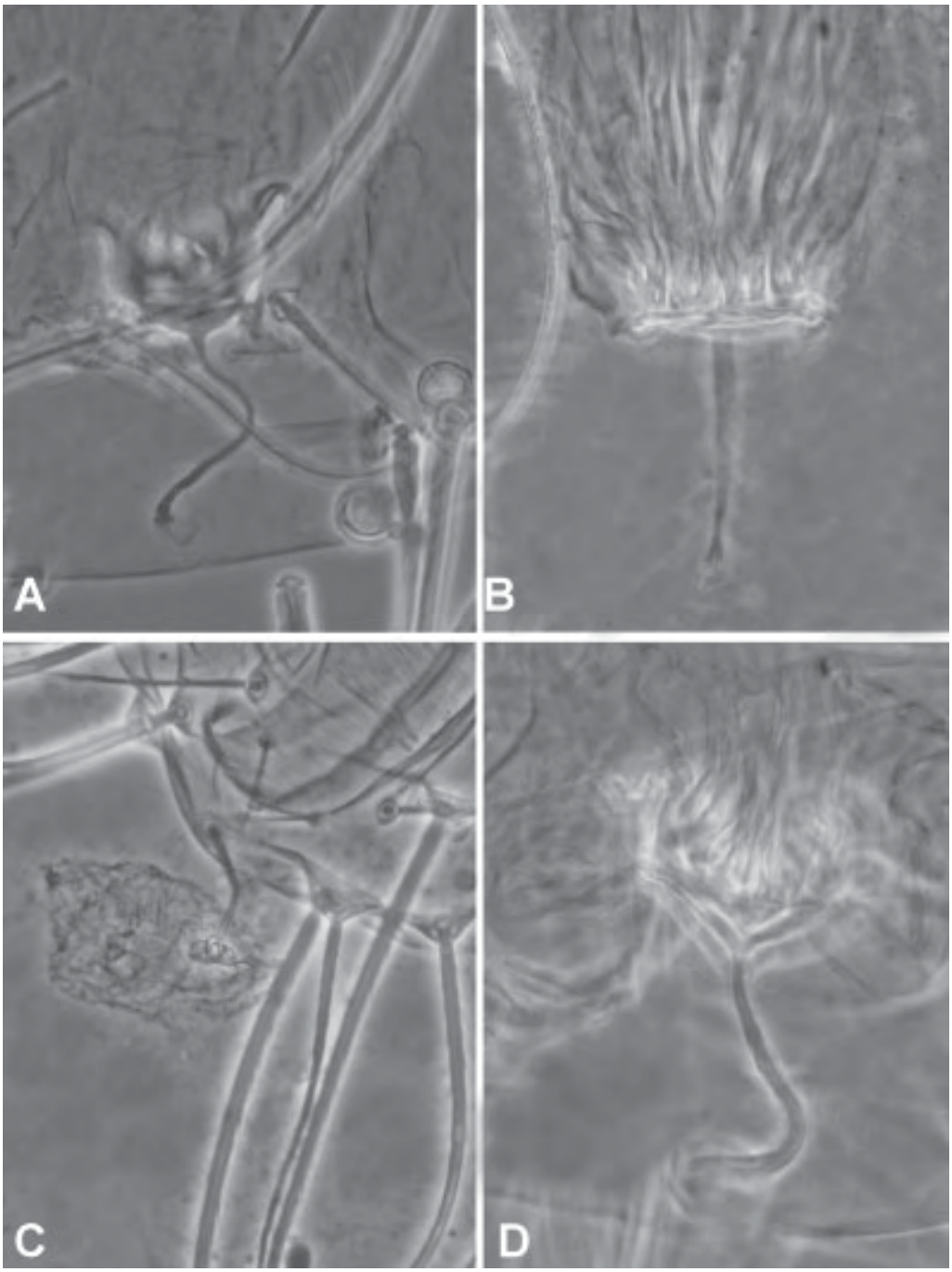


PLATE 11. Spermatheca (female). A, *Tyrophagus neiswanderi* Johnston & Bruce; B, *T. putrescentiae* (Schrank); C, *T. robertsonae* Lynch; D, *T. savasi* Lynch.

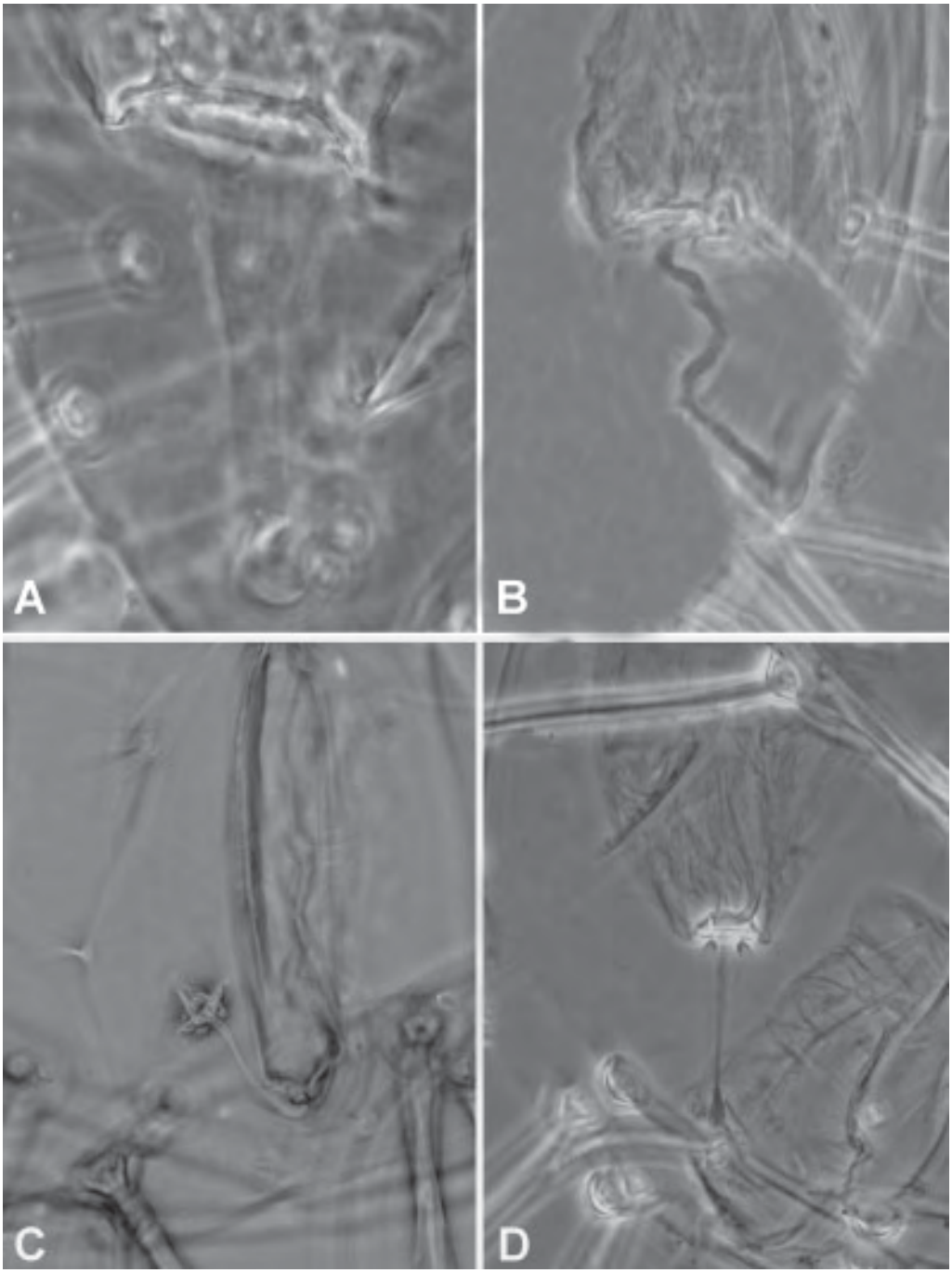


PLATE 12. Spermatheca (female). A, *Tyrophagus similis* Volgin; B, *T. vanheurni* Oudemans; C, *T. javensis* (Oudemans); D, *T. pacificus* **sp. n.**.

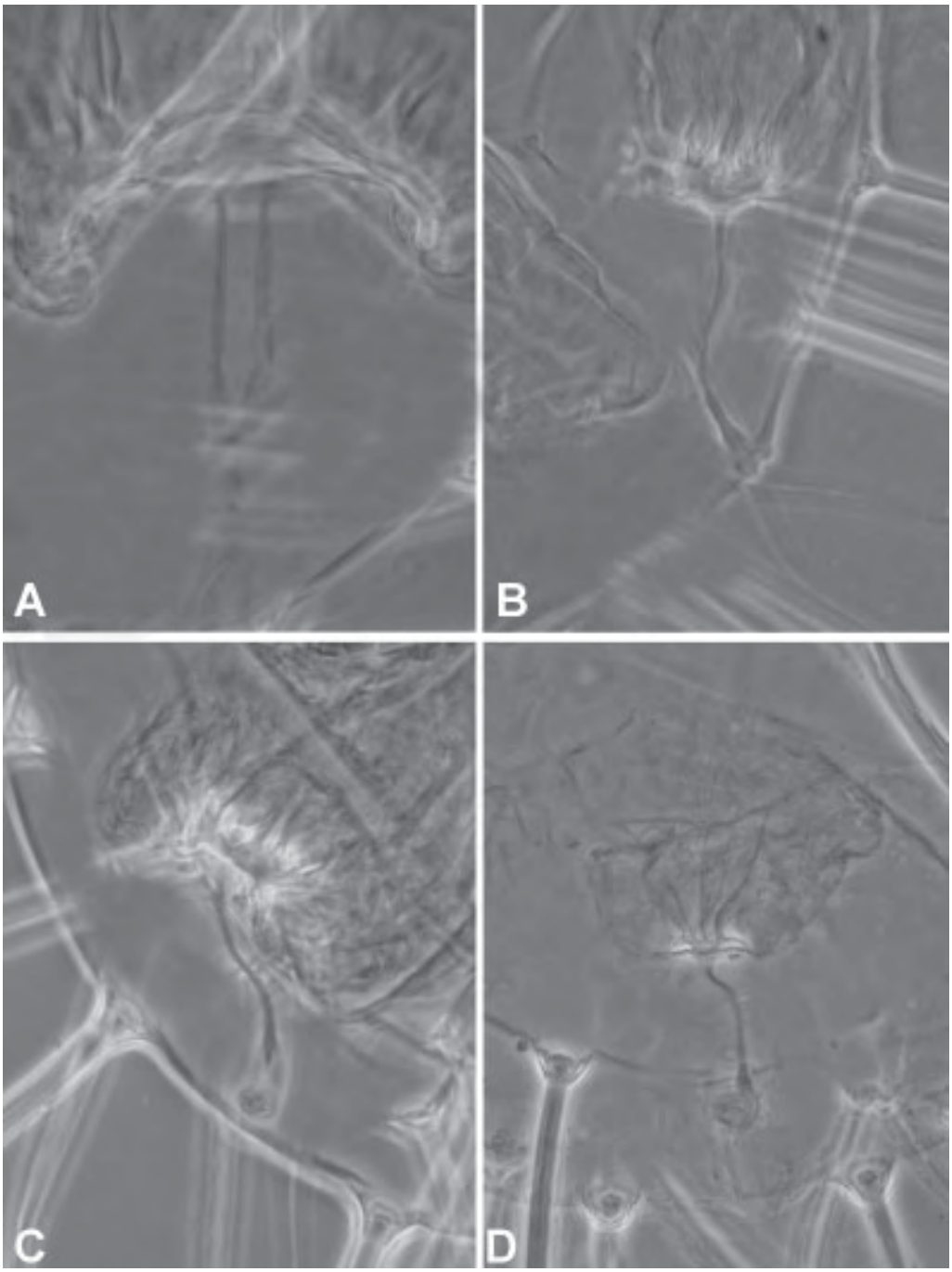


PLATE 13. Spermatheca (female). A, *Tyrophagus perniciosus* Zakhvatkin; B, *T. tropicus* Robertson; C, *T. womersleyi* **sp. n.**; D, *T. xenoductus* **sp. n.**

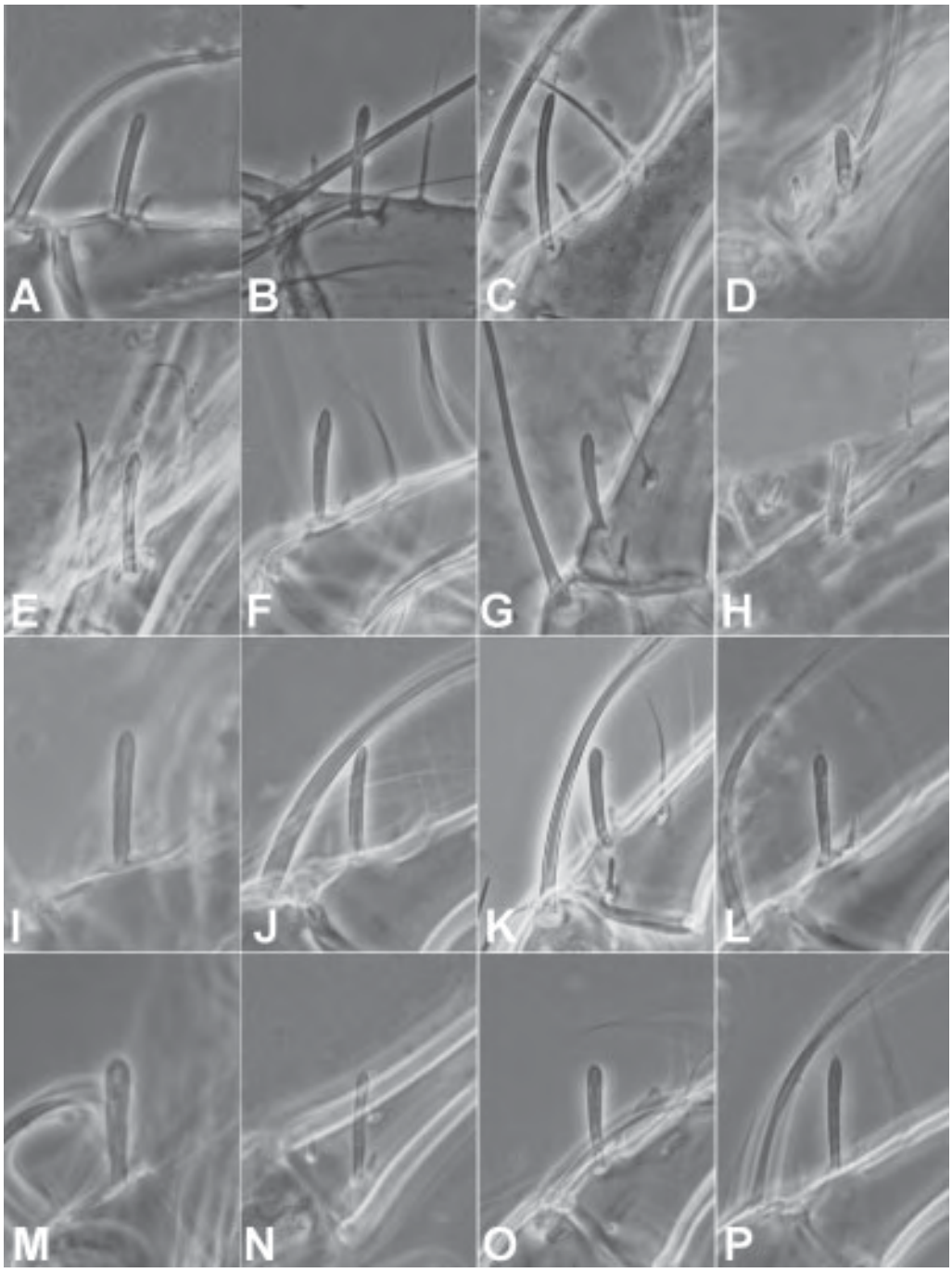


PLATE 14. Solenidion ω_1 on tarsus I (female). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. macfarlanei* **sp. n.**; E, *T. neiswanderi* Johnston & Bruce; F, *T. putrescentiae* (Schrank); G, *T. robertsonae* Lynch; H, *T. savasi* Lynch; I, *T. similis* Volgin; J, *T. vanheurni* Oudemans; K, *T. javensis* (Oudemans); L, *T. pacificus* **sp. n.**; M, *T. perniciosus* Zakhvatkin; N, *T. tropicus* Robertson; O, *T. womersleyi* **sp. n.**; P, *T. xenoductus* **sp. n.**

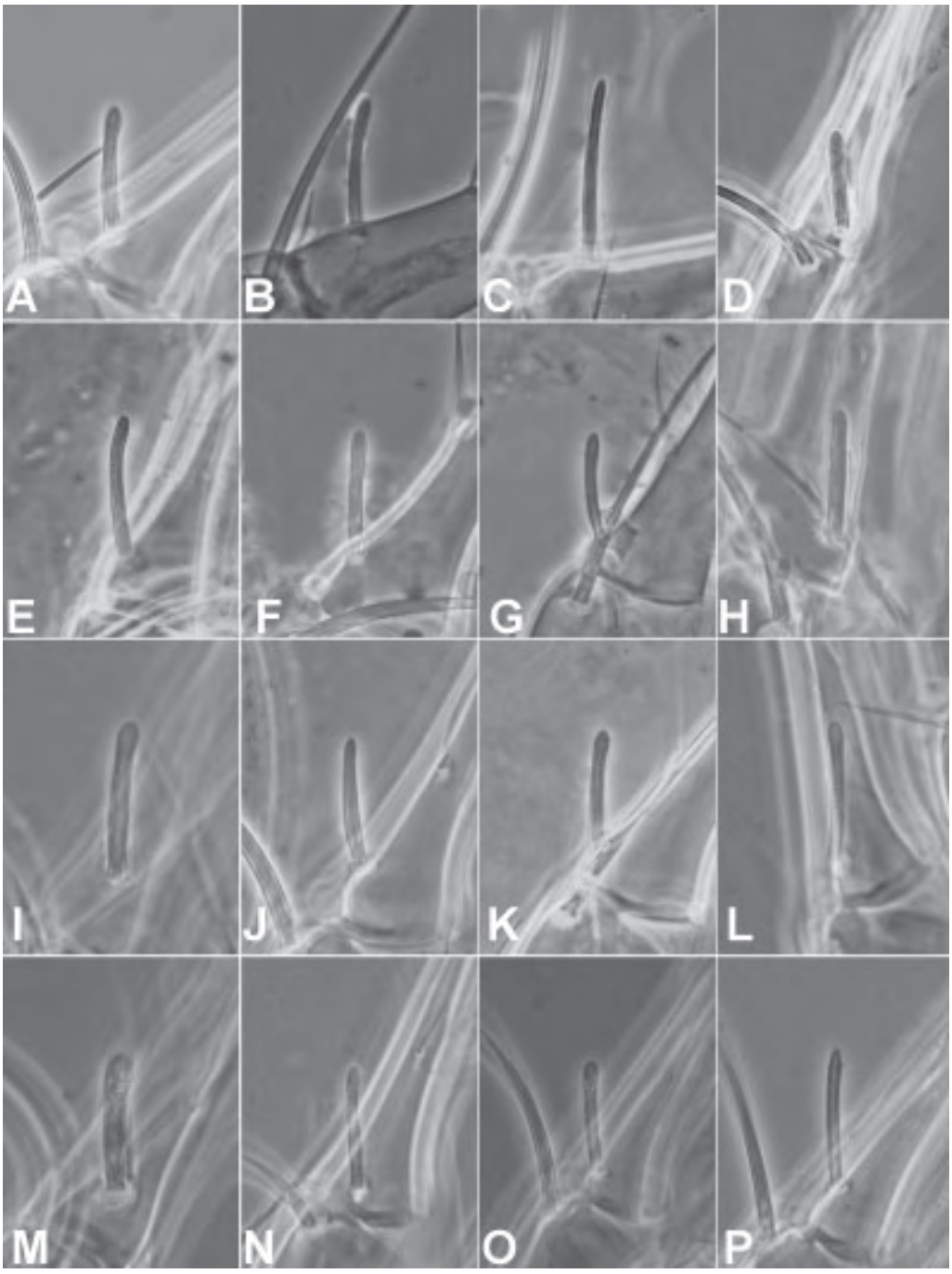


PLATE 15. Solenidion ω on tarsus II (female). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. macfarlanei* **sp. n.**; E, *T. neiswanderi* Johnston & Bruce; F, *T. putrescentiae* (Schrank); G, *T. robertsonae* Lynch; H, *T. savasi* Lynch; I, *T. similis* Volgin; J, *T. vanheurni* Oudemans; K, *T. javensis* (Oudemans); L, *T. pacificus* **sp. n.**; M, *T. perniciosus* Zakhvatkin; N, *T. tropicus* Robertson; O, *T. womersleyi* **sp. n.**; P, *T. xenoductus* **sp. n.**

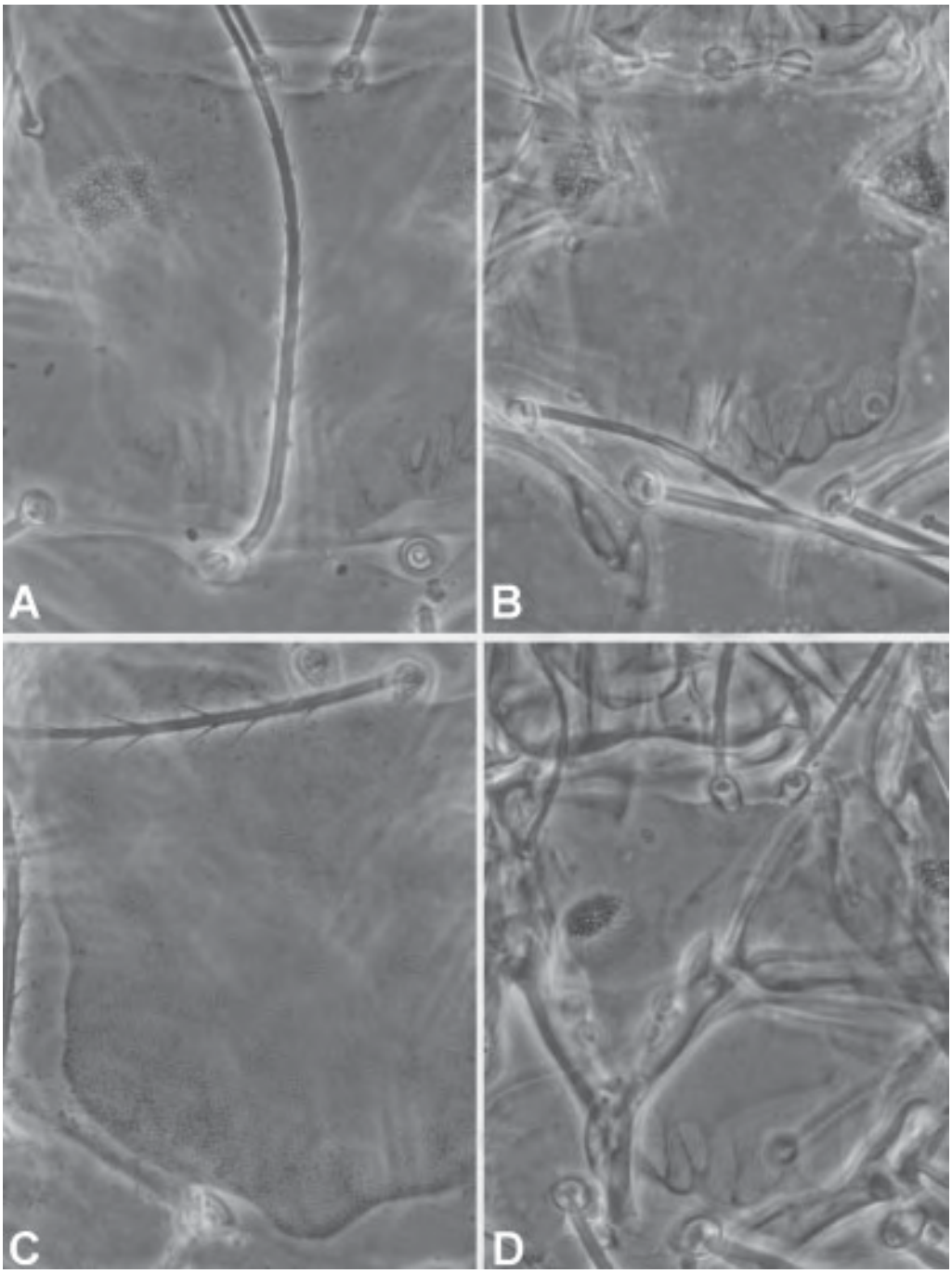


PLATE 16. Prodorsal shield (male). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. neiswanderi* Johnston & Bruce.

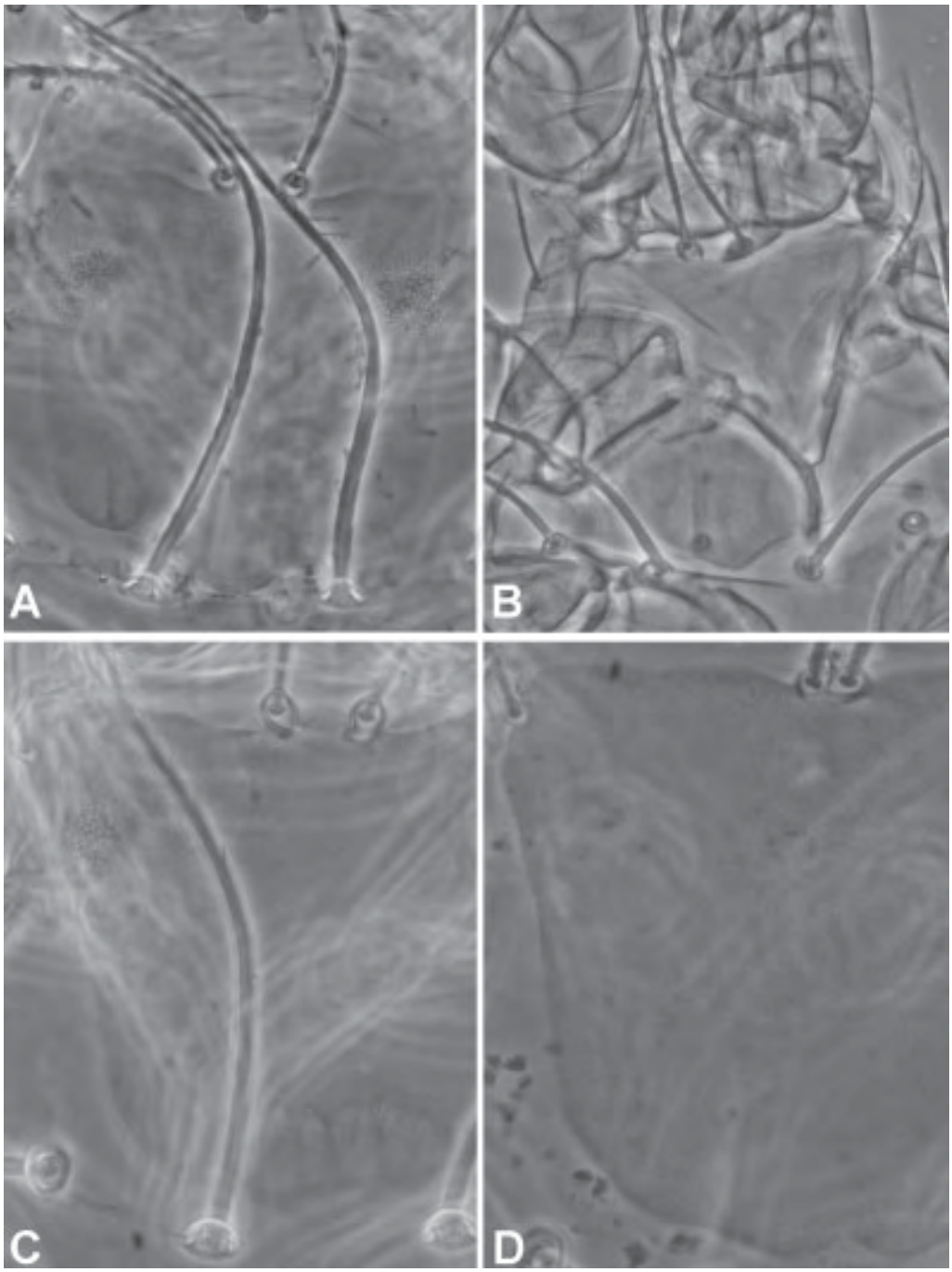


PLATE 17. Prodorsal shield (male). A, *Tyrophagus putrescentiae* (Schrank); B, *T. robertsonae* Lynch; C, *T. savasi* Lynch; D, *T. similis* Volgin.

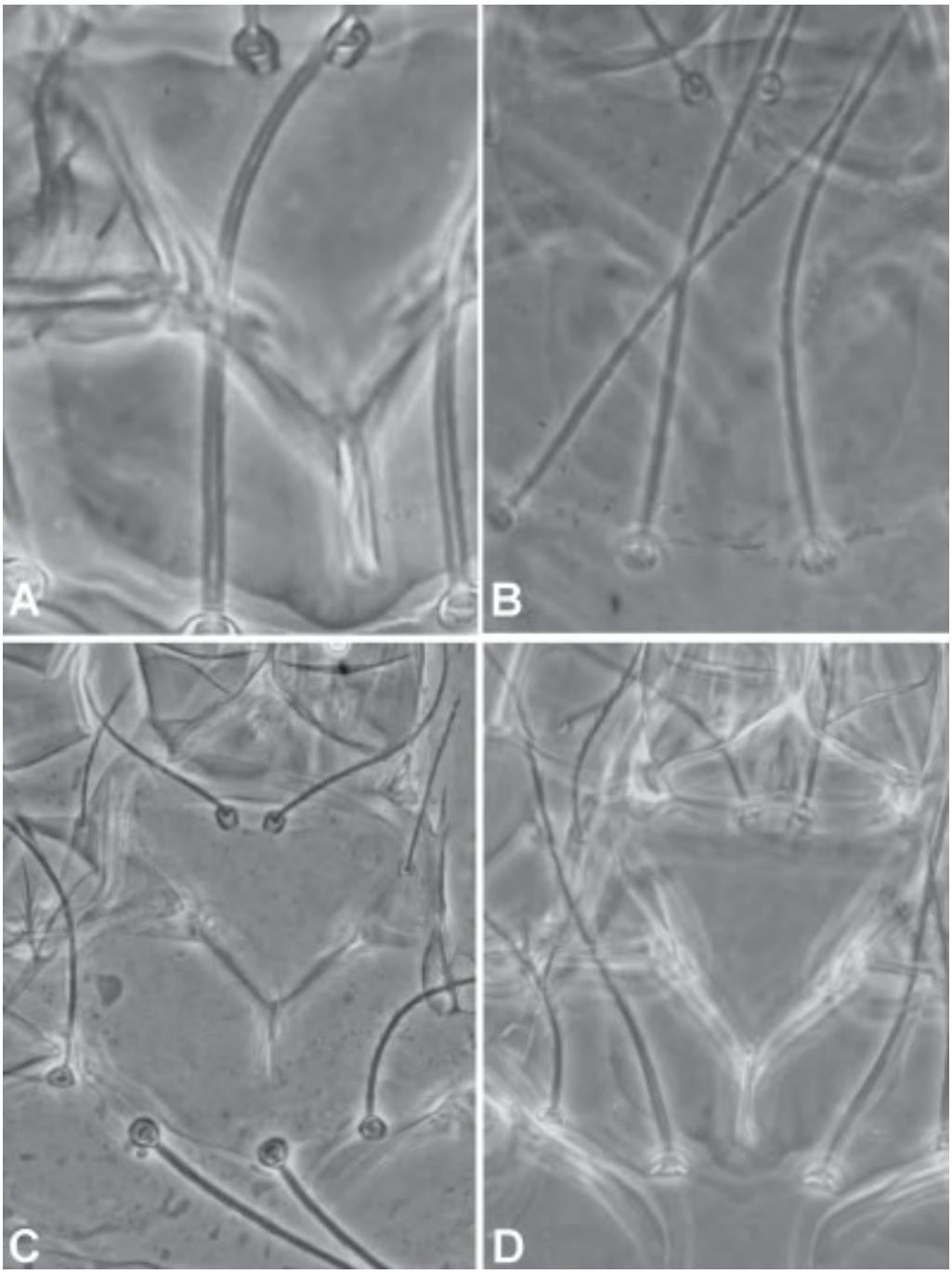


PLATE 18. Prodorsal shield (male). A, *Tyrophagus vanheurni* Oudemans; B, *T. australasiae* (Oudemans); C, *T. javensis* (Oudemans); D, *T. pacificus* **sp. n.**

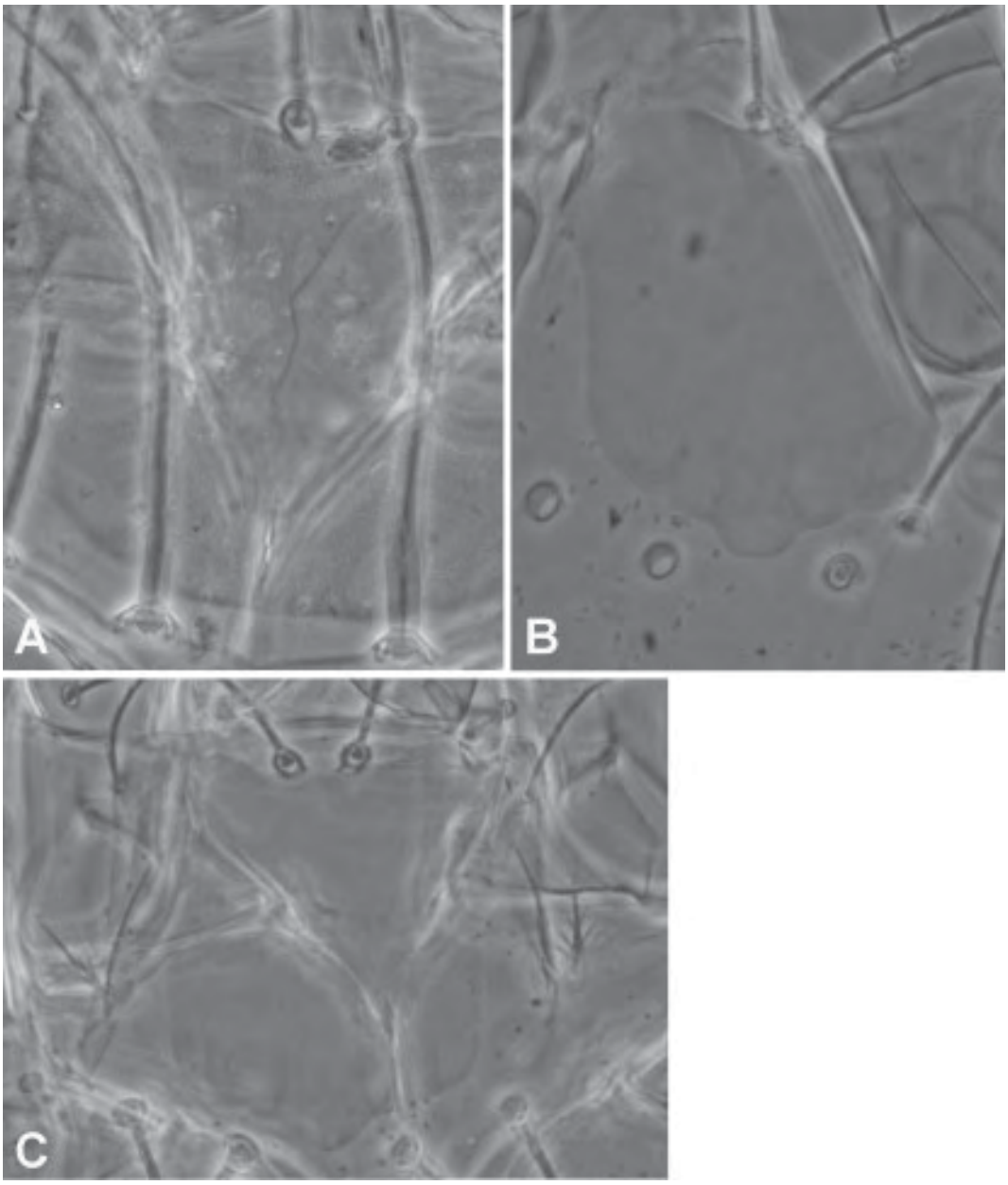


PLATE 19. Prodorsal shield (male). A, *Tyrophagus perniciosus* Zakhvatkin; B, *T. tropicus* Robertson; C, *T. xenoductus* **sp. n.**

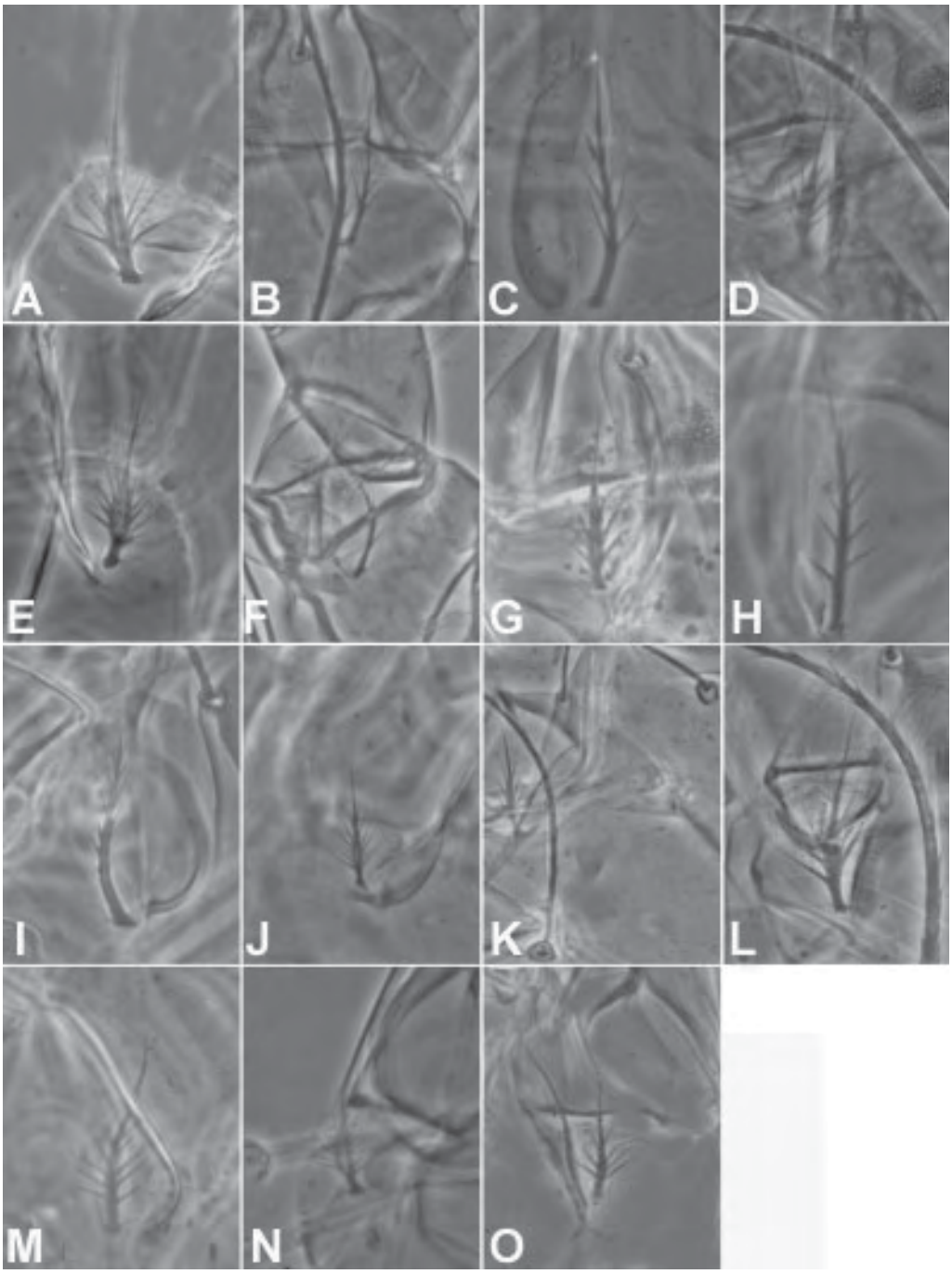


PLATE 20. Supracoxal seta (male). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. neiswanderi* Johnston & Bruce; E, *T. putrescentiae* (Schrank); F, *T. robertsonae* Lynch; G, *T. savasi* Lynch; H, *T. similis* Volgin; I, *T. vanheurni* Oudemans; J, *T. australasiae* (Oudemans); K, *T. javensis* (Oudemans); L, *T. pacificus* **sp. n.**; M, *T. perniciosus* Zakhvatkin; N, *T. tropicus* Robertson; O, *T. xenoductus* **sp. n.**

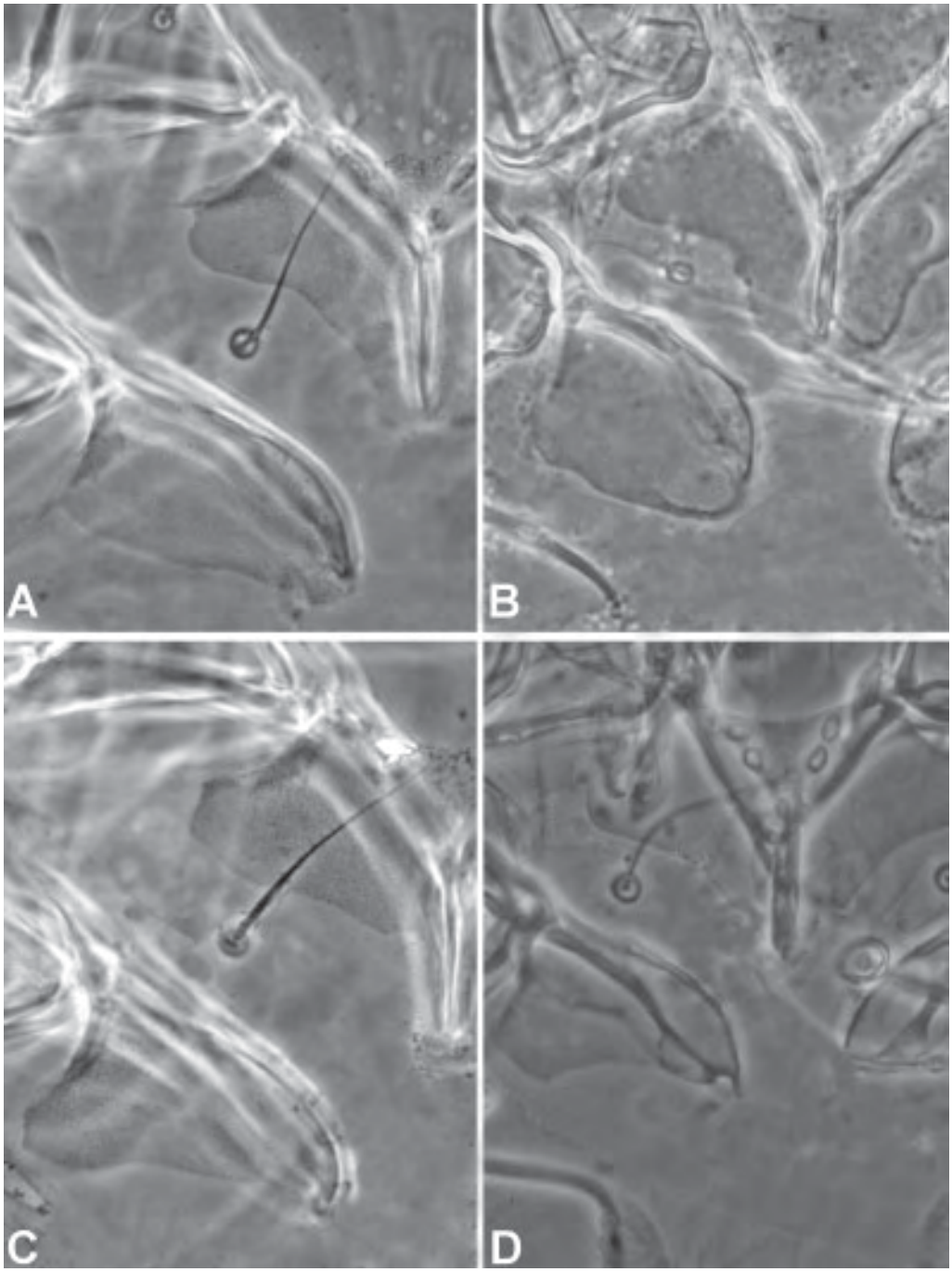


PLATE 21. Coxae I–II (male). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. neiswanderi* Johnston & Bruce.

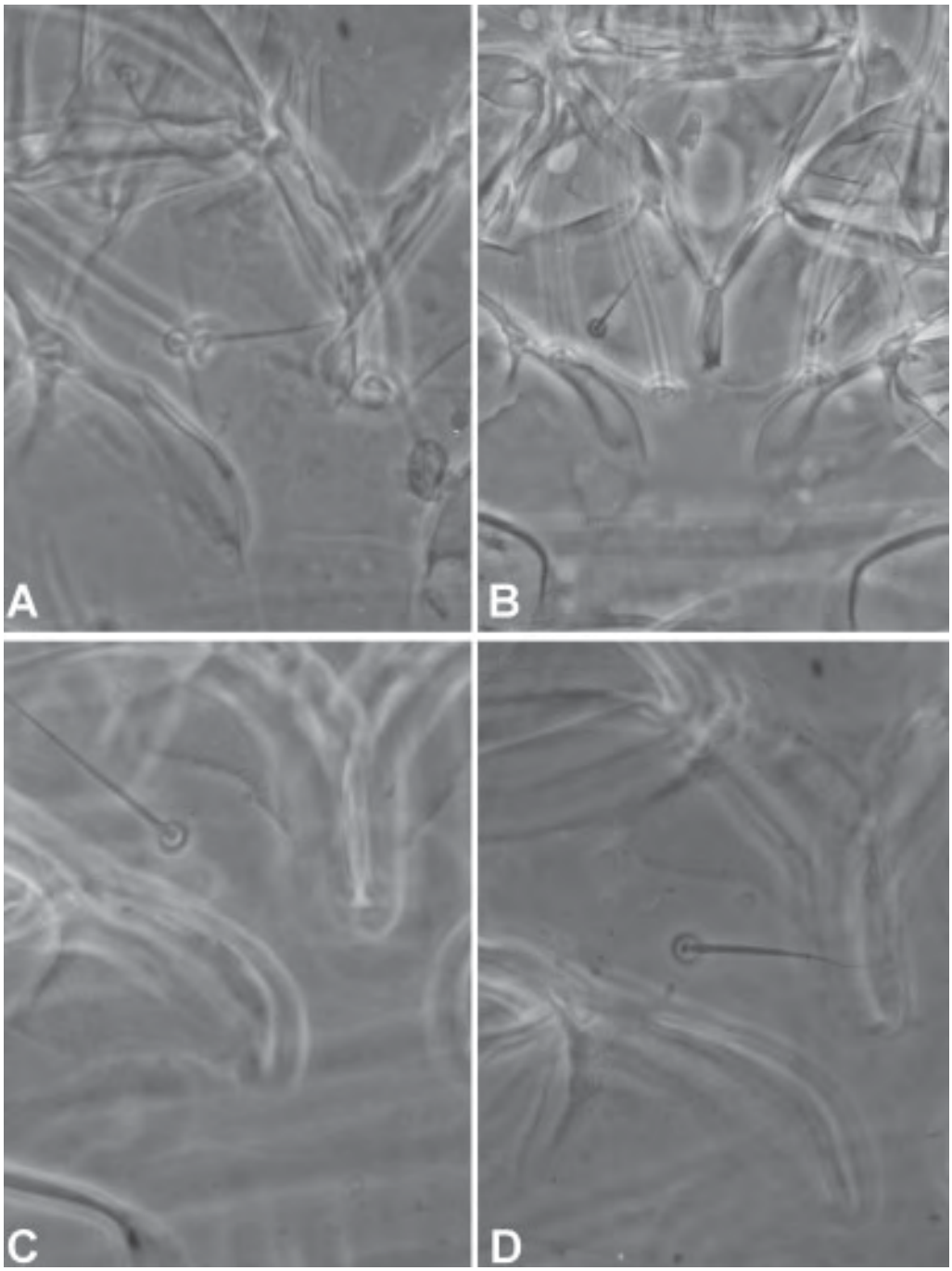


PLATE 22. Coxae I–II (male). A, *Tyrophagus putrescentiae* (Schrank); B, *T. robertsonae* Lynch; C, *T. savasi* Lynch; D, *T. similis* Volgin.

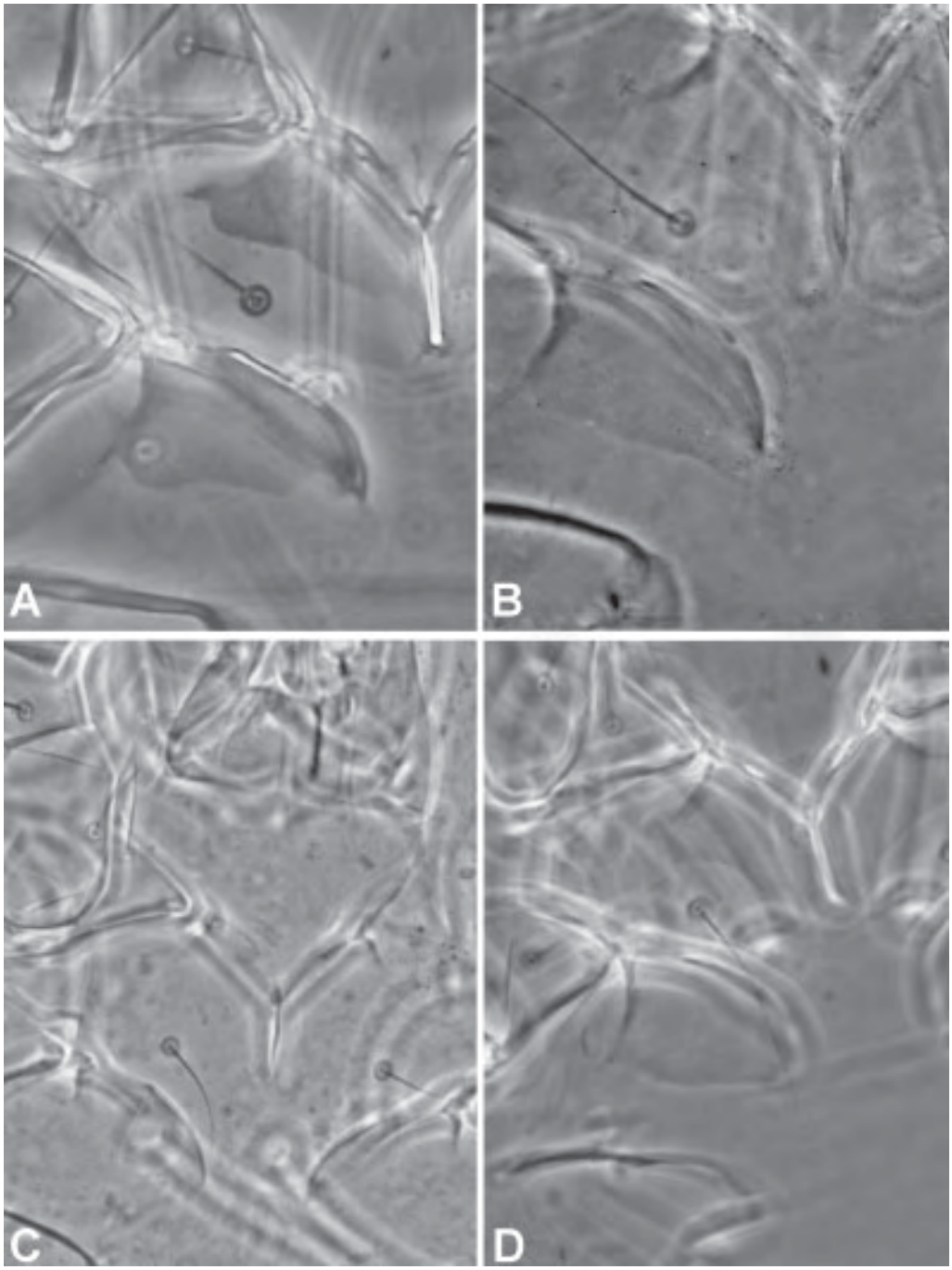


PLATE 23. Coxae I–II (male). A, *Tyrophagus vanheurni* Oudemans; B, *T. australasiae* (Oudemans); C, *T. javensis* (Oudemans); D, *T. pacificus* **sp. n.**

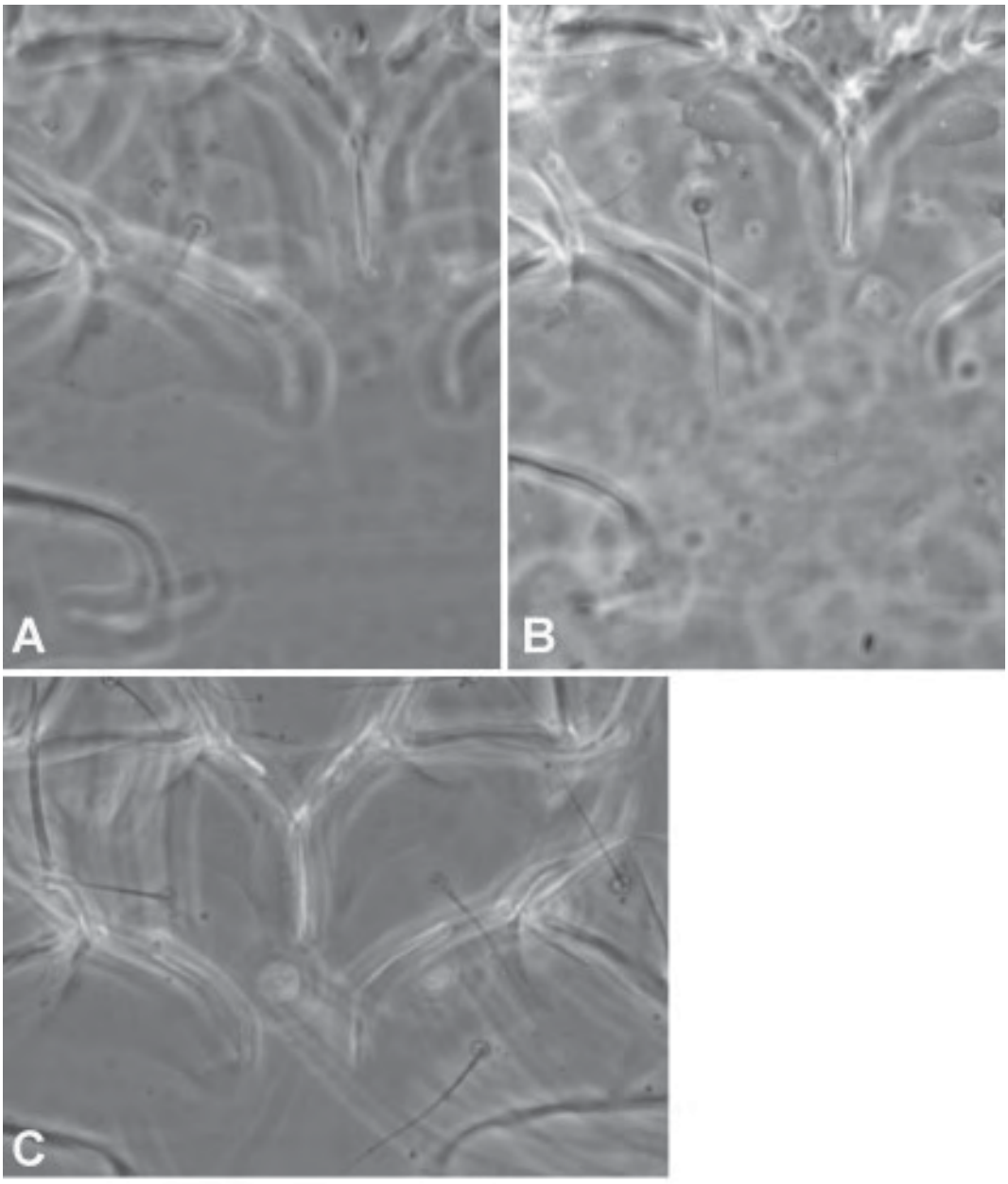


PLATE 24. Coxae I–II (male). A, *Tyrophagus perniciosus* Zakhvatkin; B, *T. tropicus* Robertson; C, *T. xenoductus* **sp. n.**

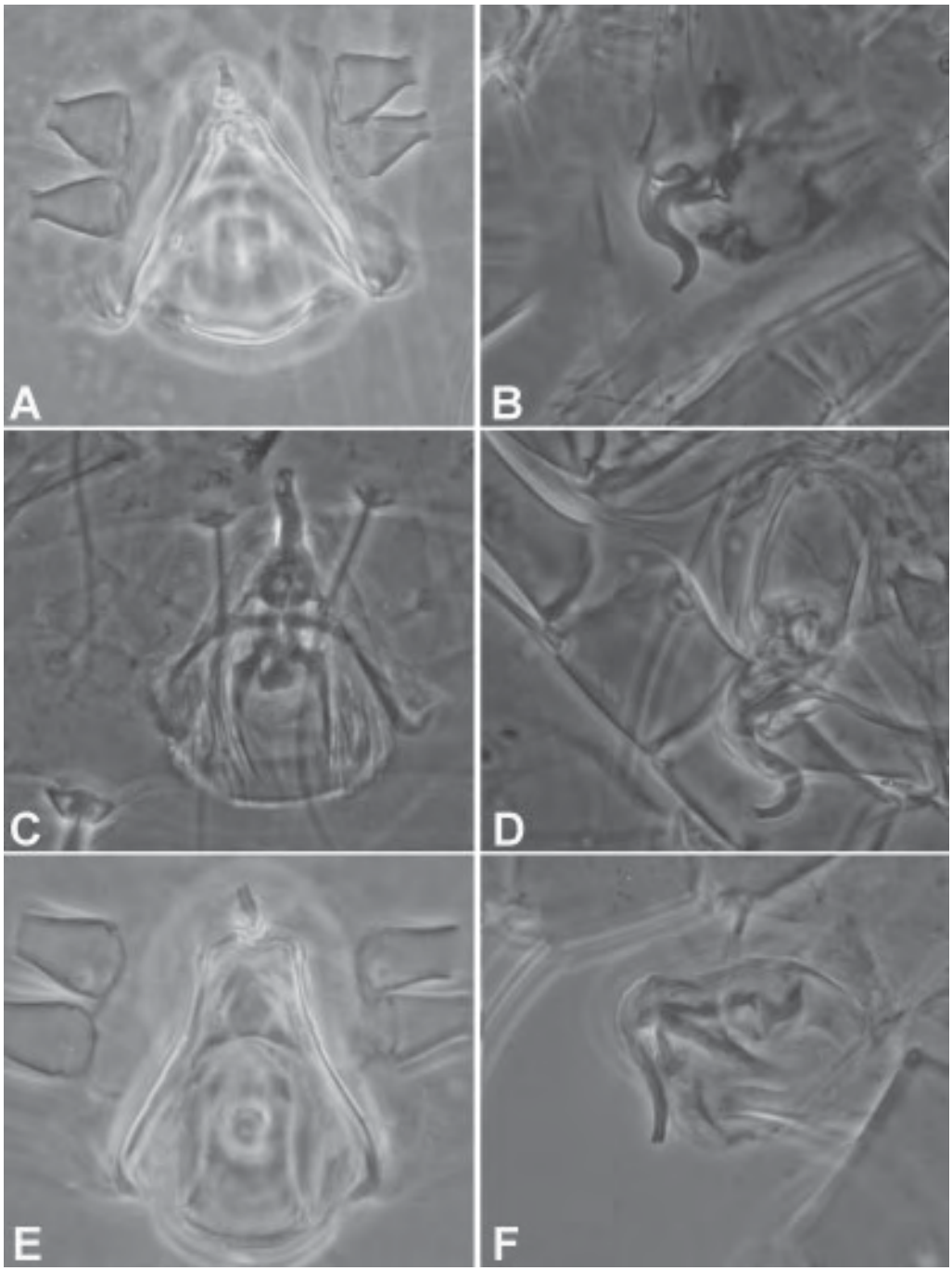


PLATE 25. Aedeagus (male). A, *Tyrophagus communis* **sp. n.** (ventral view); B, *T. communis* **sp. n.** (lateral view); C, *T. curvipenis* Fain & Fauvel (ventral view); D, *T. curvipenis* Fain & Fauvel (lateral view); E, *T. longior* (Gervais) (ventral view); F, *T. longior* (Gervais) (lateral view).

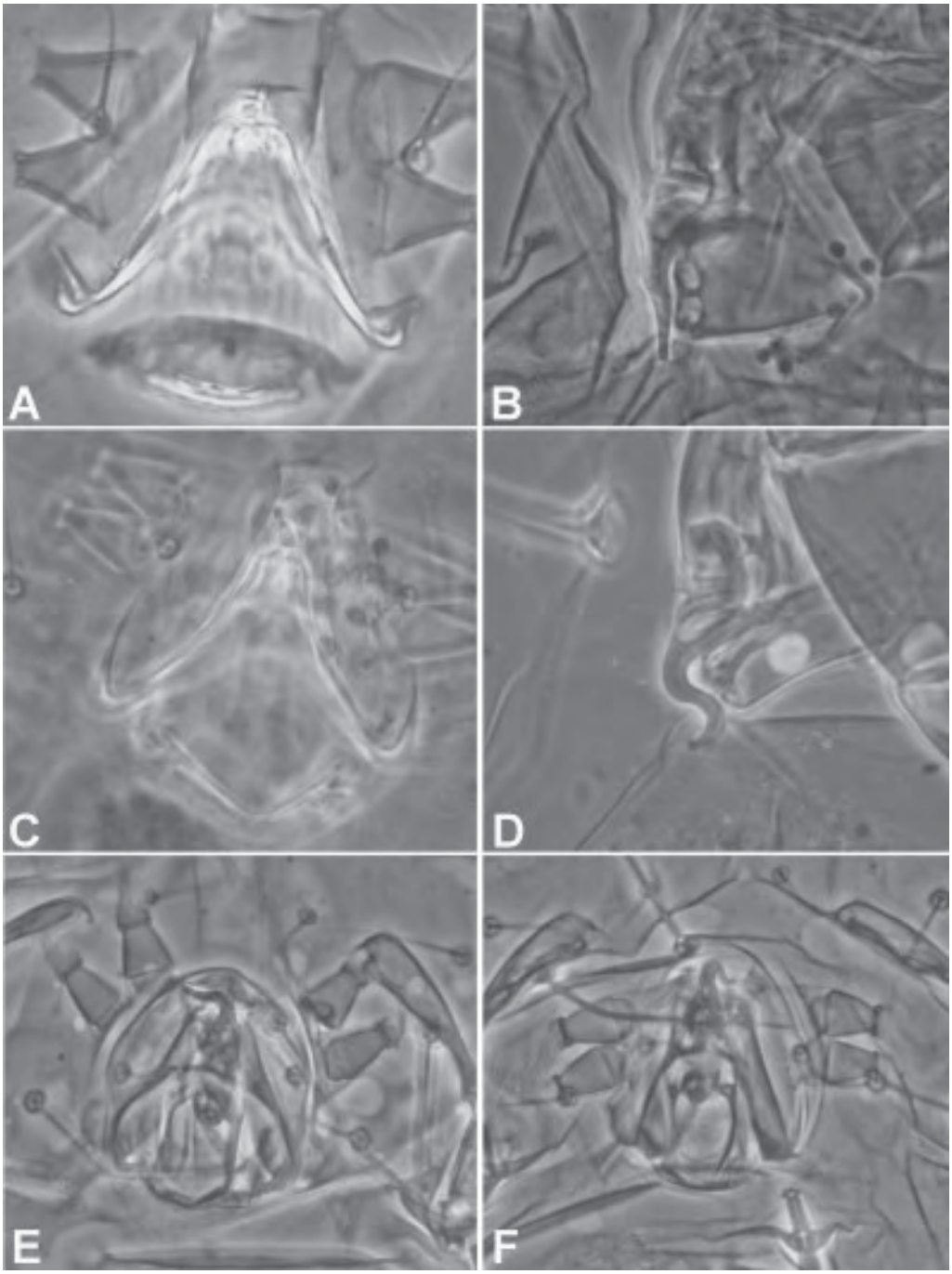


PLATE 26. Aedeagus (male). A, *Tyrophagus neiswanderi* Johnston & Bruce (ventral view); B, *T. neiswanderi* Johnston & Bruce (lateral view); C, *T. putrescentiae* (Schrank) (ventral view); D, *T. putrescentiae* (Schrank) (lateral view); E, *T. robertsonae* Lynch (lateral view); F, *T. robertsonae* Lynch (lateral view).

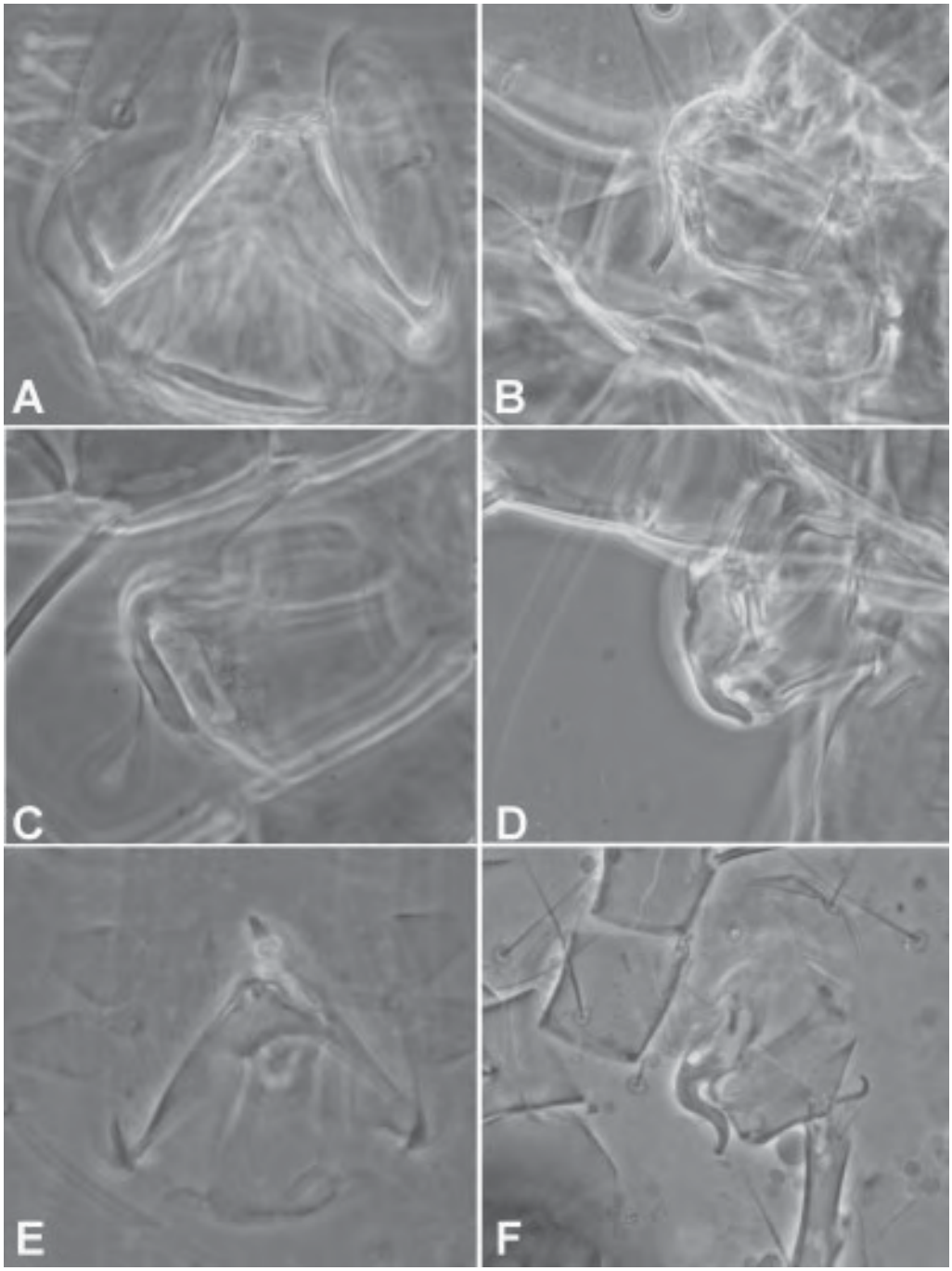


PLATE 27. Aedeagus (male). A, *Tyrophagus savasi* Lynch (ventral view); B, *T. savasi* Lynch (lateral view); C, *T. similis* Volgin (lateral view); D, *T. vanheurni* Oudemans (lateral view); E, *T. australasiae* (Oudemans) (ventral view, P6921); F, *T. australasiae* (Oudemans) (lateral view, P6910).

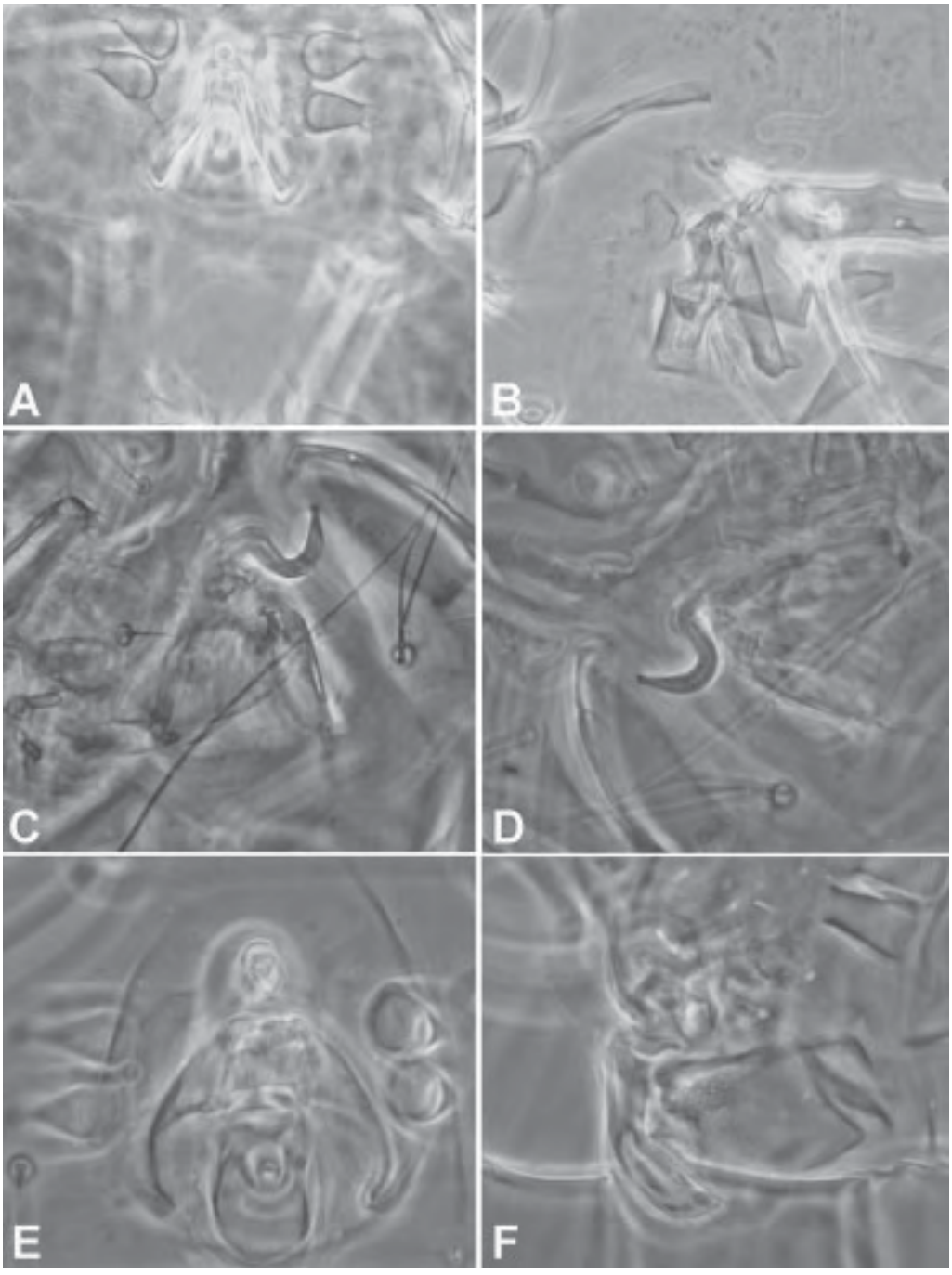


PLATE 28. Aedeagus (male). A, *Tyrophagus javensis* (Oudemans) (ventral view); B, *T. javensis* (Oudemans) (lateral view); C, *T. pacificus* **sp. n.** (lateral view); D, *T. pacificus* **sp. n.** (lateral view); E, *T. perniciosus* Zakhvatkin (ventral view); F, *T. perniciosus* Zakhvatkin (lateral view).

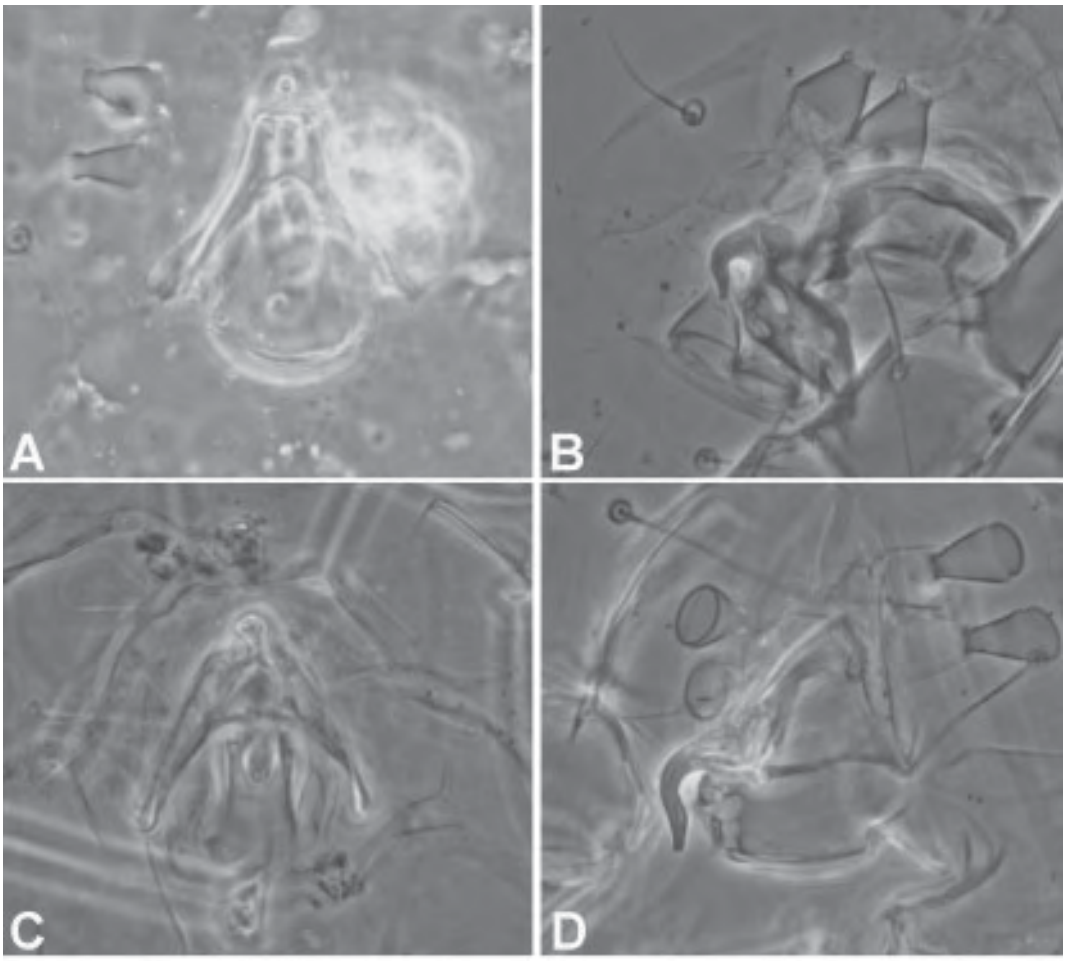


PLATE 29. Aedeagus (male). A, *Tyrophagus tropicus* Robertson (ventral view); B, *T. tropicus* Robertson (lateral view); C, *T. xenoductus* **sp. n.** (ventral view); D, *T. xenoductus* **sp. n** (lateral view)**.**

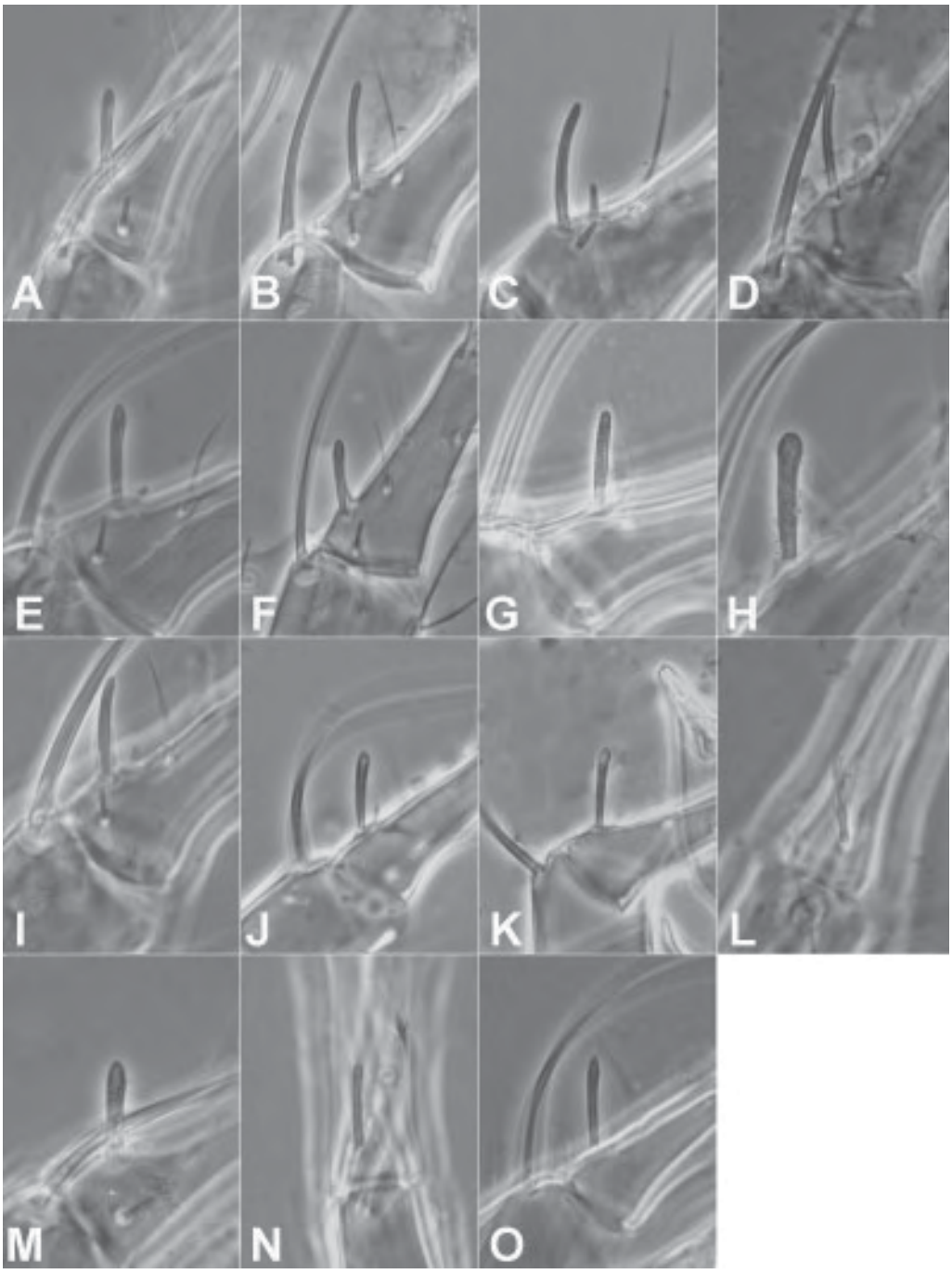


PLATE 30. Solenidion ω_1 on tarsus I (male). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. neiswanderi* Johnston & Bruce; E, *T. putrescentiae* (Schrank); F, *T. robertsonae* Lynch; G, *T. savasi* Lynch; H, *T. similis* Volgin; I, *T. vanheurni* Oudemans; J, *T. australasiae* (Oudemans); K, *T. javensis* (Oudemans); L, *T. pacificus* **sp. n.**; M, *T. perniciosus* Zakhvatkin; N, *T. tropicus* Robertson; O, *T. xenoductus* **sp. n.**

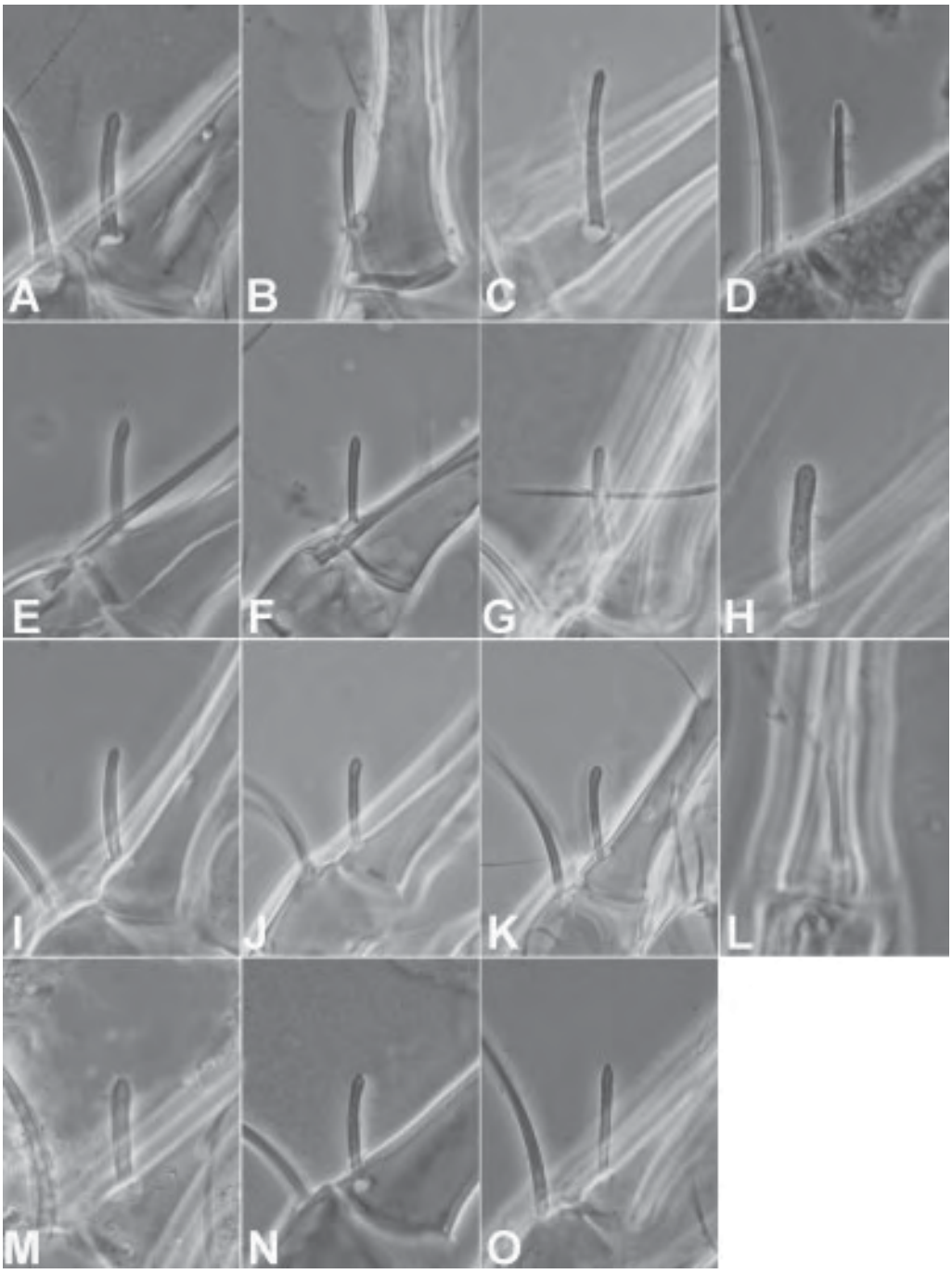


PLATE 31. Solenidion ω on tarsus II (male). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. neiswanderi* Johnston & Bruce; E, *T. putrescentiae* (Schrank); F, *T. robertsonae* Lynch; G, *T. savasi* Lynch; H, *T. similis* Volgin; I, *T. vanheurni* Oudemans; J, *T. australasiae* (Oudemans); K, *T. javensis* (Oudemans); L, *T. pacificus* **sp. n.**; M, *T. perniciosus* Zakhvatkin; N, *T. tropicus* Robertson; O, *T. xenoductus* **sp. n.**

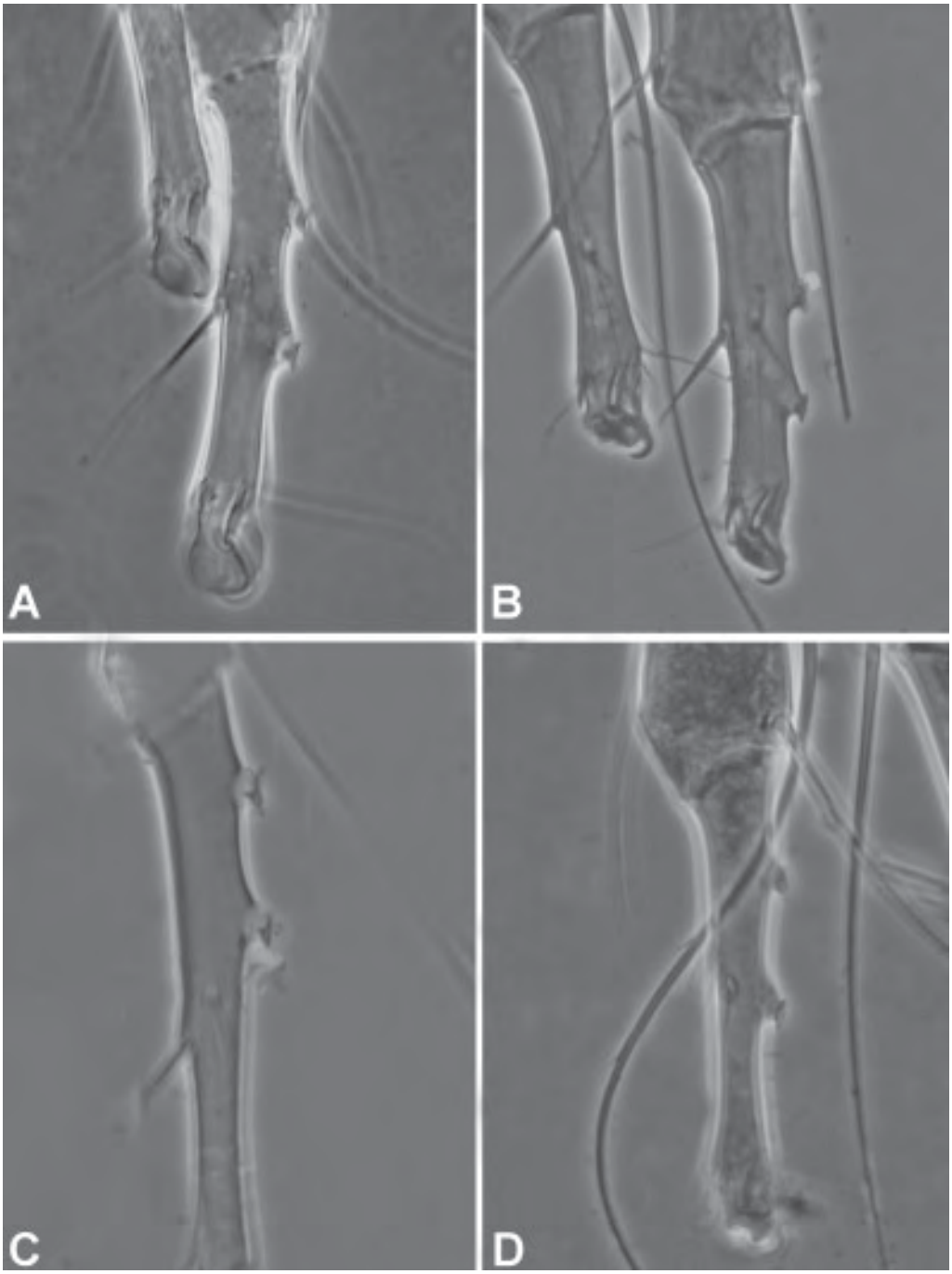


PLATE 32. Tarsus IV (male). A, *Tyrophagus communis* **sp. n.**; B, *T. curvipenis* Fain & Fauvel; C, *T. longior* (Gervais); D, *T. neiswanderi* Johnston & Bruce.

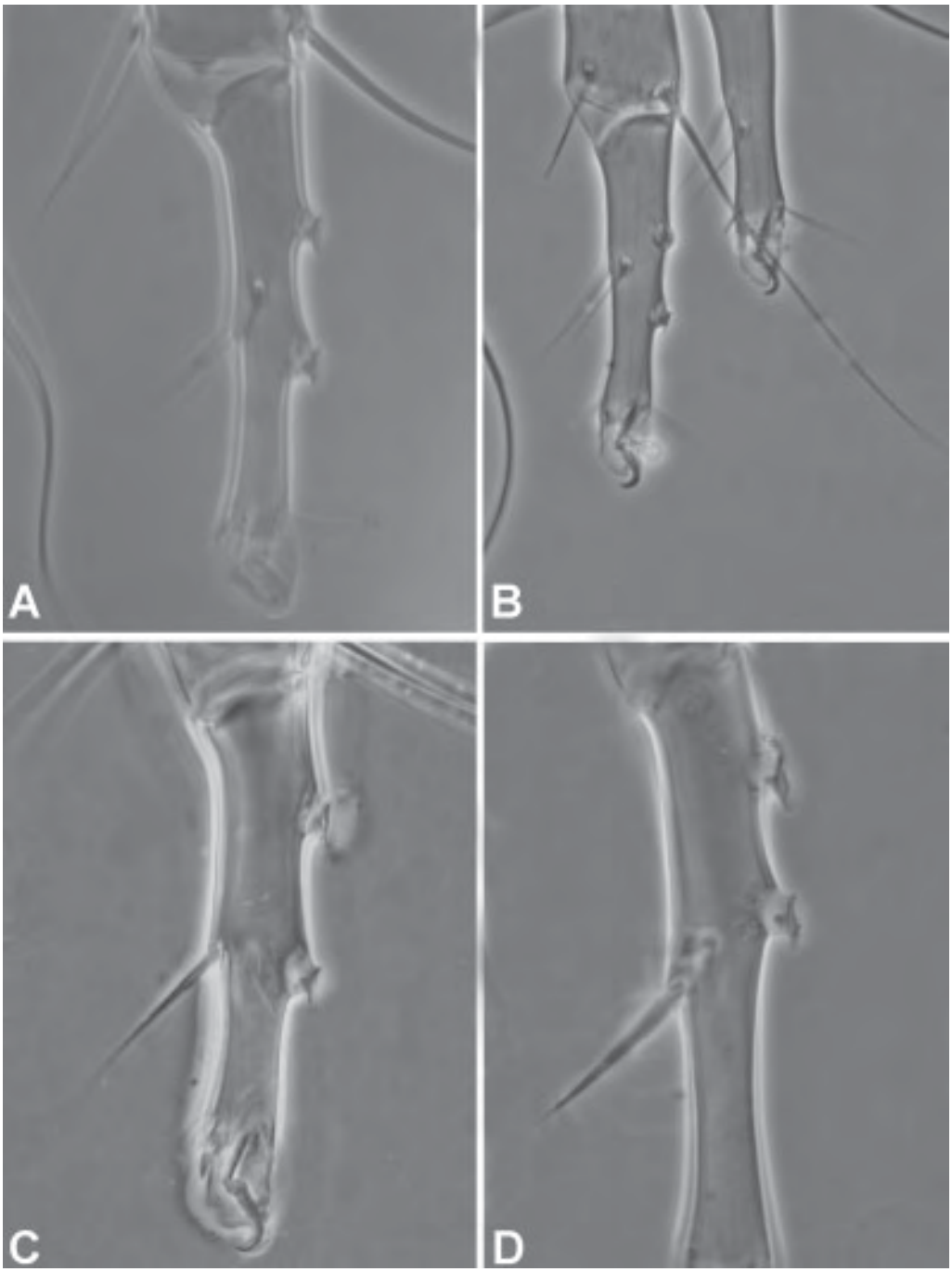


PLATE 33. Tarsus IV (male). A, *Tyrophagus putrescentiae* (Schrank); B, *T. robertsonae* Lynch; C, *T. savasi* Lynch; D, *T. similis* Volgin.

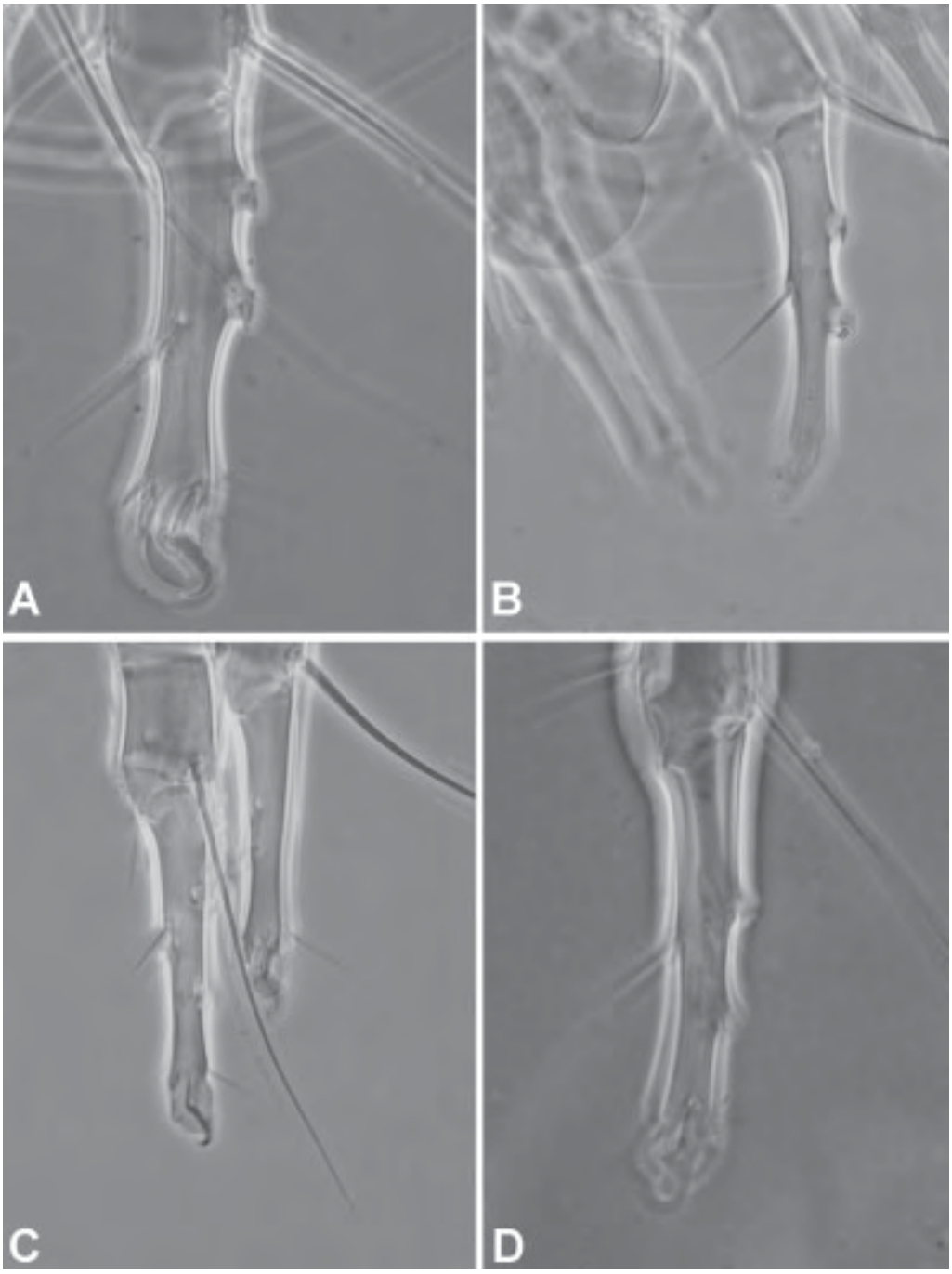


PLATE 34. Tarsus IV (male). A, *Tyrophagus vanheurni* Oudemans; B, *T. australasiae* (Oudemans); C, *T. javensis* (Oudemans); D, *T. pacificus* **sp. n.**

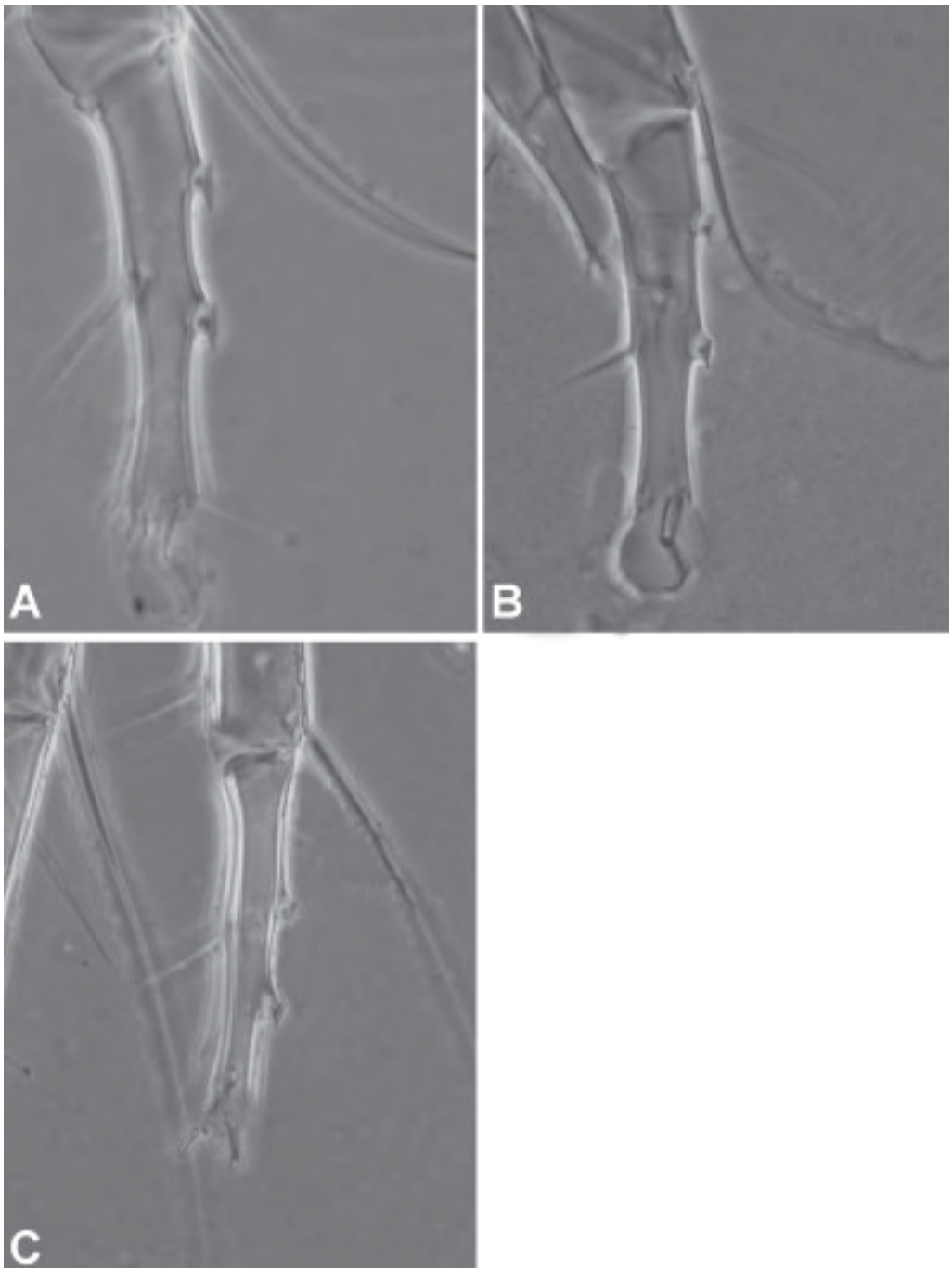
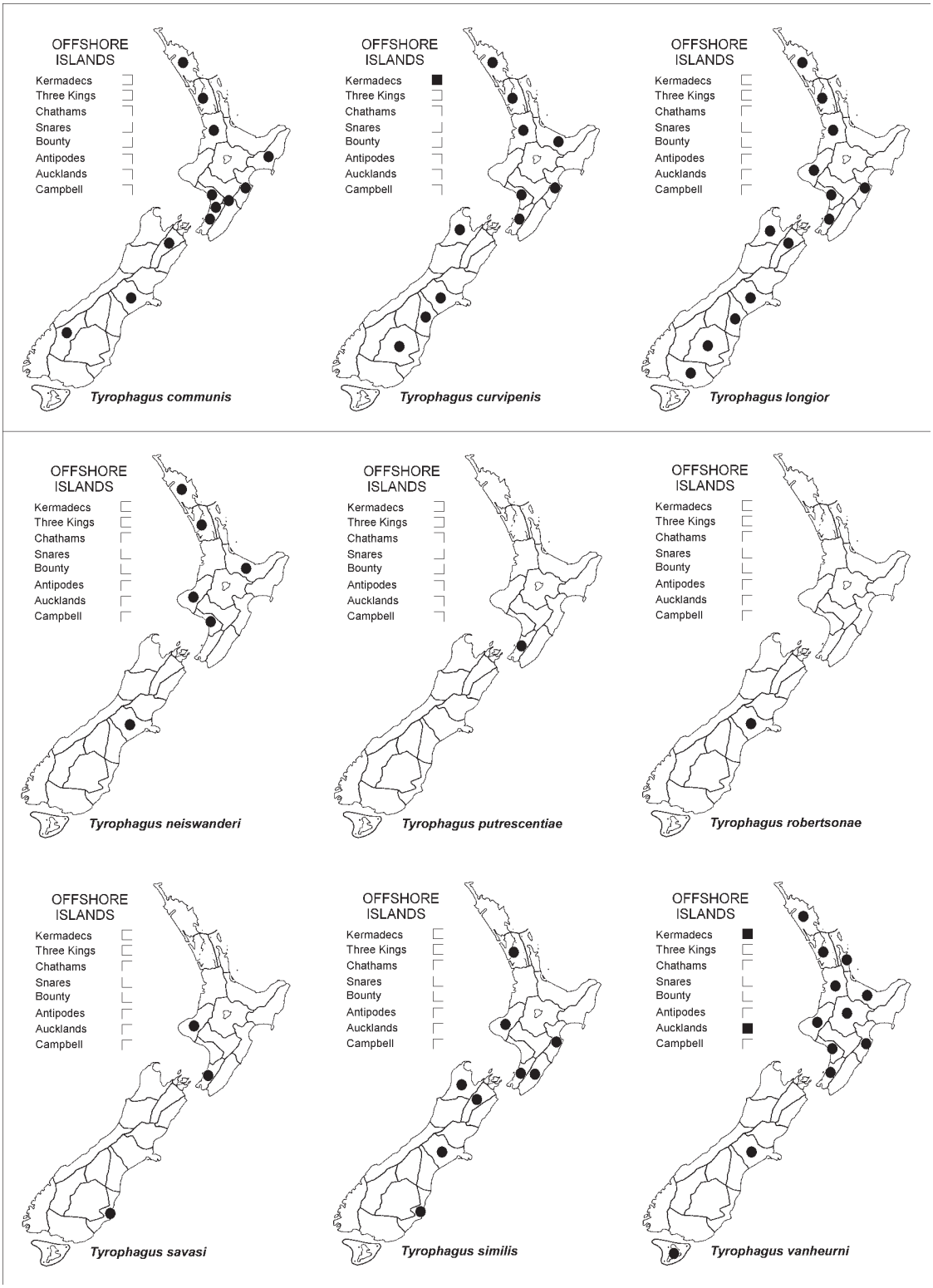


PLATE 35. Tarsus IV (male). A, *Tyrophagus perniciosus* Zakhvatkin; B, *T. tropicus* Robertson; C, *T. xenoductus* **sp. n.**



Species distribution maps according to area codes of Crosby *et al*. (1976, 1998); detailed locality information in appendix 1.

TAXONOMIC INDEX

This index covers the nominal taxa mentioned in the text, regardless of their current status in taxonomy. In the case of synonyms, the combinations of generic and specific names listed are those originally published by authors, and may differ from combinations implicit in current usage. Taxa in **bold** indicate valid taxa. Page numbers in **bold** indicate the entries of the descriptions. The letters "**kf**" or "**km**" after a page indicate the page of the **key** to the female or male. The letter "**f**" after a page indicates a **figure**. The letter "**p**" after a page indicates a **plate**. The letter "**m**" indicates a **distribution map**. The Figures, Plates and Distributional maps are on the following pages: **Figures**, pages 69–241; **Plates**, pages 242–276; **Distribution maps**, page 277.

INDEX TO HOSTS (habitats)

LIST OF SPECIES BY HOST

oil-producing (seeds)—*perniciosus*
onion—*communis*, *curvipenis*, *longior*, *neiswanderi*, *robertsonae*
onion (diseased)—*neiswanderi*
orange—*communis*, *neiswanderi*, *putrescentiae*
orange (calyx end)—*communis*
orchid—*communis*, *neiswanderi*, *putrescentiae*, *similis*
orchid (flower)—*neiswanderi*
orchid (house floor)—*neiswanderi*
orchid (pot)—*neiswanderi*
Orchidaceae—*communis*
ornamentals—*longior*
Orthodera ministralis (ootheca)—*vanheurni*
Oryctolagus cuniculus—*similis*

Pachyptila turtur (nest)—*longior*
pallet and scraping—*communis*, *curvipenis*, *longior*
palm kernel dust—*tropicus*
palm (seeds)—*communis*, *putrescentiae*
passalid beetle—*communis*
passion fruit—*curvipenis*
pasture—*similis*
pea (damaged)—*longior*
peanut—*communis*
pepino—*neiswanderi*
persimmon—*communis*, *curvipenis*
Phalaenopsis (flower buds)—*neiswanderi*
pimento—*communis*
pine tree (seeds)—*communis*
pineapple—*communis*, *javensis*, *womersleyi*
Plagiolepis longipes—*communis*, *australasiae*, *javensis*
plant (roots)—*communis*
Plumeria—*communis*
pollen from hive—*communis*, *vanheurni*
pollen (stored)—*longior*
Polyconoceris alaskis—*communis*
Polynesian rat—*similis*, *perniciosus*
pomelo—*longior*
Populus nigra var. *italica* (galls)—*curvipenis*
potato—*communis*
Prionoplus reticularis (dead)—*communis*, *longior*
prosciutto in meat works—*longior*
Prunus (leaves)—*neiswanderi*
Psocoptera (lab culture)—*communis*
Puffinus tenuirostris—*putrescentiae*
pumpkin—*similis*, *perniciosus*

Quercus (acorns)—*longior*, *similis*

rabbit—*communis*, *similis*
Ranunculus (bulb)—*communis*, *putrescentiae*
raspberry (jam)—*communis*
Rattus exulans—*curvipenis*, *similis*, *vanheurni*
Rattus exulans (dead)—*vanheurni*
Rattus norvegicus—*similis*, *vanheurni*
Rattus norvegicus (dead)—*curvipenis*, *vanheurni*
Rattus rattus—*vanheurni*
red dates—*communis*
Rhopoea larva (dead)—*similis*
rice plant—*communis*
rooster feathers “Tintinhull”—*communis*
rose—*communis*
ryegrass (seeds)—*longior*

saint paulia—*communis*
sandy soil in pots of Rama ryegrass—*similis*
scale culture room—*neiswanderi*
Scirpus tuberosus—*communis*
sea bird (nest)—*longior*, *similis*
seeds & spices—*communis*
seeds and debris from tent—*similis*
shallot—*curvipenis*, *longior*
sheep (scrapie-infected)—*longior*
sheep faeces—*communis*
shell fish (dried)—*communis*
shepherd—*longior*
short-tailed bat—*vanheurni*
silverfish (culture)—*communis*
soft wax scale—*vanheurni*
soil—*communis*, *robertsonae*
soil (agricultural)—*similis*
soil and dead plant residues—*perniciosus*
soil and plant material—*neiswanderi*
Solanum muricatum—*neiswanderi*
sorghum (stored)—*communis*
soya bean—*communis*
soyabean flour—*longior*
sparrow (nest)—*curvipenis*
sphecids stick-trap—*vanheurni*
spinach—*similis*, *perniciosus*
spinach (bud)—*similis*
spoon from kitchen—*communis*
Sporotrichum—*communis*
starling (nest)—*perniciosus*
Stathmopoda (dead larva)—*curvipenis*
stored food products—*longior*
stored grain—*longior*
strawberry—*communis*, *curvipenis*, *longior*
straws of rice (rotten)—*similis*
Sturnus vulgaris (nest)—*curvipenis*, *longior*, *similis*, *perniciosus*
sugarbeet field—*similis*
swallow (nest)—*curvipenis*

tamarillo—*longior*
taro—*communis*
tea-tree (scrub)—*similis*
Theobroma cacao—*communis*, *tropicus*
Tinca tinca—*putrescentiae*
Tineola biselliella—*communis*
tomato—*communis*, *neiswanderi*, *perniciosus*
tomato chutney—*longior*
tree onion (bulb)—*curvipenis*
Tribolium (culture)—*communis*
tulip (bulb)—*communis*, *putrescentiae*

vanilla bean—*communis*
vegetable leaves (dried)—*communis*
Vespula germanica (nest)—*curvipenis*
Virgilia divaricata—*communis*

water chestnut—*communis*
water melon—*javensis*
wedding cake—*longior*
weed—*longior*
wheat—*communis*, *longior*
white heron—*similis*

Ya pear—*communis*
yam—*communis*

Zantedeschia (bulb)—*neiswanderi*
Zenarge turneri (larva)—*similis*

LIST OF SPECIES BY DISTRIBUTION

Africa—*communis*, *tropicus*
Argentina—*communis*
Australia—*communis*, *curvipenis*, *javensis*, *longior*, *neiswanderi*, *perniciosus*, *putrescentiae*, *similis*, *vanheurni*, *womersleyi*
Australia (Lord Howe I.)—*communis*
Australia (Norfolk I.)—*communis*

Belgium—*longior*, *similis*
Brazil—*communis*
Bulgaria—*longior*, *perniciosus*

Canada—*longior*
Chile—*communis*
China (mainland)—*communis*, *neiswanderi*, *putrescentiae*, *tropicus*, *similis*
China (Hong Kong)—*communis*, *tropicus*
China (Taiwan)—*communis*, *putrescentiae*,
Cook Is—*communis*, *pacificus*
Crete—*communis*

Denmark—*longior*

Ecuador—*communis*, *javensis*, *longior*, *putrescentiae*
Egypt—*longior*

Faroe Is—*longior*, *similis*
Fiji—*communis*, *pacificus*
France—*curvipenis*, *longior*, *similis*

Germany—*communis*, *longior*, *neiswanderi*, *perniciosus*, *putrescentiae*, *tropicus*, *similis*
Greece—*communis*, *longior*

Iceland—*similis*
India—*communis*, *longior*, *tropicus*
Indonesia—*australasiae*, *communis*, *javensis*, *longior*,
Iran—*similis*
Ireland—*longior*
Italy—*communis*, *longior*, *similis*

Jamaica—*communis*
Japan—*communis*, *neiswanderi*, *perniciosus*, *putrescentiae*, *similis*

Kazakhstan—*perniciosus*

Madagascar—*communis*
Malaysia—*tropicus*
Malta—*communis*
Mexico—*neiswanderi*, *similis*

Netherlands—*communis*, *longior*, *neiswanderi*, *perniciosus*, *putrescentiae*, *similis*, *vanheurni*
New Zealand—*communis*, *curvipenis*, *longior*, *macfarlanei*, *neiswanderi*, *putrescentiae*, *robertsonae*, *savasi*, *similis*, *vanheurni*
Nigeria—*tropicus*
Niue—*pacificus*

Panama—*javensis*
Papua New Guinea—*communis*
Philippines—*communis*, *javensis*, *longior*
Poland—*longior*, *neiswanderi*
Portugal—*curvipenis*

Romania—*similis*
Russia—*perniciosus*

Samoa—*communis*, *pacificus*, *tropicus*
Singapore—*communis*, *javensis*
Solomon Is—*communis*
Spain—*communis*
South Africa—*neiswanderi*, *similis*
Sweden—*longior*, *similis*
Switzerland—*neiswanderi*
Thailand—*communis*, *javensis*, *robertsonae*
Tokelau Is—*communis*
Tonga—*communis*, *pacificus*, *xenoductus*

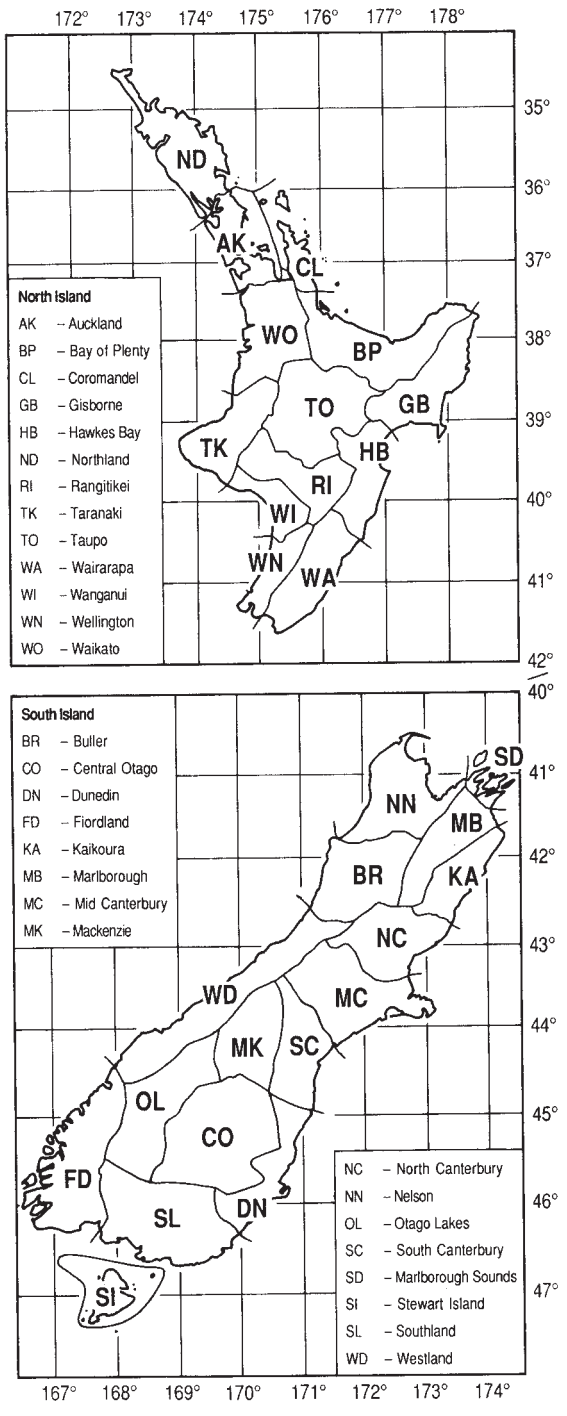
Turkey—*communis*, *perniciosus*
Tuvalu—*vanheurni*

U.K.—*communis*, *longior*, *neiswanderi*, *perniciosus*, *savasi*, *similis*, *vanheurni*
Uruguay—*longior*
U.S.A.—*communis*, *longior*, *neiswanderi*, *perniciosus*, *putrescentiae*, *robertsonae*, *similis*

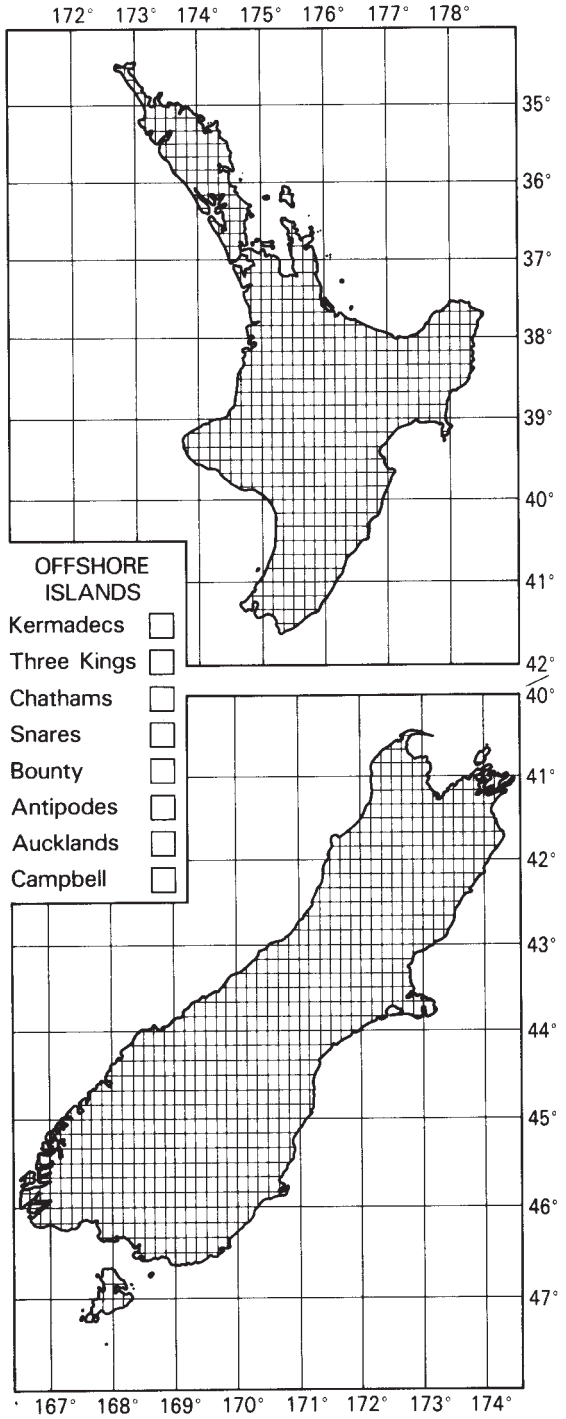
Vanuatu—*communis*

West Africa—*communis*, *tropicus*

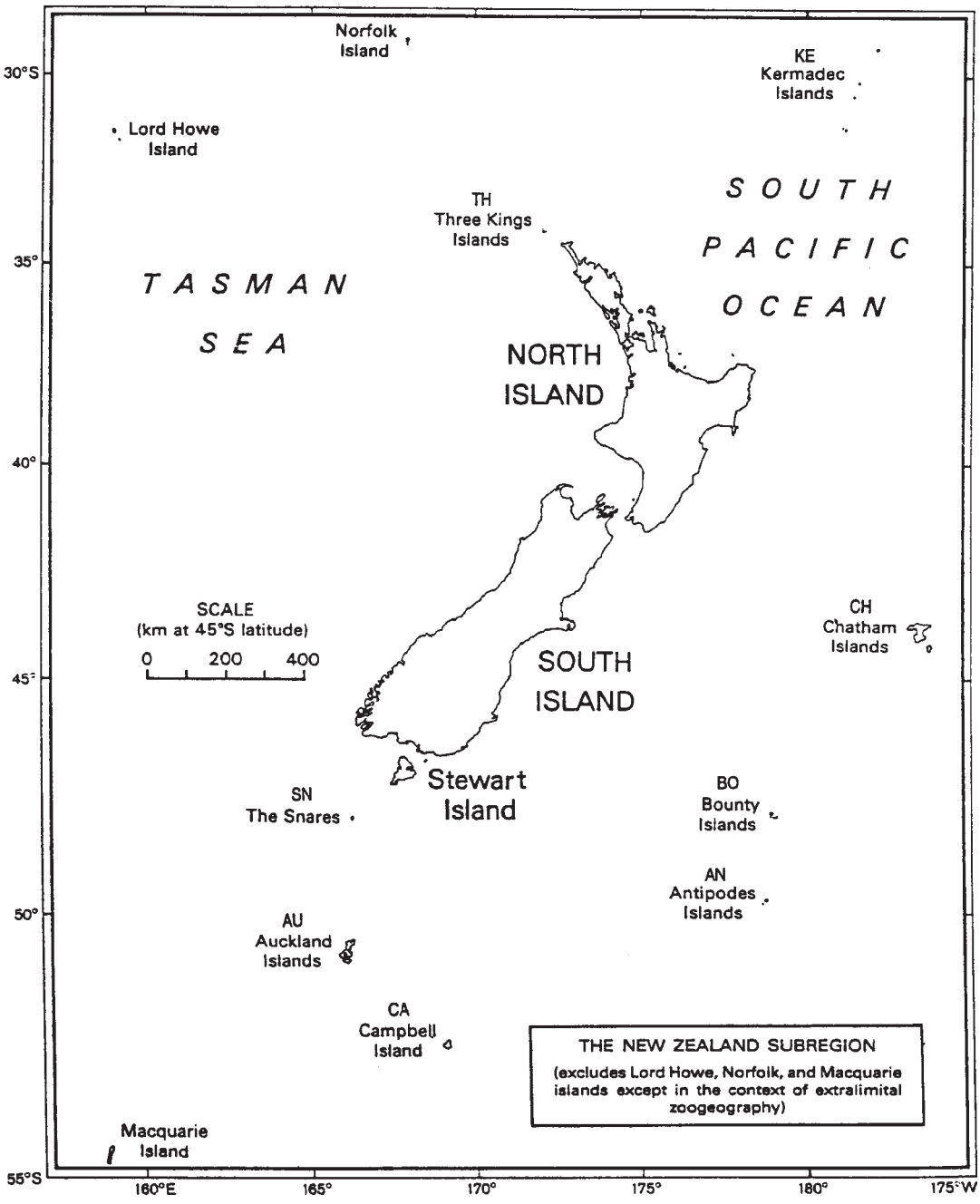
Yemen—*similis*



Area codes and boundaries used to categorise specimen locality data (after Crosby *et al.* 1976)



Base-map for plotting collection localities; this may be photocopied without copyright release



The New Zealand subregion with area codes (from Crosby *et al.* 1998).

TITLES IN PRINT / PUNA TAITARA TAA

1 Terebrantia (Insecta: Thysanoptera). *Laurence A. Mound & Annette K. Walker.* ISBN 0-477-06687-9, 23 Dec 1982, 120 pp. $29.95

2 Osoriinae (Insecta: Coleoptera: Staphylinidae). *H. Pauline McColl.* ISBN 0-477-06688-7, 23 Dec 1982, 96 pp. $18.60

3 Anthribidae (Insecta: Coleoptera). *B.A. Holloway.* ISBN 0-477-06703-4, 23 Dec 1982, 272 pp. $41.00

4 Eriophyoidea except Eriophyinae (Arachnida: Acari). *D.C.M. Manson.* ISBN 0-477-06745-X,12 Nov 1984, 144 pp. $29.95

5 Eriophyinae (Arachnida: Acari: Eriophyoidea). *D.C.M. Manson.* ISBN 0-477-06746-8, 14 Nov 1984, 128 pp. $29.95

6 Hydraenidae (Insecta: Coleoptera). *R.G. Ordish.* ISBN 0-477-06747-6, 12 Nov 1984, 64 pp. $18.60

7 Cryptostigmata (Arachnida: Acari) – a concise review. *M. Luxton.* ISBN 0-477-06762-X, 8 Dec 1985, 112 pp. $29.95

8 Calliphoridae (Insecta: Diptera). *James P. Dear.* ISBN 0-477-06764-6. 24 Feb 1986, 88 pp. $18.60

9 Protura (Insecta). *S.L. Tuxen.* ISBN 0-477-06765-4, 24 Feb 1986, 52 pp. $18.60

10 Tubulifera (Insecta: Thysanoptera). *Laurence A. Mound & Annette K. Walker.* ISBN 0-477-06784-0, 22 Sep 1986, 144 pp. $34.65

11 Pseudococcidae (Insecta: Hemiptera). *J.M. Cox.* ISBN 0-477-06791-3, 7 Apr 1987, 232 pp. $49.95

12 Pompilidae (Insecta: Hymenoptera). *A.C. Harris.* ISBN 0-477-02501-3, 13 Nov 1987, 160 pp. $39.95

13 Encyrtidae (Insecta: Hymenoptera). *J.S. Noyes.* ISBN 0-477-02517-X, 9 May 1988, 192 pp. $44.95

14 Lepidoptera – annotated catalogue, and keys to family-group taxa. *J.S. Dugdale.* ISBN 0-477-02518-8, 23 Sep 1988, 264 pp. $49.95

15 Ambositrinae (Insecta: Hymenoptera: Diapriidae). *I.D. Naumann.* ISBN 0-477-02535-8, 30 Dec 1988, 168 pp. $39.95

16 Nepticulidae (Insecta: Lepidoptera). *Hans Donner & Christopher Wilkinson.* ISBN 0-477-02538-2, 28 Apr 1989, 92 pp. $22.95

17 Mymaridae (Insecta: Hymenoptera) – introduction, and review of genera. *J.S. Noyes & E.W. Valentine.* ISBN 0-477-02542-0, 28 Apr 1989, 100 pp. ... $24.95

18 Chalcidoidea (Insecta: Hymenoptera) – introduction, and review of genera in smaller families. *J.S. Noyes & E.W. Valentine.* ISBN 0-477-02545-5, 2 Aug 1989, 96 pp. $24.95

19 Mantodea (Insecta), with a review of aspects of functional morphology and biology. *G.W. Ramsay.* ISBN 0-477-02581-1, 13 Jun 1990, 96 pp. $24.95

20 Bibionidae (Insecta: Diptera). *Roy A. Harrison.* ISBN 0-477-02595-1. 13 Nov 1990, 28 pp. $14.95

21 Margarodidae (Insecta: Hemiptera). *C.F. Morales.* ISBN 0-477-02607-9, 27 May 1991, 124 pp. $34.95

22 Notonemouridae (Insecta: Plecoptera). *I.D. McLellan.* ISBN 0-477-02518-8, 27 May 1991, 64 pp. $24.95

23 Sciapodinae, Medeterinae (Insecta: Diptera) with a generic review of the Dolichopodidae. *D.J. Bickel.* ISBN 0-477-02627-3, 13 Jan 1992, 74 pp. $27.95

24 Therevidae (Insecta: Diptera). *L. Lyneborg.* ISBN 0-477-02632-X, 4 Mar 1992, 140 pp. $34.95

25 Cercopidae (Insecta: Homoptera). *K.G.A. Hamilton & C.F. Morales.* ISBN 0-477-02636-2, 25 May 1992, 40 pp. $17.95

26 Tenebrionidae (Insecta: Coleoptera): catalogue of types and keys to taxa. *J.C. Watt.* ISBN 0-477-02639-7, 13 Jul 1992, 70 pp. $27.95

27 Antarctoperlinae (Insecta: Plecoptera). *I.D. McLellan.* ISBN 0-477-01644-8, 18 Feb 1993, 70 pp. $27.95

28 Larvae of Curculionoidea (Insecta: Coleoptera): a systematic overview. *Brenda M. May.* ISBN 0-478-04505-0, 14 Jun 1993, 226 pp. $55.00

29 Cryptorhynchinae (Insecta: Coleoptera: Curculionidae). *C.H.C. Lyal.* ISBN 0-478-04518-2, 2 Dec 1993, 308 pp. $65.00

30 Hepialidae (Insecta: Lepidoptera). *J.S. Dugdale.* ISBN 0-478-04524-7, 1 Mar 1994, 164 pp. $42.50

31 Talitridae (Crustacea: Amphipoda). *K.W. Duncan.* ISBN 0-478-04533-6, 7 Oct 1994, 128 pp. $36.00

32 Sphecidae (Insecta: Hymenoptera). *A.C. Harris.* ISBN 0-478-04534-4, 7 Oct 1994, 112 pp. $33.50

33 Moranilini (Insecta: Hymenoptera). *J.A. Berry.* ISBN 0-478-04538-7, 8 May 1995, 82 pp. $29.95

34 Anthicidae (Insecta: Coleoptera). *F.G. Werner & D.S. Chandler.* ISBN 0-478-04547-6, 21 Jun 1995, 64 pp. $26.50

35 Cydnidae, Acanthosomatidae, and Pentatomidae (Insecta: Heteroptera): systematics, geographical distribution, and bioecology. *M.-C. Larivière.* ISBN 0-478-09301-2, 23 Nov 1995, 112 pp. $42.50

36 Leptophlebiidae (Insecta: Ephemeroptera). *D.R. Towns & W.L. Peters.* ISBN 0-478-09303-9, 19 Aug 1996, 144 pp. $39.50

37 Coleoptera: family-group review and keys to identification. *J. Klimaszewski & J.C. Watt.* ISBN 0-478-09312-8, 13 Aug 1997, 199 pp. $49.50

38 Naturalised terrestrial Stylommatophora (Mollusca: Gastropoda). *G.M. Barker.* ISBN 0-478-09322-5, 25 Jan 1999, 253 pp. $72.50

39 Molytini (Insecta: Coleoptera: Curculionidae: Molytinae). *R.C. Craw.* ISBN 0-478-09325-X, 4 Feb1999, 68 pp. $29.50

40 Cixiidae (Insecta: Hemiptera: Auchenorrhyncha). *M.-C. Larivière.* ISBN 0-478-09334-9, 12 Nov 1999, 93 pp. $37.50

41 Coccidae (Insecta: Hemiptera: Coccoidea). *C.J. Hodgson & R.C. Henderson.* ISBN 0-478-09335-7, 23 Feb 2000, 264 pp. $72.50

42 Aphodiinae (Insecta: Coleoptera: Scarabaeidae). *Z. T. Stebnicka.* ISBN 0-478-09341-1, 15 Jun 2001, 64 pp. $29.50

43 Carabidae (Insecta: Coleoptera): catalogue. *A. Larochelle & M.-C. Larivière.* ISBN 0-478-09342-X, 15 Jun 2001, 285 pp. $72.50

44 Lycosidae (Arachnida: Araneae). *C.J. Vink.* ISBN 0-478-09347-0, 23 Dec 2002, 94 pp. $37.50

45 Nemonychidae, Belidae, Brentidae (Insecta: Coleoptera: Curculionoidea). *G. Kuschel.* ISBN 0-478-09348-9, 28 Apr 2003, 100 pp. $40.00

46 Nesameletidae (Insecta: Ephemeroptera). *T.R. Hitchings & A.H. Staniczek.* ISBN 0-478-09349-7, 14 May 2003, 72 pp. $32.50

47 Erotylidae (Insecta: Coleoptera: Cucujoidea): phylogeny and review. *R.A.B. Leschen.* ISBN 0-478-09350-0, 5 June 2003,108 pp. $42.50

48 Scaphidiinae (Insecta: Coleoptera: Staphylinidae). *I. Löbl & R.A.B. Leschen.* ISBN 0-478-09353-5,18 Nov 2003, 94 pp. $37.50

49 Lithinini (Insecta: Lepidoptera: Geometridae: Ennominae). *J.D. Weintraub & M.J. Scoble.* ISBN 0-478-09357-8, 29 Apr 2004, 48 pp. $24.50

50 Heteroptera (Insecta: Hemiptera): catalogue. *M.-C. Larivière & A. Larochelle.* ISBN 0-478-09358-6, 14 May 2004, 330 pp. $89.00

51 Coccidae (Insecta : Hemiptera: Coccoidea): adult males, pupae and prepupae of indigenous species. *C.J. Hodgson & R.C. Henderson.* ISBN 0-478-09360-8, 22 June 2004, 228 pp. $65.00

52 Raphignathoidea (Acari: Prostigmata). *Qing-Hai Fan & Zhi-Qiang Zhang.* ISBN 0-478-09371-3, 20 May 2005, 400 pp. $89.00

53 Harpalini (Insecta: Coleoptera: Carabidae: Harpalinae). *A. Larochelle & M.-C. Larivière.* ISBN 0-478-09369-1, 4 July 2005, 160 pp. $55.00

54 *Hierodoris* (Insecta: Lepidoptera: Gelechoidea: Oecophoridae), and overview of Oecophoridae. *Robert J. B. Hoare.* ISBN 0-478-09378-0, 24 December 2005, 100 pp. $40.00

55 Criconematina (Nematoda: Tylenchida). *W. M. Wouts.* ISBN 0-478-09381-0, 24 March 2006, 232 pp. $65.00

56 *Tyrophagus* (Acari: Astigmata: Acaridae). *Qing-Hai Fan & Zhi-Qiang Zhang.* ISBN-13 978-0-478-09386-5, May 2007, 291 pp. $80.00

Visit the Manaaki Whenua Press Website at:
http://www.mwpress.co.nz/
for further information, and to gain access to on-line extracts from these publications.

Taxonomic groups covered in the *Fauna of New Zealand* series

Insecta

Coleoptera

Family-group review and keys to identification (*J. Klimaszewski & J.C. Watt*, FNZ 37, 1997)
Anthribidae (*B.A. Holloway*, FNZ 3, 1982)
Anthicidae (*F.G. Werner & D.S. Chandler*, FNZ 34, 1995)
Carabidae: catalogue (*A. Larochelle & M.-C. Larivière*, FNZ 43, 2001)
Carabidae: Harpalinae: Harpalini (*A. Larochelle & M.-C. Larivière*, FNZ 53, 2005)
Curculionidae: Cryptorhynchinae (*C.H.C. Lyal*, FNZ 29, 1993)
Curculionidae: Molytinae: Molytini (*R. C. Craw*, FNZ 39, 1999)
Curculionoidea: Nemonychidae, Belidae, Brentidae (*G. Kuschel*, FNZ 45, 2003)
Curculionoidea larvae: a systematic overview (*Brenda M. May*, FNZ 28, 1993)
Erotylidae: phylogeny and review (*Richard A. B. Leschen*, FNZ 47, 2003)
Hydraenidae (*R.G. Ordish*, FNZ 6, 1984)
Scarabaeidae: Aphodiinae (*Z. T. Stebnicka*, FNZ 42, 2001)
Staphylinidae: Osoriinae *(H. Pauline McColl,* FNZ 2, 1982)
Staphylinidae: Scaphidiinae (*I. Löbl & Richard A. B. Leschen*, FNZ 48, 2003)
Tenebrionidae: catalogue of types and keys to taxa (*J.C. Watt*, FNZ 26, 1992)

Diptera

Bibionidae (*Roy A. Harrison*, FNZ 20, 1990)
Calliphoridae (*James P. Dear*, FNZ 8, 1986)
Dolichopodidae: Sciapodinae, Medeterinae with a generic review (*D.J. Bickel*, FNZ 23, 1992)
Therevidae (*L. Lyneborg*, FNZ 24, 1992)

Ephemeroptera

Leptophlebiidae (*D.R. Towns & W.L. Peters*, FNZ 36, 1996)
Nesameletidae (*Terry R. Hitchings & Arnold H. Staniczek*, FNZ 46, 2003)

Hemiptera

Cercopidae (*K.G.A. Hamilton & C.F. Morales*, FNZ 25, 1992)
Cixiidae (*M.-C. Larivière*, FNZ 40, 1999)
Coccidae (*C. J. Hodgson & R. C. Henderson*, FNZ 41, 2000); adult males, pupae and prepupae of indigenous species (*C. J. Hodgson & R. C. Henderson*, FNZ 51, 2004)
Cydnidae, Acanthosomatidae, and Pentatomidae (*M.-C. Larivière*, FNZ 35, 1995)
Heteroptera: catalogue (*M.-C. Larivière & A. Larochelle*, FNZ 50, 2004)
Margarodidae (*C.F. Morales*, FNZ 21, 1991)
Pseudococcidae (*J.M. Cox*, FNZ 11, 1987)

Hymenoptera

Chalcidoidea: introduction, and review of smaller families (*J.S. Noyes & E.W. Valentine*, FNZ 18, 1989)
Diapriidae: Ambositrinae (*I.D. Naumann*, FNZ 15, 1988)
Encyrtidae (*J.S. Noyes*, FNZ 13, 1988)
Mymaridae (*J.S. Noyes & E.W. Valentine*, FNZ 17, 1989)
Pompilidae (*A.C. Harris*, FNZ 12, 1987)
Pteromalidae: Eunotinae: Moranilini (*J.A. Berry*, FNZ 33, 1995)
Sphecidae (*A.C. Harris*, FNZ 32, 1994)

Lepidoptera

Annotated catalogue, and keys to family-group taxa (*J. S. Dugdale*, FNZ 14, 1988)
Geometridae: Ennominae: Lithinini (*Jason D. Weintraub & Malcolm J. Scoble*, FNZ 49, 2004)
Hepialidae (*J.S. Dugdale*, FNZ 30, 1994)
Nepticulidae (*Hans Donner & Christopher Wilkinson*, FNZ 16, 1989)
Oecophoridae: *Hierodoris* (*Robert J. B. Hoare,* FNZ 54, 2005).

Mantodea, with a review of aspects of functional morphology and biology (*G.W. Ramsay*, FNZ 19, 1990)

Plecoptera

Antarctoperlinae (*I.D. McLellan*, FNZ 27, 1993)
Notonemouridae (*I.D. McLellan*, FNZ 22, 1991)

Protura (*S.L. Tuxen*, FNZ 9, 1986)

Thysanoptera

Terebrantia (*Laurence A. Mound & Annette K. Walker*, FNZ 1, 1982)
Tubulifera *(Laurence A. Mound & Annette K. Walker,* FNZ 10, 1986)

Arachnida

Acari

Acaridae: *Tyrophagus* (*Qing-Hai Fan & Zhi-Qiang Zhang,* FNZ 56, 2007)
Cryptostigmata – a concise review (*M. Luxton,* FNZ 7, 1985)
Eriophyoidea except Eriophyinae (*D.C.M. Manson*, FNZ 4, 1984)
Eriophyinae (*D.C.M. Manson*, FNZ 5, 1984)
Raphignathoidea (*Qing-Hai Fan & Zhi-Qiang Zhang,* FNZ 52, 2005)

Araneae

Lycosidae (*C. J. Vink,* FNZ 44, 2002)

Crustacea

Amphipoda

Talitridae (*K.W. Duncan*, FNZ 31, 1994)

Mollusca

Gastropoda

Naturalised terrestrial Stylommatophora (*G.M. Barker*, FNZ 38, 1999)

Nematoda

Tylenchida: Criconematina (*W. M. Wouts*, FNZ 55, 2006)

NOTICES

This series of refereed publications has been established to encourage those with expert knowledge to publish concise yet comprehensive accounts of elements in the New Zealand fauna. The series is professional in its conception and presentation, yet every effort is made to provide resources for identification and information that are accessible to the non-specialist.

Fauna of N.Z. deals with non-marine invertebrates only, since the vertebrates are well documented, and marine forms are covered by the series *Marine Fauna of N.Z.*

Contributions are invited from any person with the requisite specialist skills and resources. Material from the N.Z. Arthropod Collection is available for study.

Contributors should discuss their intentions with a member of the Invertebrate Systematics Advisory Group or with the Series Editor before commencing work; all necessary guidance will be given.

Subscribers should address inquiries to *Fauna of N.Z.*, Manaaki Whenua Press, Landcare Research, P.O. Box 40, Lincoln 8152, New Zealand.

Subscription categories: 'A' – standing orders; an invoice will be sent with each new issue, as soon after publication as possible; 'B' – promotional fliers with order forms will be sent from time to time.

Retail prices (see 'Titles in print', page 288) include packaging and surface postage. Subscribers in New Zealand and Australia pay the indicated amount in $NZ; GST is included in the price. Other subscribers pay the listed price in $US, or its equivalent.

Back issues of all numbers are available, and new subscribers wishing to obtain a full set or a selection may request a discount. Booksellers and subscription agents are offered a trade discount of ten percent.

NGA PANUI

Kua whakatūria tēnei huinga pukapuka hei whakahauhau i ngā tohunga whai mātauranga kia whakaputa i ngā kōrero poto, engari he whaikiko tonu, e pā ana ki ngā aitanga pepeke o Aotearoa. He tōtika tonu te āhua o ngā tuhituhi, engari ko te tino whāinga, kia mārama te marea ki ngā tohu tautuhi o ia ngārara, o ia ngārara, me te roanga atu o ngā kōrero mō tēnā, mō tēnā.

He titiro whāiti tā tēnei pukapuka ki ngā mea noho whenua, kāore he tuarā; i pēnei ai i te mea kei te mōhio whānuitia ngā mea whai tuarā, ā, ko ngā mea noho moana, koirā te tino kaupapa o te huinga pukapuka *Marine Fauna of N.Z.*

Ka āhei te tangata ki te **whakauru tuhituhinga** mehemea kei a ia ngā tohungatanga me ngā rauemi e tutuki pai ai tana mahi. Heoi anō, e wātea ana te Kohinga Angawaho o Aotearoa hei āta tirotiro mā te tangata mehemea he āwhina kei reira.

Me whāki te kaituhi i ōna whakaaro ki tētahi o te Kāhui Ārahi Whakarōpūtanga Tuarā-Kore, ki te ģtita rānei i mua i te tīmatanga, ā, mā rātou a ia e ārahi mō te wāhi ki tana tuhinga.

Ko te hunga pīrangi **hoko pukapuka**, me tuhi ki *Fauna of N.Z.*, Manaaki Whenua Press, Manaaki Whenua, Pouaka Poutāpeta 40, Lincoln 8152, Aotearoa.

E rua ngā tūmomo kaihoko: "A" – kaihoko tūmau, ka tukua ia pukapuka, ia pukapuka, me te nama, i muri tonu i te tānga; "B" – ka tukua ngā pānui whakatairanga me ngā puka tono i ōna wā anō.

Te utu (tirohia "Titles in print", whārangi 288). Ko te kōpaki me te pane kuini kei roto i te utu. Me utu te hunga e noho ana i Aotearoa me Ahitereiria ki ngā tāra o Aotearoa. Ko ētahi atu me utu te moni kua tohua, ki ngā tāra Merikana, ki te nui o te moni rānei e rite ana.

E toe ana he pukapuka o ngā putanga katoa o mua. Mehemea e hiahia ana koe ki te katoa o ngā pukapuka, ki ētahi rānei, tonoa mai kia whakahekea te utu. Tekau ōrau te heke iho o te utu ki ngā toa hoko pukapuka.