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The tetranychid mites (Acari: Tetranychidae) of Kenya and a redescription of the species *Peltanobia erasmusi* Meyer (Acari: Tetranychidae) based on males

FAITH J. TOROITICH[1,2,5], EDWARD A. UECKERMANN[1,3], PIETER D. THERON[1] & MARKUS KNAPP[4]

[1]*School of Environmental Science and Development, North-West University, Potchefstroom, 2520, South Africa*
[2]*African Insect Science for Food and Health (ICIPE). P. O. Box 30772, Nairobi, Kenya*
[3]*ARC-Plant Protection Research Institute, Private Bag X134, Queenswood, Pretoria, 0120, South Africa*
[4]*Koppert Biological Systems, Postbus 155, 2650 AD Berkel en Rodenrijs, The Netherlands*
[5]*Corresponding author E-mail:ftoroitich@icipe.org; f_jebet@yahoo.com*

Abstract

This paper reports 18 tetranychid mite species (Acari: Tetranychidae) from various plant hosts in Kenya. Four species of these belong to the subfamily Bryobiinae and the other 14 belong to the subfamily Tetranychinae. Eight of the mite species identified belong to the genera *Bryobia*, *Petrobia*, *Peltanobi*a, *Paraplonobia*, *Duplanychus*, *Eutetranychus and Mixonychus* and are being reported for the first time in Kenya while the other ten had already been reported before. The paper provides a list of these species and their brief descriptions as well as a redescription of *Peltanobia erasmusi* Meyer (Acari: Tetranychidae) to include male characters that were not included in the original description.

Key words: Acari, Prostigmata, Tetranychidae, spider mites, Kenya

Introduction

The family Tetranychidae Donnadieu, is one of the most important families of the Acari because many species can be serious pests of agricultural crops. This family comprises a large group of about 1,250 phytophagous species (Migeon and Dorkeld, 2006) and their damage has been reported in ornamentals, horticultural crops, fruit crops and some staple food crops (Jeppson *et al.,* 1975). Virtually any plant may be subject to attack and economic damage caused by spider mites because of their broad host plant range, high fecundity and rapid developmental rates (Smiley and Baker, 1995). An earlier record of spider mites from Kenya was given in the world's catalogue of Tetranychidae by Bolland *et al* (1998), which listed 9 species from Kenya, and a more recent website 'The Spider web' (Migeon and Dorkeld, 2006) which lists 10 species. These earlier records include *Eutetranychus orientalis* Klein, *Mononychellus progresivus* Doreste, *Oligonychus coffeae* Nietner, *Oligonychus gossypi* Zacher, *Schizotetranychus spiculus* Baker and Pritchard, *Tetranychus evansi* Baker and Pritchard, *Tetranychus urticae* Koch, *Tetranychus neocaledonicus* André, *Tetranychus ludeni* Zacher and *Tetranychus lombardiini* Baker and Pritchard. The last record was that of *Tetranychus evansi* Baker and Pritchard in 2001 (Knapp *et al.,* 2003). This paper gives a report of tetranychid mites collected from September 2005 to December 2007 in our study. In addition, tetranychids reported before by different authors are also included and remarks on their first report added. A re-description of *Peltanobia erasmusi* Meyer and illustrations of the males are included.

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Materials and methods

Mites were collected from a number of plants from Central, Coast, Eastern, Nairobi, Nyanza, and Western provinces of Kenya in both cultivated fields and natural vegetation. The beating method was used in situations where the plants being sampled were large and mite damage symptoms could not be seen. Branches of the plants were beaten with a stick and the mites collected from a plate placed under the plant using a fine hair brush and directly put into vials containing 70% ethanol. In situations where mite damage symptoms were obvious, damaged leaves containing mites were picked and placed in paper bags and transported to the laboratory where the mites were picked. The mites were left in 70% ethanol for 10 days after which they were mounted in polyvinyl alcohol mounting medium and examined under an Olympus phase contrast compound microscope. Drawings were made using a lucida drawing tube attached to the microscope. Measurements were taken under a microscope directly connected to the computer using the Olympus Soft Imaging System and are given in micrometers (µm), minimum to maximum range (in parenthesis) followed by the mean. The terminology used for the body seta is according to Lindquist (1985) and the style of description as that of Meyer (1987). World distribution of each species and host range is according to Migeon and Dorkeld (2006).

Bryobia Koch (Bryobiinae: Bryobiini)

Adult members of *Bryobia* have 4 pairs of setae on the prodorsum, first two pairs set on prominent prodorsal lobes; 12 pairs of setae are located on the opisthosoma; fourth pair of dorsocentral setae (f_1) marginal; peritreme ends either simply or in anastomosis. Empodia on tarsi pad-like and with tenent hairs.

Bryobia praetiosa Koch, 1836

Tarsus I very long, more than twice as long as other tarsi. It has five pairs of genitoanal setae and one pair of pregenital setae. Tarsus I with two pairs of duplex setae and tarsus II has one pair. The peritreme ends in a protruding sausage-like structure (anastomosis). Body measurements are as follows: Body length: 550µm, width 350µm. Leg I is 590µm long and leg II is 240µm long.

Leg chaetotaxy as follows: genua 8-6-6-5; femora 21-11-5-(4/3); coxae 2-1-1-1.

Solenidia on tarsus III and IV associated with tactile setae to form duplex setae. Leg I slightly longer than total body length.

Specimens examined: Four females collected on *Chloris gayana* (Poaceae) in Ngarenyiro, Laikipia district (N00°04.971'; E036°55.956') and 3 larvae collected on *Sida schimperiana* (Malvaceae) from Kitengela, Kajiado district (S01°32.319'; E036°56.497').

Remarks: This species has a world-wide distribution and occurs on a wide range of low lying host plants belonging to a wide range of families (Migeon and Dorkeld, 2006). Previous records of this species on members of the family Poaceae which include wheat, rye and barley were reported in Arizona (Tuttle and Baker, 1964). In this study, the specimens were collected in savanna grasslands. The species is dark red in colour

Paraplonobia (*Anaplonobia*) (Bryobiinae: Hystrichonychini)

Prodorsum with three pairs of setae; opisthosoma with ten pairs of dorsal setae; prodorsum without lobes over gnathosoma; opisthosoma without plates; coxal formula not exceeding 4-3-2-2 and dorsal setae not set on strong tubercles.

***Paraplonobia (Anaplonobia) prosopis* (Tuttle & Baker, 1964)**

Aplonobia prosopis Tuttle & Baker, 1964; *Neopetrobia prosopis* Meyer, 1987

The peritremes end in anastomosis with a network of cell-like structures. Prodorsal and opisthosomal setae are strongly serrate and sub-spatulate with e_2, f_1, f_2 and h_1 set on small tubercles. Setae well separated from each other, almost equidistant between all dorsocentrals, dorsal setae sub-equal in length. Dorsal striations faint, longitudinal on prodorsum and transverse on hysterosoma and without lobes. Leg setae strong, lanceolate and serrated. Legs shorter than the body.

Leg chaetotaxy as follows: tarsi 13(2)-10(1)-9-8; tibiae 9-7-8-7; genua 4-4-3-2; femora 5-4-3-3; coxae 2-2-1-1.

Specimens examined: Four females collected on *Prosopis juliflora* (Fabaceae) from Marigat, Baringo district (N00°28.907'; E036°03.230').

Remarks: *P. prosopis* Tuttle and Baker was first described from *Prosopis juliflora* in Arizona (United States of America) and the second record of this species is from Mexico (Tuttle and Baker, 1964). This is the first record of this species in the Afro-tropical region on *P. juliflora* which is an invasive plant species in Kenya after being introduced as a land reclamation plant in the semi-arid parts of the country. It is therefore possible that this mite was introduced together with its host plant although in our collection, the mite population was very low and the damage symptoms could not be observed on the host plant. The males of this species are not known. In the field, this species is dark red in colour.

***Peltanobia* Meyer 1974 (Bryobiinae: Hystrichonychiini)**

Prodorsum with three pairs of setae and opisthosoma with ten pairs of dorsal setae. The first four pairs of dorsocentrals *c1*, *d1* e*1* and *f1* are located on cushion-like sclerites.

***Peltanobia erasmusi* Meyer 1974**

The first description of this species was based on females only (Figure 1) as follows:

Female: Dorsum provided with 13 pairs of broadly spatulate, serrate setae, which are located on prominent tubercles; 3 pairs present on propodosoma and 10 pairs on hysterosoma; 4 of 5 pairs of dorsocentral hysterosomal setae located on four oblong cushion-like plates, which have rounded corners; humeral setae situated in line with 3 pairs of dorsolaterals, outer sacrals and fifth pair of dorsocentrals all located marginally; dorsal setae subequal and shorter than distances between bases of consecutive setae except for fifth pair of hysterosomals, which are the longest. Striae on integument absent.

Stylophore relatively broad and acuminate anteriorly; peritreme branches distally and forms a horn-like complex structure protruding above prodosoma.

Palptarsus bears 1 solenidion and 6 additional setae.

Tarsus I with 2 pairs of duplex setae, tibia I with 1 pair.

Redescription of *Peltanobia erasmusi* Meyer using male characters.

Male (Figures 2 and 3): Males smaller in size compared to females, with a more elongated and narrow body. Peritremes anastomosing and protrude as horn-like structures above prodorsum as in the female (Fig. 2A and B). Aedeagus long and straight protruding at posterior end and its shaft narrows distally to a sharp tip. Aedeagus bears a sheath attached to it (Fig. 2A and D). Dorsal plates faintly visible in male as opposed to female. It has 5 pairs of genito-anal setae. Para anals (h_2 and h_3) considerably small in size, lanceolate and borne on strong tubercles. Palp tarsus thick three times as long and wide (Fig. 2C).

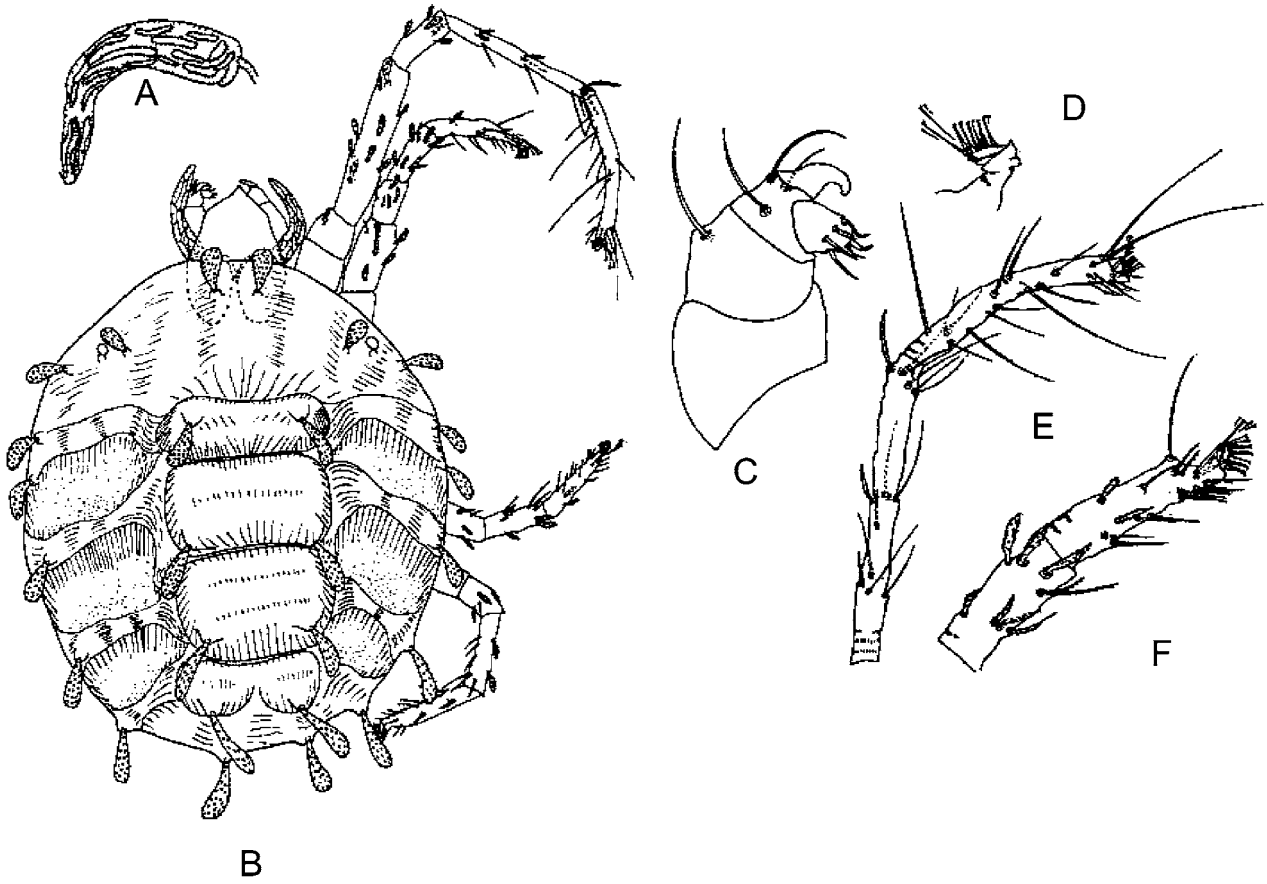

FIGURE 1. *Peltanobia erasmusi* Meyer female (from Meyer 1974, with permission). A—Peritreme, B— Dorsum, C—Palp-tarsus, D—Empodium, E—Tarsus and tibia I, F—Tarsus and tibia II.

Leg chaetotaxy as follows: tarsi 15+2-15+1-14-14; tibiae 15+2-9-8-8; genua 5-5-5-5; femora 9-6-4-4; trochanter 1-0-1-1; coxae 2-2-1-1.

Length of body (including gnathosoma) (612-625) 618.5; body width (310-322) 316; setal length; ve (24-25) 24.5; sci (22-23) 22.5; sce(26-28) 27; c1(17-19) 18; c2 (25-31) 28; c3 (28-30)29; d1 (18-21) 19.5; d2 (28-29)28.5; e1 (17-24) 20.5; e2 (31-42) 36.5; f1 (23-25) 24; f2 (35-39) 37; h1 (36-45) 40.5.

Legs: tarsotibia I (232); tarsotibia II (145); tarsotibia III (157); tarsotibia IV (189) (Figure 3).

Specimens examined: Three females and three males collected from *Cynodon dactylon* (Poaceae) in Rongai, Nakuru district (S00°09.033'; E035°50.749').

Remarks: This species was first described from grass in Umfolozi reserve, South Africa and has also been reported from Zimbabwe on *Commelina sp*. and *Ipomaea magnusiana* (Meyer, 1987). The specimens used in this description were collected on grass from an open grazing patch. In the field, this species is dark red in colour, appear round in shape and larger compared to other spider mites species collected. Damage symptoms are not clearly visible on the host plants.

Petrobia Ewing 1909 (Bryobiinae: Petrobiini)

It has 3 pairs of prodorsal setae and 10 pairs of opisthosomal setae all borne on prominent tubercles, peritreme ending simply with a bulb-like structure. Empodium curved distally and has two rows of ventrally directed tenent hairs. With 3 pairs of anal and 3 pairs of para-anal setae. Tarsus I has 3 pairs of duplex setae.

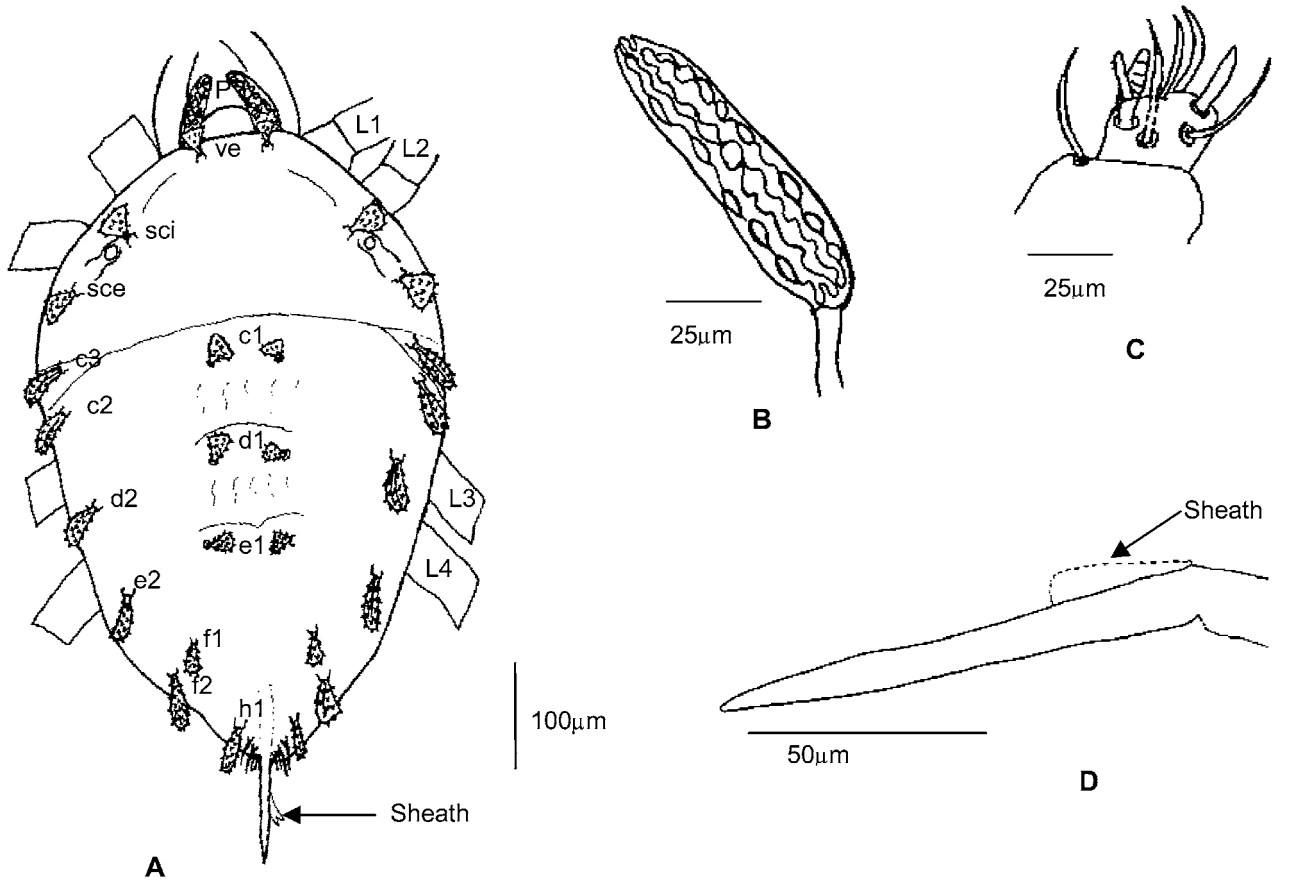

FIGURE 2. *Peltanobia erasmusi* Meyer, male: (A) dorsum, (B) peritreme (C) distal segment of the palp tarsus, (D) male aedeagus.

***Petrobia (Tetranychina) harti*, (Ewing, 1909)**

Female: Dorsal body setae long, slender, spiculate, on prominent tubercles and much longer than distances between bases of consecutive rows of setae; f_1 closer together than other dorso-centrals. Prodorsum between v_e and sc_1 punctate, opisthosoma with transverse striae which bear lobes.

Males: Dorsal setae much shorter and borne on weak tubercles, legs I and IV very long, more than twice length of body but legs II and III of ordinary length i.e. as long as the body. Aedeagus slightly curved, narrowing caudally to tip.

Leg chaetotaxy: tarsi 13(2)-10(1)-9-8; tibiae 9-7-8-7; genua 4-4-3-2; femora 5-4-3-3; coxae 2-2-1-1.

Specimen examined: 8 females and 5 males collected on *Oxalis compressa* (Oxalidaceae) from Runda, Kiambu district (S01º13.470'; 036º48.050').

Remarks: This species has a worldwide distribution and has been reported from a wide range of hosts. Many weed species of the genus *Oxalis* have been recorded to host this species. From Africa, the earlier reports of this species are from Egypt, Southern Africa and the Indian Ocean islands of Madagascar and Mauritius. In the field, the damage symptoms of this species are visible as silver stipples on the leaves of the host. They prefer the under side of the leaves as is typical for most spider mites. They are bright red and their long legs and setae are conspicuous even under a hand lens.

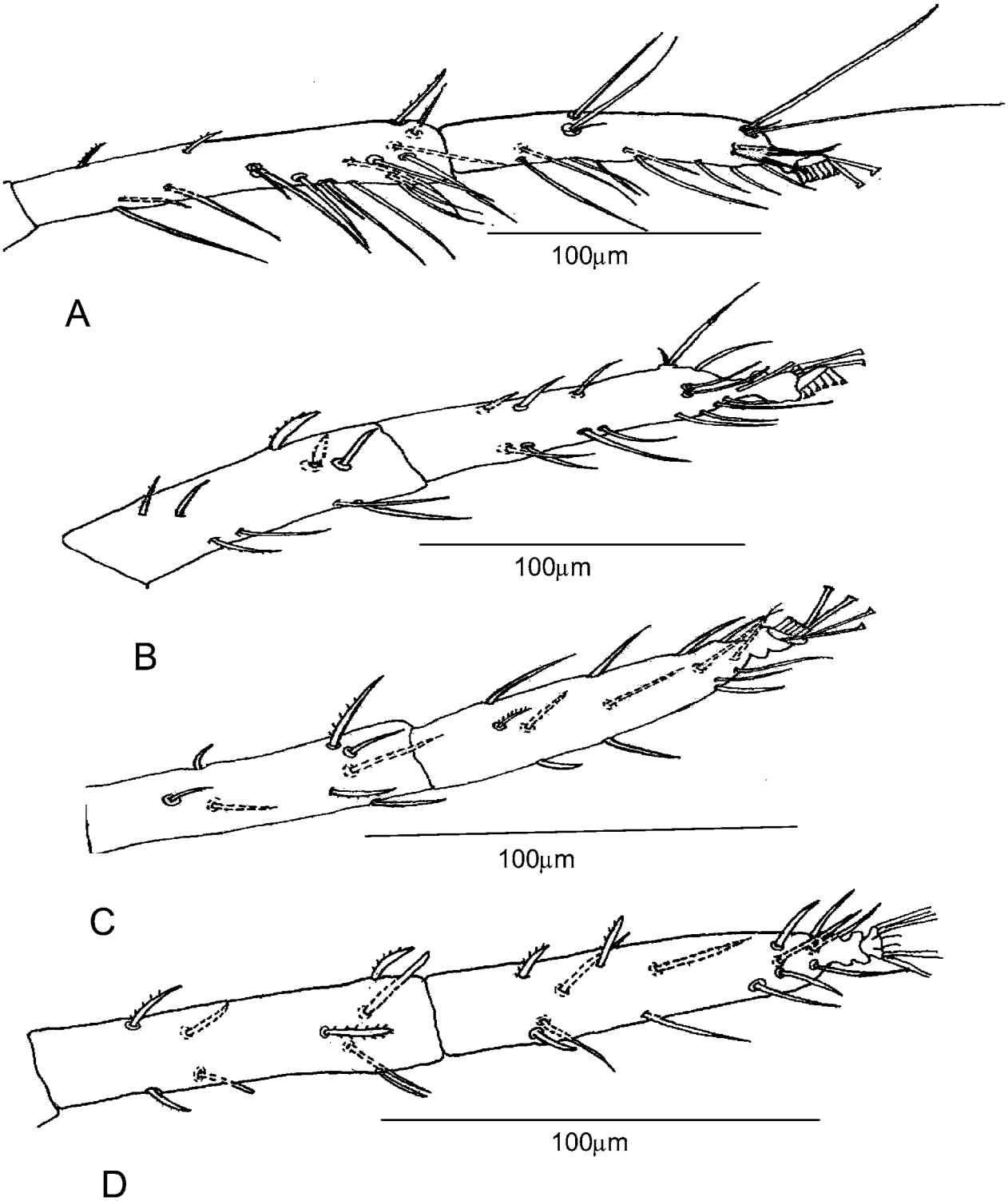

FIGURE 3. (D) tarsus and tibia leg I, (E) tarsus and tibia leg II, (F) tarsus and tibia leg III, (G) tarsus and tibia leg IV.

***Duplanychus* Meyer 1974 (Tetranychinae: Eurytetranychini)**

True claws pad-like with tenent hairs, empodium rudimentary. Prodorsum has three pairs of setae, opisthosoma with ten pairs of setae, two pairs of anals and two pairs of para-anals. All setae set on strong tubercles. First pair of dorsocentral setae (c_1) contiguous, fourth pair of dorsocentrals (f_1) more widely spaced than other dorsocentrals; f_2 conspicuously smaller and shorter than rest of dorsal setae; dorsum is punctulate.

***Duplanychus sanctiluciae* Meyer, 1974**

This species is characterized by dorsal body setae which are setose and expanded distally. Peritreme ends in a simple bulb. Palp tarsus small, twice as long as broad with a teat-like clear structure at the tip. Setae sc_i much longer than seta v_e and sc_e, at least more than twice their lengths. Setae c_3, e_2 and f_2 very short, less than half lengths of corresponding dorsocentrals.

Leg chaeotaxy: The leg chaetotaxy of this species can vary within specimens, even amongst type specimens. Tarsi 10(1)+2-9(1)-8(1)-8(1); tibiae 8(2)-7(1)-7-7; genua 5-5-3-2; femora 8(1)-7-4-4; coxae 2-2-1-1.

Specimens examined: Eight females collected from *Grewia plagiophylla* (Tiliaceae) and one female from *Anacardium occidentale* (Anacardiaceae) both from Malindi district (S03°20.132'; E04°00.779').

Remarks: This species was first reported and described from South Africa on *Scutia mytrina* (Rhamnaceae) and *Grewia caffra* (Tiliaceae) and this is the only second report of this species. In the field they are grayish green in colour.

***Eutetranychus* Banks 1917 (Tetranychinae: Eurytetranychini)**

Empodia absent or rudimentary 3 pairs of propodosomal setae and 10 pairs of hysterosomal setae mostly set on tubercles; dorsocentral setae in normal position; peritremes simple or slightly expanded distally; 2 pairs of anal and 2 pairs of para-anal setae. Tarsus I and II without characteristic duplex setae but with loosely associated setae probably homologous but alveoli not coalesced. Legs of males relatively longer than those of females.

***Eutetranychus africanus* (Tucker, 1926)**

Anychus africanus Tucker, 1926

Dorsal setae of this species serrate, sub-spatulate borne on tubercles. Dorsocentral setae c_1, d_1, e_1 and f_1 half the length of corresponding dorso-laterals c_2, d_2, e_2 and f_2 which are long and slender. Body measurements are 500µm long and 360µm wide.

Leg chaetotaxy as follows: tarsi 15(2)-13(1)-10(1)-10(1); tibiae 9(1)-6-6-7; genua 5-5-2-2; femora 8-6-3-1; coxae 2-2-1-1.

Specimens examined: Five females from *Citrus sinensis* (Rutaceae) in Shimba Hills, Kwale district (S04°20.121'; E039°28.877'); 8 females and 1 male on *Harrisonia abyssinica* (Simaroubaceae) from Muhaka, Kwale district (S04°10.611'; E039°26.852') and 13 specimens on *Cadiaeum variegatum* (Euphorbiaceae) from Shimba Hills, Kwale (S04°20.913'; E039°19.688').

Remarks: This species is distributed in the Afrotropical, Australasian and Oriental regions and has been recorded on oranges, lemons, frangipani and a variety of other host plants. It was first described on oranges, lemons (Rutaceae) and frangipani (Apocynaceae) from South Africa (Tucker, 1926). In the field this species appear dull grey in colour.

***Eutetranychus carinae* Meyer, 1974**

This species has sub-spatulate setae, dorsolaterals and h_1 set on very weak tubercles, dorsocentrals c_1, d_1, e_1 and f_1 not set on tubercles. Solenidion of loosely associated setae on tarsus I about two thirds length of proximal tactile seta whereas that of tarsus II is same length or slightly longer than proximal tactile seta. Dorsal striations faint compared to other two species of *Eutetranychus* examined.

Leg chaetotaxy as follows: tarsi 12(1)-10(1)-8(1)-8(1); tibiae 9(1)-6-5-6; genua 5-5-2-2; femora 8-6-2-1; coxae 2-2-1-1.

Specimens examined: Three females and one male collected on *Ficus burkei* (Moraceae) from Alupe area, Busia district (N00°29.870'; E034°07.732') and two females collected on *Ricinus communis* (Euphorbiaceae) from Marigat, Baringo district (N00°28.132'; E036°00.906').

Remarks: This species was first recorded on *Ficus sp.* and *Morus sp.* from South Africa (Meyer, 1974). It has been reported from several *Ficus* species and it seems to show preference for the members of the family Moraceae. This species has previously been reported from South Africa only and thus its distribution records are still very limited. They are grey in colour

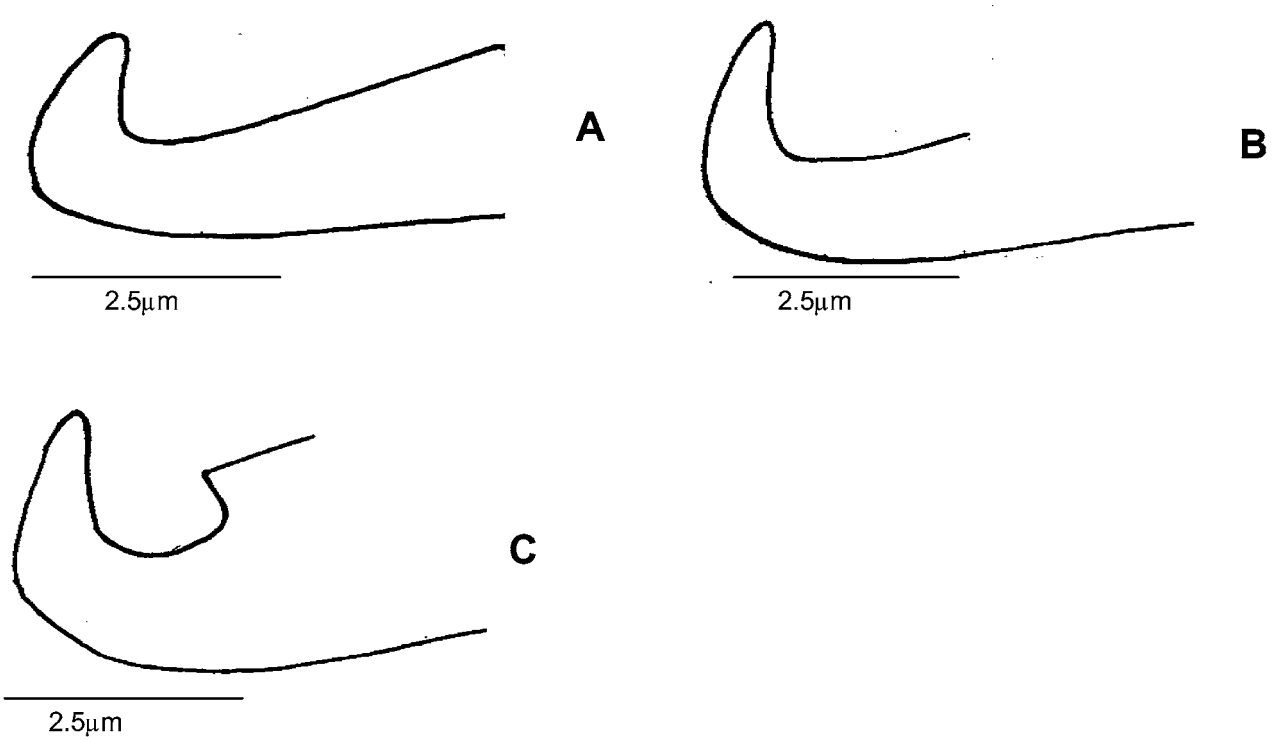

FIGURE 4. *Eutetranychus sp.* aedegi (from Meyer, 1974 with modifications): (A) *E. africanus* aedeagus, (B) *E. carinae* aedeagus, (C) *E. orientalis* aedeagus.

***Eutetranychus orientalis* Klein, 1936**

This species is characterized as follows: Striae on prodorsum longitudinal and tuberculate; striation pattern between second (d_1) and third pairs of dorsocentral setae (e_1) vary from longitudinal to V-shaped; 13 pairs of dorsocentral setae set on tubercles and vary in length and shape; dorsolateral setae (c_2, d_2, e_2 and f_2) long and lanceolate, subspatulate or broadly spatulate with dorsocentral setae (c_1, d_1, e_1, f_1 and h_1) short and spatulate, lanceolate or subspatulate.

The leg chaetotaxy as follows: tibiae 10-6-6-7; genua 5-5-2-2; femora 8-6-3-1; coxae 2-1-1-1.

Specimens examined: Three males and five females collected on *Citrus limon* (Rutaceae) from Baringo district (N00º29.132'; E036º00.906'); five males and eight females on orange *Citrus sinensis* (Rutaceae) from Makueni district (S01°50.188'; E037°38.166').

More specimen of this species were collected on *Citrus paradisi* (Rutaceae) from Kilifi and *Melia azadarach* (Meliaceae) from Kisumu.

Remarks: This species can be separated from the closely related *E. africanus* by the presence of only one seta on coxa II and an aedeagus whose bent portion is longer than the dorsal margin of the shaft (Figure 4C).

It has a wide distribution in the Afrotropical, Australasian and Palearctic regions as a pest of citrus. It has also been reported on members of other host families. In Kenya, this species was previously recorded on *Citrus* sp. (Rutaceae) from Thika district, Kenya (Meyer, 1987) and in this study it was collected from citrus trees in most of the areas where sampling was done. They are grey in colour and in cases of severe infestation, the plant appears dull in colour as though covered by a grey layer of soot.

Mixonychus Ryke and Meyer 1960 (Tetranychinae: Tetranychini)

This genus has a claw-like empodium which is devoid of proximoventral hairs and much longer than pads of true claws, dorsal integument in this genus appears reticulate due to clustering of striae, has ten pairs or opisthosomal setae present on dorsum, has two pairs of para-anal setae, peritreme ends in a simple bulb, true claws padlike provided with tenent hairs, empodium claw-like and devoid of proximoventral hairs, duplex seta on tarsus I distal and approximate.

Mixonychus acaciae Ryke and Meyer, 1960

Distinctive of this species are female dorsal opisthosomal setae which are set on tubercles, spiculate, do not taper, shorter than distances to next row of setae. Fourth pair of dorsocentrals (f_1) nearer to each other than members of other three pairs of dorsocentrals.

Leg chaetotaxy as follows: tarsi 10(2)-9(1)-7-7; tibiae 9-5-5-5; genua 5-5-3-3; femora 7-6-3-2; coxae 2-2-1-1.

Specimens examined: nine females collected from *Acacia nilotica* (Fabaceae) from Machakos district (S01º25.137'; E037º00.953') and two females on *Acacia* sp. from Baringo district (N00°30.590'; E035°38.766').

Remarks: This species has previously been reported in the Southern Africa region only. It was first described on *Acacia karoo* from South Africa (Ryke and Meyer, 1960) and has subsequently been collected on several species of *Acacia.* Although it is known to occur on hosts from other plants families, it seems to exhibit preference for the family Fabaceae. It is however found in small numbers and thus do not seem to cause any serious threat to the thorn trees. They are reddish brown in colour.

Mononychellus Wainstein 1960 (Tetranychinae: Tetranychini)

This genus has two pairs of anal setae and two pairs of para-anal setae, striae on opisthosoma variable usually with prominent lobes, dorsal body setae strongly serrate and borne on small tubercles, tarsus I with 2 sets of distal and adjacent duplex setae, empodium padlike, split distally into 3 hairs.

Mononychellus progresivus Doreste, 1981

Female characterized by first to third pairs of dorsocentral setae (c_1, d_1 and e_1) which are progressively longer towards rear, first pair about half as long as distances to bases of second pair; dorsal body setae generally long, setose and tapering but somewhat widened. Dorsal striations bear rounded lobes with basal spots. Aedeagus somewhat straight, narrowing distally to a relatively slender neck before ending in small angulations with anterior ventral angulation being acute and the distal dorsal one being very slightly curved.

Leg chaetotaxy as follows: tarsi 13+2-12+1-10-9; tibiae 9(1)-7-6-6; genua 5-5-4-3; femora 10-7-4-3; coxae 2-2-1-1.

Specimens examined: 3 females and 1 male on *Manihot esculenta* (Euphorbiaceae) from Kabarnet, Baringo district (N00°27.785'; E035°45.722').

Remarks: An earlier record of this species was reported by Girling *et al*. (1978) as *Mononychellus tanajoa* Bondar and later Guitterez (1987) reported that all the species from Africa earlier reported as *Mononychellus tanajoa* were infact *Mononychellus progresivus*. The host plant and specific location where this species was collected from in Kenya was not specified by the authors. This species is widespread in the tropics where *Manihot esculenta* is cultivated. It is likely that the pest spread with the spread of this crop to many tropical countries. This is one of the most important arthropod pests of *Manihot esculenta* and is amongst the spider mite species that are host specific since all the reports of this pest are from *Manihot* sp as a host plant. There have however been numerous debates on the identity of this species occurring in Africa with some authors insisting that the species that occur in cassava fields all over Africa is *Mononychellus tanajoa* Bondar and thus most publications that deal with its control and economic importance refer to *Mononychellus tanajoa* which has been successfully controlled using the phytoseiid mite *Typhlodromalus aripo* De Leon. However, comparing the features of the specimen I have with the description given by Meyer (1987) together with the paper by Guitterez (1987) show that our specimen correspond to the description of *Mononychellus progressivus*.

In the field, damaged leaves exhibit the typical silver stipples caused by spider mites and the species appears yellowish in colour.

Oligonychus Berlese 1886 (Tetranychinae: Tetranychini)

With a single pair of para-anal setae, empodium well developed and clawlike, with proximoventral hairs, body setae usually not set on tubercles. Two pairs of duplex setae on tarsus I distal and approximate.

Oligonychus coffeae Nietner, 1861

Acarus coffeae, Nietner, 1861

Peritreme ends in a bulb. Aedeagus distally bends ventrad at a right angle to shaft axis and gradually narrows to a slender truncate tip; male palptarsus with a tiny terminal sensillum; male tarsus bears 3 tactile setae and 2 solenidia proximal to duplex setae; empodia provided with 5 pairs of proximoventral hairs; serrate dorsal body setae of female longer than distances between consecutive setae.

Specimens examined: Four females and two males on *Mangifera indica* (Anacardiaceae) from Bungoma district (N00°25.425'; E034°30.225').

Remark: This species has a world-wide distribution and is found on a wide range of host plants. It was first collected on *Coffeae arabica* (Rubiaceae) from Sri Lanka (Nietner, 1861). The first record of this species in Kenya was on *Anacardium occidentale* (Anacardiacea) from Matuga, Kwale district (Baker and Pritchard, 1960). They are dark red in colour. Damage symptoms were not visible on the host plant.

Oligonychus gossypii Zacher, 1921

Paratetranychus gossypii Zacher, 1921

Peritreme of this species ends with a small curve. Dorsal setae long and lanceolate extending beyond bases of next row of setae. Male aedeagus narrows distally and curves dorsad at about a right angle; distally, aedeagus has a large knob bearing a small anterior projection and a long, undulate posterior projection; tip directed ventrad; female opisthosoma with longitudinal striae between members of third (e1) and fourth (f1) pairs of

dorsocentral setae; a diamond shaped structure present between these two pairs of setae. Leg chaetotaxy as follows: tarsi 13(1)+2-8+1-8-8/7; tibiae 10-7-6-7; genua 5-5-4-4; femora 10-6-4-4; foxae 2-2-1-1.

Specimens examined: Four males and six females collected on *Haplocoelum inoploeum* (Sapindaceae) from Malindi district (S03.19818°; E039.92382°).

Remark: This species was first described on *Gossypium* sp. from Togo (Zacher, 1921). This species is widely distributed in the Afrotropics and Neotropics and it has a wide host range. In Africa, it is considered as a pest of cassava. An earlier record of this species in Kenya was by Nyiira (1982) on an unspecified host plant and location.

Schizotetranychus Trägårdh, 1915

This genus has 2 pairs of para-anal setae (h_2 and h_3), duplex setae of tarsus I distal and approximate, empodia strong, claw-like, split and with appendant hairs. Peritreme is mostly simple.

Schizotetranychus spiculus Baker and Pritchard, 1960

Females of this species have short dorsal body setae which are broader at base, tapering distally and subequal in length, half length of longitudinal intervals between them. Longitudinal striae extend to first pair of dorsocentral setae (c_1); striae between first and second pairs of dorsocentral setae transverse, between second and third pairs form a V pattern; fourth pair of dorsocentrals f_1 situated further apart than other 3 pairs of dorsocentrals.

Remarks: This species was described on *Citrus* sp. (Rutaceae) from Kaloleni, Mombasa district; by Baker and Pritchard (1960). It has been reported on *Murraya koenigii* (Rutaceae) from India (Karuppuchamy and Mohanasundaram, 1987). No specimens were collected in this study.

Tetranychus Dufour 1832 (Tetranychinae: Tetranychini)

Has a single pair of para-anal setae, duplex setae of tarsus I widely separated, dividing it into more or less three equal parts, empodia split into 3 pairs of proximoventral hairs, male empodia may possess medio-dorsal spur, body setae not set on tubercles.

Tetranychus evansi Baker & Pritchard, 1960

Male of *T. evansi* has a slender aedeagal shaft that curves dorsad; axis of knob forms a strong angle with shaft axis; knob very small but bearing a small anterior projection and a relatively longer acute and somewhat deflexed posterior projection (Figure 5A). Female tarsus I with proximal pair of duplex setae more or less in a line with tactile setae and empodium I with a minute mediodorsal spur.

Specimens examined: Many specimens have been examined all collected on solanaceous plants from Kenya which include *Lycopersicon esculentum* from Kajiado, Migori, Suba, Nakuru, Machakos, Kwale, Makueni and Taita districts; *Solanum incanum* from Mwea; *Solanum nigrum* from Baringo, Kiambu and Taita; *Solanum melongena* from Kibwezi and Machakos and *Solanum tuberosum* from Sagana, Nyeri district.

Remarks: This species was first described from Mauritius on *Lycopersicon esculentum* (Baker and Pritchard, 1960) and is considered an invasive in Africa and parts of Europe. It has a worldwide occurrence but is not considered as a serious pest in the country of origin which is believed to be Brazil. However, in introduced places, it posses a threat to commercial production of solanaceous crops especially in greenhouse

conditions and warmer climates. This species has been reported on a wide variety of host plants but it shows preference for plants from the family solanaceae. An earlier report of this species was on *Lycopersicon esculentum* (Solanaceae) from Kirinyaga district (Knapp *et al*., 2003) and is currently the most important pest in tomato production in Kenya being wide spread in the major tomato growing areas. Biological control of this pest using the phytoseiid mite *Phytoseiulus longipes* Evans are underway and preliminary results in Kenya show high levels of control in the laboratory. However, field efficacy of the predator is not known since field releases have not been carried out. This species is brick-red to dark orange in colour when observed in the field. It produces dense webbing compared to the other species of the same genus in the field. In severe cases, the web produced covers the entire plant. Some pesticides registered for the control of spider mite are still effective in their control except dimethoate which is ineffective against *T. evansi* (Toroitich, unpublished data).

Tetranychus lombardinii Baker & Pritchard, 1960

Aedeagus curves dorsad, forming a knob about one fourth to one fifth length of dorsal margin of shaft; knob and shaft axes almost parallel; posterior projection small and acute; anterior projection rounded (Figure 5B) male empodium I with 2 proximoventral spurs and a minute mediodorsal spur; empodium II with 3 pairs of proximoventral hairs and a tiny mediodorsal spur; female striae between third (e_1) and fourth (f_1) pairs of dorsocentral setae longitudinal, a diamond-shaped figure formed between these setae; dorsal lobes narrow, triangular, mostly taller than broad and well separated at their bases; in some specimens ventral lobes weak or absent but usually low, semicircular, broad and extend from genital opening to near gnathosoma; lobes on prodorsum very broad and hardly more than an occasional incision of striae.

Specimens examined: Five males and several females collected on *Morus* sp. (Moraceae) from ICIPE compound, Nairobi (S01°13.140'; E036°53.440').

Remark: This species has been reported from the Tropics, Australia and Oriental Indian regions. It has a wide host range and occurs as a pest of several agricultural crops (Meyer, 1974). The first record of this species in Kenya was on *Spinacia oleraceae* (Amaranthaceae) from Ruiru, Thika district (Baker and Pritchard, 1960). It appears uniformly red in colour in the field.

Tetranychus ludeni Zacher, 1913

Aedeagus bends dorsad; aedeagal knob without a posterior projection, anterior projection small and acuminate; knob and shaft axis parallel (Figure 5C). Proximal pair of duplex setae on tarsus I almost in a straight line with tactile setae.

Specimens examined: Many individuals available collected on *Physalis heterophylla* (Solanaceae) growing in a flower bed in Kangemi, Nairobi (S01°15.984'; E036°45.810') and on *Bidens pilosa* (Asteraceae) in Runda (S01°13.470'; E036°48.050') Nairobi.

Remark: This species is widespread world-wide and occurs on a wide range of host plants. It was first described on *Cucurbita* sp. and *Salvia splendens* from Germany (Zacher, 1913). Its first report in Kenya was on *Chrysanthemum* sp. (Asteraceae) from an unknown locality (Jeppson *et al*., 1975).

Tetranychus neocaledonicus André, 1933.

Distinctive of this species is the shape of male aedegus that curves dorsad and both anterior and posterior projections are rounded and knob bears a small indent medially (Figure 5D). The female tarsus I with proximal pair of duplex setae distal to proximal tactile setae

Specimens examined: Five males and several females collected on *Manihot esculenta* (Euphorbiaceae) from Shimba Hills, Kwale district (S04°21.818; E039°19.490').

Remarks: This species was first described on *Gossypium* sp. from New Caledonia (Ándre, 1933) and is widely distributed in both the Afrotropics and Neotropics, USA and palearctic region on a wide range of host plants (Migeon and Dorkeld, 2006). In Kenya, the first record of this species was on *Ricinus communis* (Euphorbiaceae) from Nairobi (Baker and Pritchard, 1960). Damage on cassava leaves appear as silver stipples; severely infested plants appear stunted and leaves reduced in size.

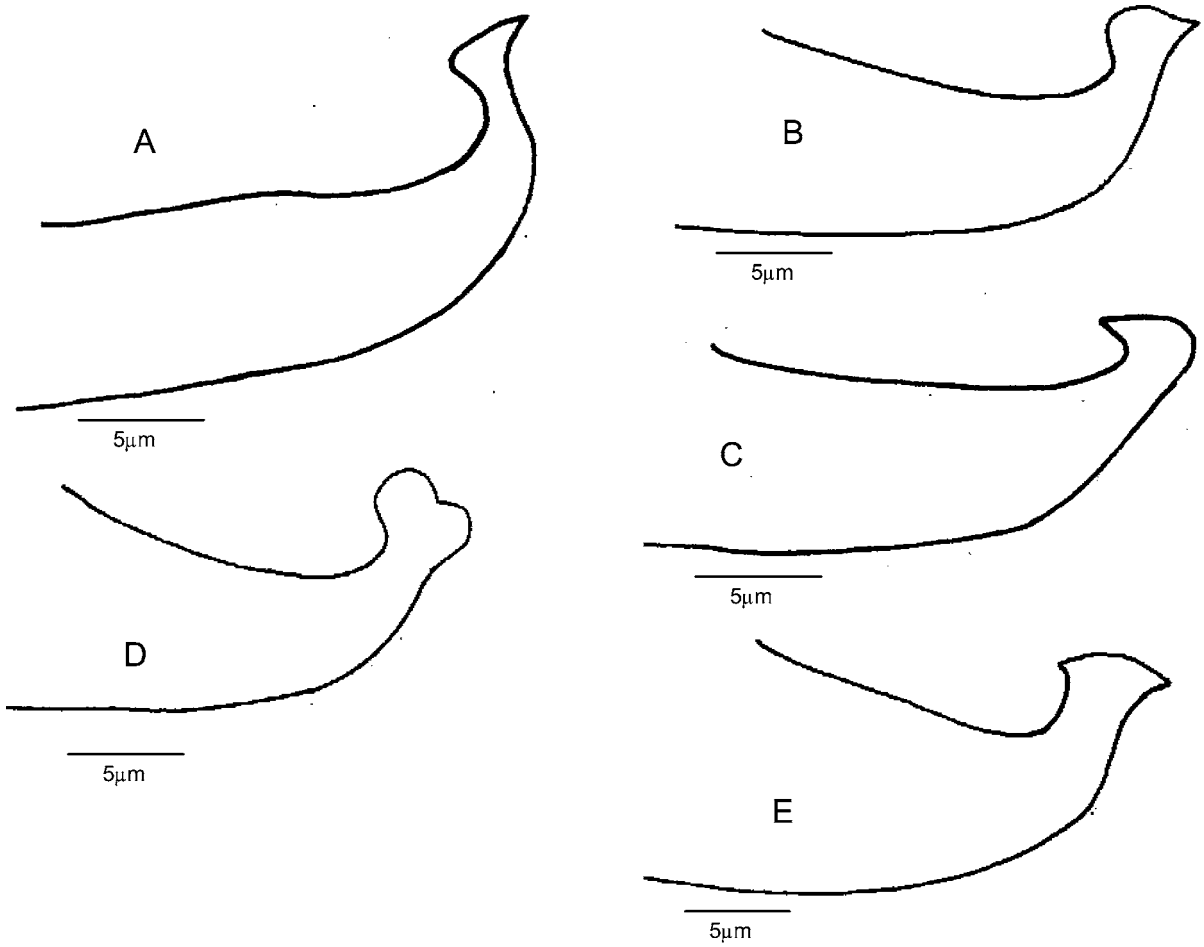

FIGURE 5. *Tetranychus sp*. aedegi modified after Meyer, 1974 (with permission). : (A) *T. evansi* aedeagus; (B) *T. lombardiini* aedeagus; (C) *T. ludeni* aedeagus; (D) *T. neocaledonicus* aedeagus; (E) *T. urticae* aedeagus.

Tetranychus urticae Koch, 1836

Knob of male aedeagus always small, axis of knob parallel to shaft axis or forms a small angle with shaft axis; dorsal margin of knob and development of anterior and posterior projections may vary, but in most case they are similar (Figure E); male empodium I with strong medio-dorsal spur; about length of 2 proximoventral spurs; empodium II consists of 3 pairs of proximoventral hairs and a strong mediodorsal spur.

Specimens examined: From many hosts all over Kenya: *Lycopersicon esculentum* (Solanaceae), *Phaseolus vulgaris* L. (Fabaceae), *Zea mays* L. (Poaceae), *Amaranthus hybridus* L. (Amaranthaceae)., *Carica papaya* (Caricaceae), *Galinsoga parviflora* (Asteraceae)., *Desmodium* sp. (Fabaceae), *Bidens pilosa* (Asteraceae), *Cucurbita pepo* (Cucurbitaceae), *Citrullus lanatus* (Cucurbitaceae), *Lactuca sativa* (Asteraceae), *Rosa* sp. (Rosaceae), *Passiflora edulis* (Passifloraceae), *Helianthus annuus* (Asteraceae),

Euphorbia sp. (Euphorbiaceae), *Tradescantia fluminensis* (Commelinaceae), *Citrus* sp. (Rutaceae), *Brassica* sp. (Brassicaceae), *Lantana camara* (Verbenaceae), *Datura stramonium* (Solanaceae), *Pisum sativum* (Fabaceae), *Dianthus caryophyllus* (Caryophyllaceae).

Remark: *Tetranychus urticae* was first described on *Glyine max* and *Urtica sp* from Germany (Koch, 1836). It is one of the most cosmopolitan spider mite species with worldwide distribution and a wide host range. It is considered a pest of many crops and is the most studied spider mite species with a high rate of pesticide resistance reported on this species by many authors. In Kenya, it is a major menace in cut flower production especially in *Rosa* sp. Its first record in Kenya was on *Allium ampeloprasum* (Alliaceae) from Machakos district and on *Lathyrus odorata* (Fabaceae) from Nairobi (Baker and Pritchard, 1960).

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