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First discovery of *Tetranychus truncatus* in Africa and new records of spider mites (Prostigmata, Tetranychidae) in Burkina Faso

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Short note

ABSTRACT

We report the first occurrence in Africa, in Burkina Faso, of an exotic spider mite, *Tetranychus truncatus*, including new host records. Due to morphological variation in the specimens we observed, we used molecular and morphological approaches to obtain a reliable identification of this alien species. Sampling events also disclosed two new spider mite records for Burkina Faso, *Eutetranychus orientalis* and *Tetranychus urticae* and several new host plant records.

Keywords alien species; COI mtDNA; faunistic survey; integrative taxonomy


Introduction

In Burkina Faso, tomato cultivation contributes to food security and increases producer incomes (MAAH, 2011). Due to its significant economic benefits, tomato cultivation is becoming increasingly important (Son, 2018). However, it faces numerous biotic constraints, including spider mites, in particular the red tomato mite *Tetranychus evansi* Baker & Pritchard, 1960 (Acari: Tetranychidae), which is a serious threat to tomato production in Burkina Faso (Drabo *et al.*, 2022). As a result, to reduce losses, producers are intensifying the use of synthetic pesticides or renounce to tomato cultivation (Drabo *et al.*, 2020).

Despite the economic importance of both tomato cultivation and spider mites in Burkina Faso, with the exception of *T. evansi*, no information is available on the diversity of tetranychid mites found on tomato. To fill this gap, from 2019 to 2020, in six different regions, we carried out sampling mainly in Solanaceae crops but also in a few others crops, sometimes including non-cultivated plants present in the vicinity.

In this work, we report three new spider mite records for Burkina Faso, including the first record of *Tetranychus truncatus* Ehara, 1956 from Africa and new host plants for spider mites.

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Material and methods

Morphology based identification

Mites were extracted using the washing method (Boller, 1984), by filtering the solution on three stacked sieves (smallest mesh size 400), and picking out mites using a camel hair brush. They were preserved in 90% ethyl alcohol. Following clearing in lactic acid (50%) for 24 hours they were mounted in Hoyer's medium. The specimens were examined using a Leica® DM LB 2 phase-contrast and DIC microscope. Morphological identifications were performed using original and supplementary descriptions after using Flechtmann and Knihinicki (2002) and the key of Kamran *et al.* (2018) for the genera *Tetranychus* and *Eutetranychus*, respectively.

Molecular based identification

For molecular analysis, mites were collected directly from field samples in 100% ethanol.

DNA extraction, amplification and sequencing

A fragment of 885 pb of Cytochrome oxidase subunit I (*COI*) mtDNA was used to characterize specimens. This marker was chosen because of its variability at intraspecific level (Gotoh *et al.*, 2009, Boubou *et al.*, 2011). DNA extraction was carried out on single females using the DNeasy tissue Kit (Qiagen, USA), following the protocol described in Boubou *et al.* (2011). All the sequences were deposited into Genbank (Table 1).

DNA sequence alignment and analysis

Three specimens were used for molecular characterisation (Table 1). Sequences were edited using Codon Aligner v.4.1.1 (CodonCode Corporation) and aligned using the default parameters. All the sequences were verified for stop codons and for insertions/deletions. BLASTs of nucleotide sequences were carried out on the NCBI database to determine the species identity by match percentage levels.

Results and discussion

Family Tetranychidae Donnadieu, 1875

Subfamily Tetranychinae Berlese, 1913

Tribe Eurytetranychini Reck, 1950

Genus *Eutetranychus* Banks, 1917

Neotetranychus (*Eutetranychus*) Banks, 1917: 197. Type-species: *Tetranychus banksi* McGregor

Eutetranychus orientalis (Klein, 1936)

Figure 1A

Table 1 Collection data of spider mites studied, followed by the number of specimens sequenced, the name of the species and GenBank accession numbers for COI mtDNA sequences.

Locality (country, name)	Lat/Long	Date	Host plant	Nb. specimens	Species	GenBank Acc. Id.
Burkina Faso, Kadiogo, Kamboinsé	12.4519° N, 1.5601° E	11-XI-2019	<i>Amaranthus hybridus</i>	2	<i>Tetranychus truncatus</i>	OR336315
Burkina Faso, Kadiogo, Kamboinsé	12.4518° N, 1.5601° E	11-XI-2019	<i>Solanum macrocarpum</i>	1	<i>Tetranychus truncatus</i>	OR336314

Specimens examined — 8 females on *Carica papaya* L. (Caricaceae), Kodéni (11°08'01.1"N 004°19'13.0"W, alt. 345 m a.s.l.), Bobo Dioulasso (Houet), Burkina Faso, 16-I-2020 leg. E. Drabo; 3 males, 9 females, same host plant, secteur 4 (12°30'51.9"N 003°32'41.3"W, alt. 263 m a.s.l.), Dédougou (Mouhoun) Burkina Faso, 18-I-2020 leg. E. Drabo; 5 males, 8 females, 2 nymphs, same host plant, secteur 10 (13°34'58.4"N 002°23'17.6"W, alt. 320 m a.s.l.), Ouahigouya (Yatenga), Burkina Faso, 24-I-2020 leg. E. Drabo.

Distinctive characters (female) — Coxa II with one seta, dorsal striation forming a “V-pattern” between members of setae d_1 and e_1 , idiosoma with most of dorsal setae inserted on tubercles, 6/7 setae present on tibia II, 6/7 setae on tibia III, 6/7 setae on femur II, most of dorsal setae oblanceolate to spatulate, tip of setae e_1 far from reaching the base of setae h_1 .

Note — New spider mite record for Burkina Faso.

Tribe Tetranychini Reck, 1950

Genus *Tetranychus* Dufour, 1832

Tetranychus Dufour, 1832: 276. Type-species: *Tetranychus lintearius* Dufour

Tetranychus (Tetranychus) evansi Baker & Pritchard, 1960

Figure 1B-C

Specimens examined — 3 males, 16 females on *Solanum lycopersicum* L. (Solanaceae), Kounda (12°08'55.2"N 001°28'30.4"W alt. 280 m a.s.l.), Saponé (Bazèga), Burkina Faso, 08-XI-2019 leg. E. Drabo; 3 males, 16 females on *Solanum melongena* L. (Solanaceae), Kombissiri (12°05'37.2"N 001°20'59.3"W, alt. 315 m a.s.l.), Kombissiri (Bazèga), Burkina Faso, 08-XI-2019 leg. E. Drabo; 3 males, 16 females on *Solanum macrocarpon* L. (Solanaceae), Pindga (12°08'52.4"N 001°28'38.4"W, alt. 298 m a.s.l.), Kombissiri (Bazèga), Burkina Faso, 08-XI-2019 leg. E. Drabo; 4 males, 12 females on *S. lycopersicum*, Kamboinsé (12°27'05.9"N 001°33'35.4"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 2 males, 3 females on *S. melongena*, Kamboinsé (12°27'08.4"N 001°33'37.3"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 4 males, 8 females on *S. macrocarpon*, Kamboinsé (12°27'03.7"N 001°33'35.7"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 3 males, 12 females on *Amaranthus hybridus* L. (Amaranthaceae), Kamboinsé (12°27'15.3"N 001°33'24.9"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 3 males, 12 females on *S. lycopersicum*, Kalabo (12°28'07.9"N 002°48'49.1"W, alt. 262 m a.s.l.), Gossina (Nayala), Burkina Faso, 19-XI-2019 leg. E. Drabo; 3 males, 12 females on *S. melongena*, Kalabo (12°27'07.3"N 002°47'49.4"W, alt. 257 m a.s.l.), Gossina (Nayala), Burkina Faso, 19-XI-2019 leg. E. Drabo; 3 males, 12 females on *S. macrocarpon*, Kalabo (12°28'01.0"N 002°48'53.4"W, alt. 263 m a.s.l.), Gossina (Nayala), Burkina Faso, 19-XI-2019 leg. E. Drabo; 3 males, 12 females on *Solanum nigrum* L. (Solanaceae), Kalabo (12°28'09.6"N 002°48'45.2"W, alt. 260 m a.s.l.), Gossina (Nayala), Burkina Faso, 19-XI-2019 leg. E. Drabo; 3 males, 12 females on *S. lycopersicum*, Pabré (12°30'30.1"N 001°35'51.8"W, alt. 296 m a.s.l.), Pabré (Kadiogo), Burkina Faso, 27-XI-2019 leg. E. Drabo; 3 males, 12 females on *S. melongena*, Pabré (12°30'38.6"N 001°36'03.8"W, alt. 296 m a.s.l.), Pabré (Kadiogo), Burkina Faso, 27-XI-2019 leg. E. Drabo; 3 males, 12 females on *S. macrocarpon*, Pabré (12°30'28.8"N 001°35'49.6"W, alt. 297 m a.s.l.), Pabré (Kadiogo), Burkina Faso, 27-XI-2019 leg. E. Drabo; 3 males, 12 females on *S. lycopersicum*, Kabo (12°49'24.2"N 002°15'07.0"W, alt. 339 m a.s.l.), Yako (Passoré), Burkina Faso, 15-XI-2019 leg. E. Drabo; 3 males, 12 females on *S. macrocarpon*, Yako (12°56'29.4"N 002°15'11.0"W, alt. 331 m a.s.l.), Yako (Passoré), Burkina Faso, 15-XI-2019 leg. E. Drabo; 3 males, 16 females on *S. lycopersicum*, Boussouma (12°57'12.7"N 001°07'49.9"W, alt. 301 m a.s.l.), Boussouma (Sanmatenga), Burkina Faso, 02-XII-2019 leg. E. Drabo; 3 males, 16 females on *S. melongena*, Boussouma (12°57'12.8"N 001°07'51.3"W, alt. 301 m a.s.l.), Boussouma (Sanmatenga),

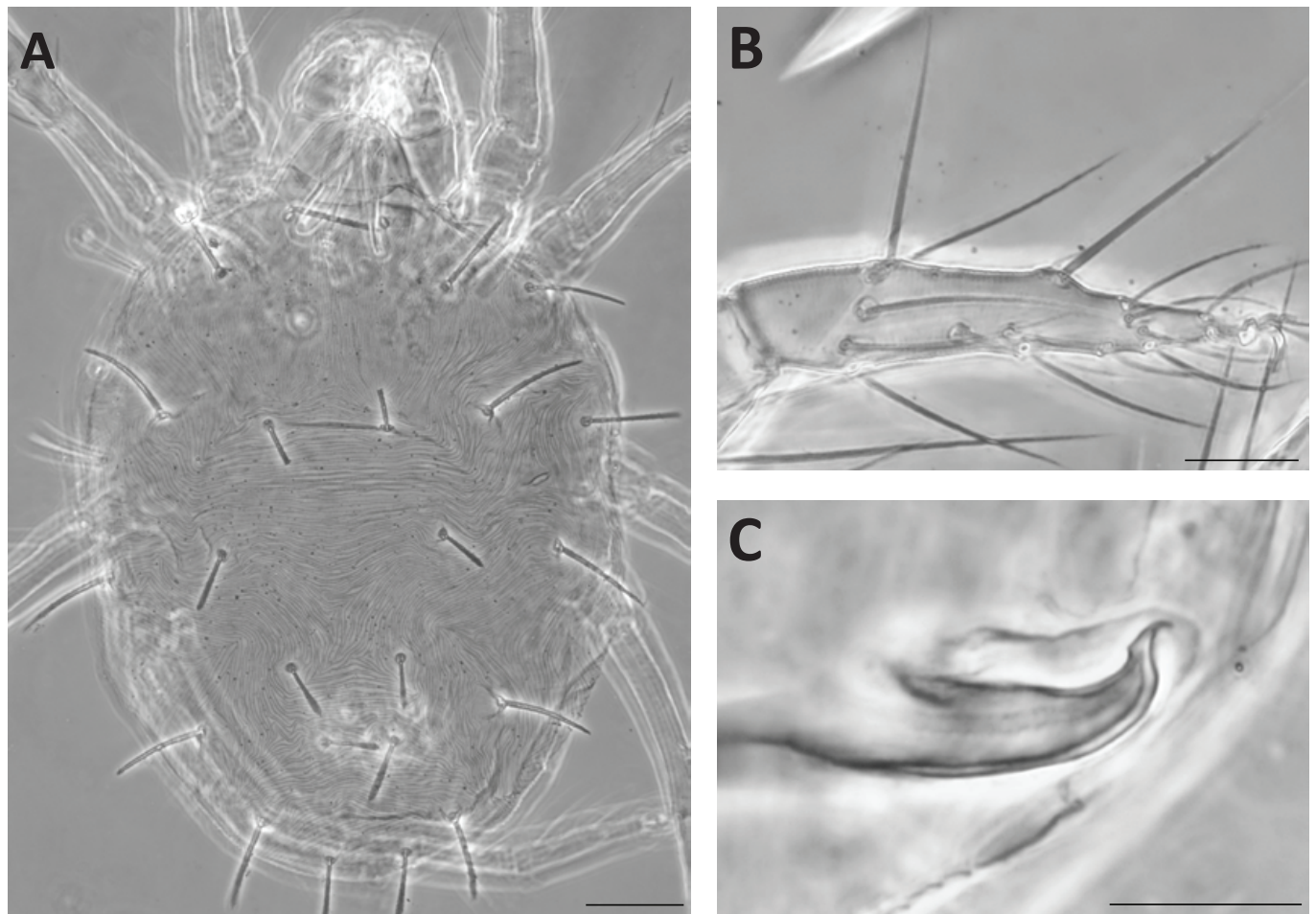


Figure 1 A – *Eutetranychus orientalis* (Klein, 1936), female habitus showing the dorsal striation forming a "V-pattern" between members of setae d_1 and e_1 , some setae inserted on tubercles and the tip of setae e_1 being far from reaching base of setae h_1 . B–C – *Tetranychus evansi* Baker & Pritchard, 1960: B – tarsus of female leg I with "in line" setal arrangement at the proximal pair of duplex setae level, C – male aedeagus. Scale bars = 50 μ m (A), 25 μ m (B), 10 μ m (C).

Burkina Faso, 02-XII-2019 leg. E. Drabo; 3 males, 16 females on *S. macrocarpon*, Boussouma (12°57'13.6"N 001°07'51.1"W, alt. 303 m a.s.l.), Boussouma (Sanmatenga), Burkina Faso, 02-XII-2019 leg. E. Drabo; 3 males, 16 females on *S. lycopersicum*, Korsimoro (12°49'06.4"N 001°02'13.6"W, alt. 288 m a.s.l.), Korsimoro (Sanmatenga), Burkina Faso, 02-XII-2019 leg. E. Drabo; 3 males, 16 females on *S. melongena*, Korsimoro (12°49'06.4"N 001°02'13.6"W, alt. 288 m a.s.l.), Korsimoro (Sanmatenga), Burkina Faso, 02-XII-2019 leg. E. Drabo; 3 males, 16 females on *S. macrocarpon*, Korsimoro (12°49'16.7"N 001°02'34.5"W, alt. 286 m a.s.l.), Korsimoro (Sanmatenga), Burkina Faso, 02-XII-2019 leg. E. Drabo; 3 males, 12 females on *S. lycopersicum*, Ouahigouya (13°35'08.6"N 002°23'29.0"W, alt. 326 m a.s.l.), Ouahigouya (Yatenga), Burkina Faso, 11-I-2020 leg. E. Drabo; 3 males, 12 females on *S. macrocarpon*, Ouahigouya (13°35'19.1"N 002°24'08.5"W, alt. 322 m a.s.l.), Ouahigouya (Yatenga), Burkina Faso, 11-I-2020 leg. E. Drabo; 3 males, 12 females on *S. lycopersicum*, Badala (12°30'58.6"N 003°32'36.5"W, alt. 264 m a.s.l.), Dédougou (Mouhoun), Burkina Faso, 17-I-2020 leg. E. Drabo; 3 males, 16 females on *S. lycopersicum*, Tolotama (11°07'49.8"N 004°19'01.3"W, alt. 453 m a.s.l.), Bobo Dioulasso (Houet), Burkina Faso, 15-I-2020 leg. E. Drabo; 3 males, 16 females on *S. melongena*, Dafinso (11°13'53.2"N 004°13'51.0"W, alt. 381 m a.s.l.), Bobo Dioulasso (Houet), Burkina Faso, 15-I-2020 leg. E. Drabo; 3 males, 16 females on *S. macrocarpon*, Kodéni (11°08'01.2"N 004°19'10.7"W, alt. 446 m a.s.l.), Bobo Dioulasso

(Houet), Burkina Faso, 15-I-2020 leg. E. Drabo.

Distinctive characters — Female tarsus I with proximal tactile setae in line with proximal duplex (desertorum group), dorsal striae between setae e_1 and f_1 forming a diamond pattern, anterogenital striation entire sometimes weak medially, male empodium I and II uncinata, empodia I-IV with obvious dorsal spur, male aedeagus shape unique in this group.

Note — New host record on *A. hybridus*.

***Tetranychus (Tetranychus) truncatus* Ehara, 1956**

Figures 2A-C

This species has been recorded in 12 countries in the Australasian, Oriental and Palearctic regions (Migeon and Dorkeld, 2023). The last two countries where it has been reported are India (Srinivasa *et al.*, 2012) and Bangladesh (Ullah and Gotoh, 2013) and the country geographically closest to the African continent, where *T. truncatus* has been recorded, is Iran (e.g. Sadeghi-Namaghi, 2010).

Specimens examined — 13 males, 25 females from *A. hybridus*, Kamboinsé (12°27'07.1"N 001°33'36.5"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 2 males, 2 females from *Cajanus cajan* L. Millsp (Fabaceae), Kamboinsé (12°27'24.5"N 001°32'56.9"W, alt. 295 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 26-VI-2019 leg. E. Drabo; 3 males, 5 females from *Vigna unguiculata* (L.) Walp (Fabaceae), Kamboinsé (12°27'21.4"N 001°33'03.1"W, alt. 296 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 26-VI-2019 leg. E. Drabo; 4 males, 9 females from *Allium cepa* L. (Amaryllidaceae), Kamboinsé (12°27'13.0"N 001°33'28.4"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 26-VI-2019 leg. E. Drabo; 3 males, 1 female from *Zea mays* L. (Poaceae), Kamboinsé (12°27'20.3"N 001°33'00.1"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 26-VI-2019 leg. E. Drabo; 2 males, 3 females from *Leptadenia hastata* Pers. (Apocynaceae), Kamboinsé (12°27'06.0"N 001°33'36.8"W, alt. 296 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 26-VI-2019 leg. E. Drabo; 7 males, 24 females from *Corchorus olitorius* L. (Malvaceae), Kamboinsé (12°27'07.4"N 001°33'36.3"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 1 male, 3 females from *S. lycopersicon*, Kamboinsé (12°27'08.1"N 001°33'36.8"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 3 males, 11 females from *S. macrocarpon*, Kamboinsé (12°27'06.6"N 001°33'36.5"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 6 males, 12 females from *S. melongena*, Kamboinsé (12°27'05.9"N 001°33'35.4"W, alt. 297 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 3 males, 8 females from *Ipomoea eriocarpa* R. Br. (Convolvulaceae), Kamboinsé (12°27'02.1"N 001°33'33.8"W, alt. 298 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 27-I-2020 leg. E. Drabo; 3 males, 12 females from *Helianthus annuus* L. (Asteraceae), Kamboinsé (12°27'09.3"N 001°33'38.1"W, alt. 296 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 15-II-2020 leg. E. Drabo.

Distinctive characters — Female tarsus I with four tactile setae proximal to the proximal pair of duplex setae on tarsus, dorsal striae between setae e_1 and f_1 forming a diamond pattern, ventral striae without lobes, anterogenital striation entire, unbroken (but may be sparse medially), male empodium I claw-like, empodia I-II each with an obvious dorsal spur, shorter on empodia III-IV, shape of the male aedeagus (Fig. 2A).

Molecular identification — A BLAST search of the three mite haplotype sequences against the NCBI's GenBank showed between 99.77% similarity (accession number MG518333.1) and 99.09% with the 56 sequences of *T. truncatus*.

Remarks — The morphological identification of our specimens of *T. truncatus* was uncertain because the male aedeagi we observed appeared to be somewhat different to that depicted in the original description by Ehara (1956). The main differences were an obvious indentation present in the aedeagal knob dorsal margin between the two knob projections and a more developed triangular posterior projection (Fig. 2A). Nevertheless, thanks to the

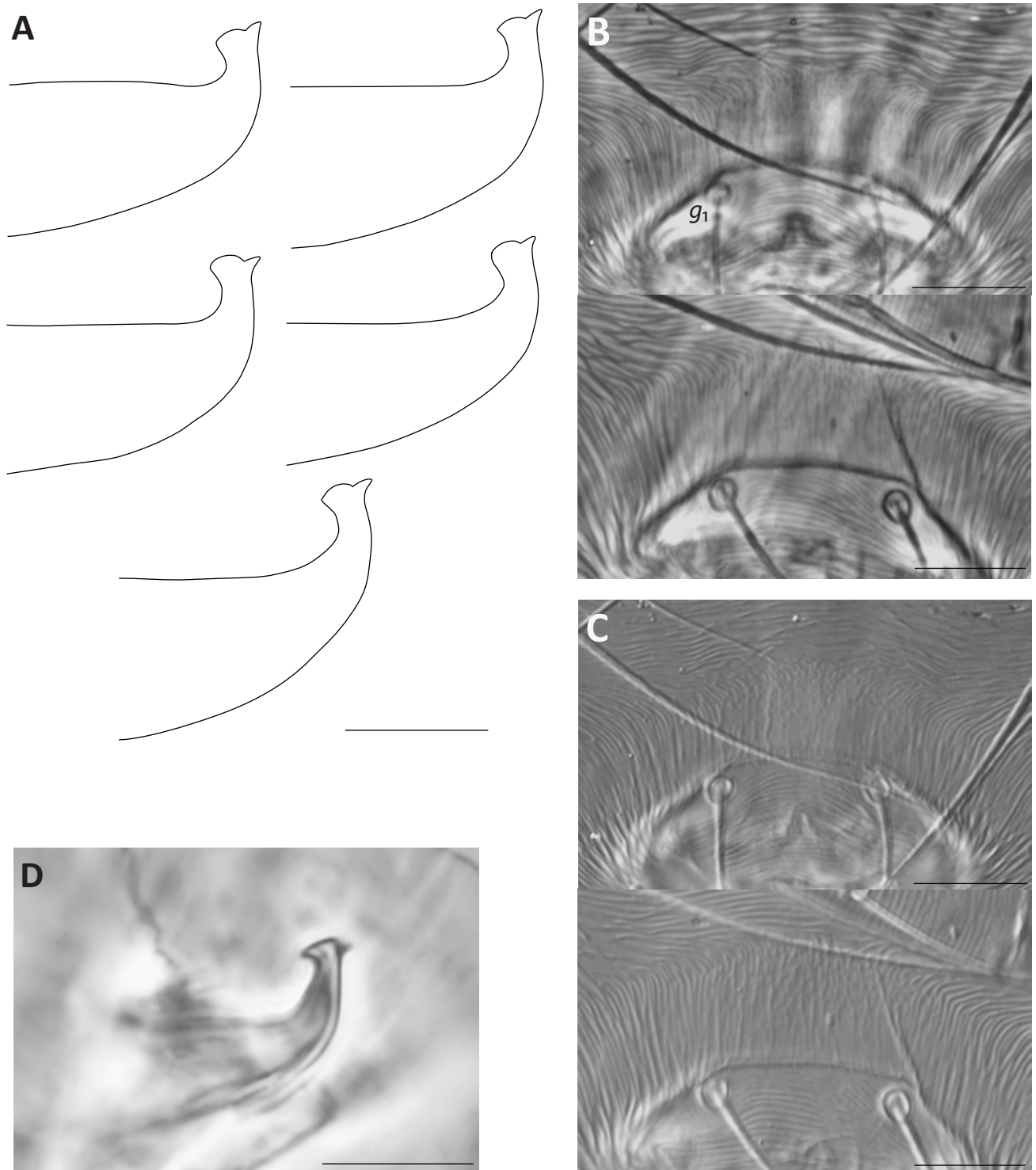


Figure 2 A–C *Tetranychus (Tetranychus) truncatus* Ehara, 1956. A – variations in male aedeagus of 5 specimens, B–C – female anterogenital striation in two specimens: B – using phase-contrast microscope, C – using DIC microscope. D – *Tetranychus urticae* Koch, 1835, male aedeagus. Scale bars = 5 μm (A), 10 μm (D), 20 μm (B,C).

examination of type specimens of *T. truncatus*, Seeman and Beard (2011) reported similar variations in the aedeagus shape of this species. However, in the same contribution, they mention that the female anterogenital striation is entire, unbroken, but sometimes sparse

medially, whereas in the specimens we examined it is sparse with small breaks medially and more or less dotted in its anterior longitudinal part (Fig. 2B,C). Despite these morphological variations, with the use of molecular tools, we were able to obtain a reliable identification of our specimens as *T. truncatus*.

There is no doubt that *T. truncatus* represents an important phytosanitary risk in Burkina Faso and, of course, at the scale of the African continent. Indeed, taking into account its pest status reported in almost all the parts of the world it colonized, particularly in Bangladesh (Tarikul Islam *et al.*, 2017), China (Jin *et al.*, 2018), India (Bhaskar and Lenin, 2018), Taiwan (Ho, 2000), Thailand (Sakunwarin *et al.*, 2004) and Vietnam (Hinomoto *et al.*, 2007), its wide range of potential host plants [92 host plants according to Migeon and Dorkeld (2023)], including major crops (e.g. rice, maize, cassava, several Solanaceae but also cotton) and its ability to develop pesticide resistances (e.g. Ullah and Gotoh, 2013; Li-Wen *et al.*, 2019), make it a major pest. Our study confirms this in part, as we already found it on 12 different host plants, the majority of which are crops.

Note — New spider mite record for Africa (Burkina Faso) and new host records on *A. hybridus*, *C. cajan*, *A. cepa*, *L. hastata*, *C. olitorius*, *S. macrocarpon* and *I. eriocarpa*.

***Tetranychus (Tetranychus) urticae* Koch, 1835**

Figure 2D

Specimens examined — 5 males, 7 females on *A. hybridus*, Kamboinsé (12°27'08.1"N 001°33'36.8"W, alt. 298 m a.s.l.), Ouagadougou (Kadiogo), Burkina Faso, 11-XI-2019 leg. E. Drabo; 7 males, 9 females on *Phaseolus vulgaris* L. (Fabaceae), Kodéni (11°08'05.1"N 004°19'09.2"W, alt. 447 m a.s.l.), Bobo Dioulasso (Houet), Burkina Faso, 16-I-2020 leg. E. Drabo; 9 males, 27 females on *Lactuca sativa* L. (Asteraceae), Kodéni (11°08'02.8"N 004°19'10.4"W, alt. 446 m a.s.l.), Bobo Dioulasso (Houet), Burkina Faso, 16-I-2020 leg. E. Drabo; 3 males, 12 females on *Brassica oleracea* L. (Brassicaceae), Kodéni (11°08'01.2"N 004°19'12.7"W, alt. 444 m a.s.l.), Bobo Dioulasso (Houet), Burkina Faso, 16-I-2020 leg. E. Drabo; 9 males, 34 females on *Manihot esculenta* Crantz (Euphorbiaceae), Kodéni (11°13'44.0"N 004°13'52.3"W, alt. 380 m a.s.l.), Bobo Dioulasso (Houet), Burkina Faso, 16-I-2020 leg. E. Drabo; 4 males, 4 females on *S. macrocarpon*, Kodéni (11°17'31.8" N 004°11'34.9"W, alt. 362 m a.s.l.), Bobo Dioulasso (Houet), Burkina Faso, 16-I-2020 leg. E. Drabo.

Distinctive characters — Female tarsus I with four tactile setae proximal to the proximal pair of duplex setae on tarsus, dorsal striae between setae e_1 and f_1 forming a diamond pattern, anterogenital striation generally entire, sometimes sparse and with small breaks medially, male empodium I claw-like, empodia I-II each with an obvious dorsal spur, shape of the male aedeagus (Fig. 2D).

Note — New spider mite record for Burkina Faso.

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