

A NEW IRANIAN SPECIES OF THE SUBGENUS *LABIDOSTOMA* (PROSTIGMATA:
LABIDOSTOMATIDAE), WITH NEW BIOGEOGRAPHIC DATA
ON THE *INTEGRUM* SPECIES GROUP

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ABSTRACT — A new species, *Labidostoma (Labidostoma) intermedia*, from Iran and clearly allied to *L. (L.) integrum*, is described and compared with specimens of the latter from various locations. Because *L. (L.) intermedia* n. sp. is closely allied to the common Mediterranean species, the authors propose to consider the eponymous species group as a group gathering species which share the lateral line of pores. These species are likely vicariants in a West to East gradient from the Atlantic Ocean to Asian countries. We provide a general key setting the new species group back among the genera and subgenera previously described, as well as biogeographical and taxonomic notes.

KEYWORDS — Labidostomatoidea; *integrum*-group of species; vicariants; Iran; Mediterranean Region; biogeography; identification key

INTRODUCTION

It is common to consider that Arachnids are an old group and that mites have passed through different changes on the earth since the Primary Era. However, speciation is a continuum occurring throughout different episodes. Vicariance is the result of speciation when a pre-existing species is subdivided and when the newly born species has kept the principal features that gave a similar role for each species in each area of distribution. Among many

authors, Boyer *et al.*, (2007) confirmed the hypothesis that continental drift drives the diversification of organisms through vicariance, following a thorough study of a group of Opiliones. As suggested by Krantz and Walter (2009), groups of mites have also likely undergone vicariant speciation and may provide much interesting models for testing biogeographical hypotheses. It is obvious that vicariance at the generic level may suppose a more ancient separation than those at the infrageneric level that are often interpreted in Europe and America as re-

sulting from changes in the late billions of years (from Tertiary to Glaciations). Labidostomids as not only primitive, but also widely distributed mites, are indeed a case in point with regard to vicariant speciations. Within the *Labidostoma* (*Labidostoma*) subgenus, and based upon available biogeographic data, we discuss how passed conditions may be linked with speciation patterns, radiation resulting from the fragmentation of the wider primitive distribution of one unidentified common ancestor.

The Labidostomatidae family, a model of primitive Prostigmata

The three European genera of Labidostomatoidea (Trombidiformes, supercohort Labidostomatides *sensu* Krantz and Walter, 2009) have a large distribution (Europe, North America and Asia): the cosmopolitan *Labidostoma* Kramer, 1879 (syn. *Nicoletiella*), or the Holarctic genera *Eunicolina* Berlese, 1911 (syn. *Grandjeanellina*) and *Akrostomma* Robaux, 1977 (Table 1).

Because Labidostomatidae Oudemans 1904 (i) have conserved a primitive morphology, (ii) are distributed all over the continents, and (iii) the distinctive variations in their morphology are easily ob-

servable, labidostomatid mites are currently considered forming (i) a basal branch among the Prostigmata, (ii) a model for biogeographic studies, (iii) a likely example of evolutive radiations (Grandjean, 1941; Bertrand, 1990a).

Labidostomatidae is the unique family that belongs to Labidostomatina, one of four infraorders forming the suborder Prostigmata (classification according to Zhang *et al.*, 2011). Labidostomatidae are one of the most primitive groups of Actinotrichid mites. An unusual and homogeneous pattern, with sclerotized cuticle forming ventral and dorsal shields characterized the species; this sclerotization may have played a role in the conservation of characters kept also by the most primitive groups of trombidiform mites (Sphaerolichina, Eupodina).

The genus *Labidostoma* and the subgenus *Labidostoma* (*Labidostoma*)

Berlese (1911) described the species type *Labidostoma integrum* from Umbria (Italy) in a brief diagnosis (less than 40 words):

"*Flavidum, ovale; angulis non in cornua productis; mandibulorum digito mobili dentibus (in medio margine dentario) numero novem, intersece statura subequalibus,*

TABLE 1: Labidostomatidae: the genera following Bertrand (1990), actualized.

Genera (Berlese, 1911; Bertrand 1990; Feider & Vasiliu 1969, 1970; Robaux, 1977)				
Genera	Subgenera	Known distribution	Notable characters	Notes
<i>Eunicolina</i> Berlese, 1911		Northern Hemisphere	Neotaxy (gland like organs)	Included <i>Grandjeanellina</i> Feider & Vasiliu 1969 (Subfamily Eunicolinae according to F & V.).
<i>Akrostomma</i> Robaux, 1977		Northern Hemisphere	Euedaphic genus. Primitive famulus, eye reduction, sclerotized developed gland like organ	
<i>Labidostoma</i> Kramer, 1879	<i>Atyeonella</i>	Southern Hemisphere	absence of cornua, spinelike famulus	Considered as the subfamily Nicoletiellinae by F & V
	<i>Labidostoma</i>	Cosmopolitan		
	<i>Nicoletiella</i>	Cosmopolitan	presence of cornua, primitive famulus	
	<i>Cornutella</i> (included <i>Mahunkiella</i>)	Holarctic (<i>Mahunkiella</i> = East Asian)	Famulus primitive, prolonged bases of proximal cheliceral setae	
<i>Sellnickiella</i> Feider & Vasiliu 1970	<i>Pselistoma</i>	South America. (A unique species described)	proroged anteriorly dorsal shield	Considered as a subfamily by F & V: Sellnickiellinae
	<i>Sellnickiella</i>	South Hemisphere	no gland like organ, simple or bifid famulus (<i>Sellnickiella</i> or <i>Dicastrilla</i>)	
	<i>Dicastrilla</i>	South America		

sat magnis; digiti fixi ramo apicali superno sat inferiorem securiformem superanti. Tuberculus mandibulae parvulus."

Berlese did not provide any details concerning the exceptional characteristic of this species: the line of dorso-lateral pores that distorts the alveolar arrangement. Fortunately, Grandjean (1942, a, b) examined some specimens and provided illustrations. He noted that Algerian and French specimens differed by:

- ornamentation of the dorsal shield,
- the number of teeth on the mobile cheliceral digit,
- the organization of the terminal and subterminal teeth of the fixed digit.

Feider and Vasiliu (1970) compared the morphology of Romanian specimens of *L. caucasicum* (Reck 1940) and *L. integrum* to clarify their identity. Until now, amongst the species belonging to the subgenus *Labidostoma*, only two shared the unusual arrangement of a dorso-lateral line of pores: i.e. *integrum* and *caucasicum*.

From 1879 to 1969, several authors described newly discovered species, named them in the genus *Labidostoma* (syn. *Nicoletiella* Kramer 1879). However, providing a different perspective from previous authors, Feider and Vasiliu (1969) and some years later, Bertrand (1990) considered that it is preferable to subdivide the genus into different subgenera. The subgenus *Labidostoma*, (comprising the species closely allied to *L. integrum*) and the subgenus *Nicoletiella*, (comprising the species closely allied to *L. luteum*) must keep separated from each other at least as subgenera if not as different genera.

The *integrum* species-group : new insights thanks to a new species

The successive descriptions in the genus *Labidostoma* filled it gradually with species that could not be assigned to any other labidostomid genus (*Eunicolina*, *Akrostomma* or *Sellnickiella*). The subgenus *Labidostoma* is now overloaded with those species

that share a regressive famulus on tarsi I: the Asian *L. (L.) nepalense* Feider and Vasiliu, 1968, some South African species (Bertrand and Theron, 1990) and some species from the Philippines (Bertrand and Corpus Raros, 1997). As a result, the subgenus *Labidostoma* (*Labidostoma*) looks like a ragbag.

Notwithstanding, the recent discovery, in Iran, of a third species sharing the major distinctive character of the *L. (L.) integrum* and *L. (L.) caucasicum* sheds light on some uncertainties and attests that some "hard nucleus" of closely allied species exists. The new Iranian species offers the opportunity to reconsider these heterogeneities. It was of interest to confront the Iranian individuals to specimens collected from Western and Eastern parts of the distribution area of the closest species *L. (L.) integrum*.

MATERIALS AND METHODS

The collection of Labidostomatid mites needs adapted soil sampling because low densities of these mites occur naturally in the upper layers of the soil. However, only repeated samplings allowed the capture of a sufficient number of individuals, to underpin a description and to verify the constancy of the characters.

Iranian specimens of the three species under scrutiny: extraction by Berlese-Tullgren funnel apparatus from soil samples, collected in the Region of Gorgan (Golestan Province), in Maragheh and in Shabestar (East Azerbaijan Province). The specimens were mounted in Hoyer's liquid, then examined and identified. Morphology was studied in Montpellier from both mounted and dissected specimens cleared in lactic acid. Two females and one male were dissected for detailed observation as temporary mounts using lactic acid in cavity slides. Measurements were made under the microscope using a calibrated Motic® camera and a camera lucida. Abbreviations follow those of Grandjean (1942 a, b).

Specimens of *Labidostoma (L.) integrum*: *L. integrum* collected from France, Corsica, North Sardinia, Spain (Castilla y León) and Kazakhstan.

1. **French specimens:** This species is common in the Mediterranean Basin (Bertrand, 1988).

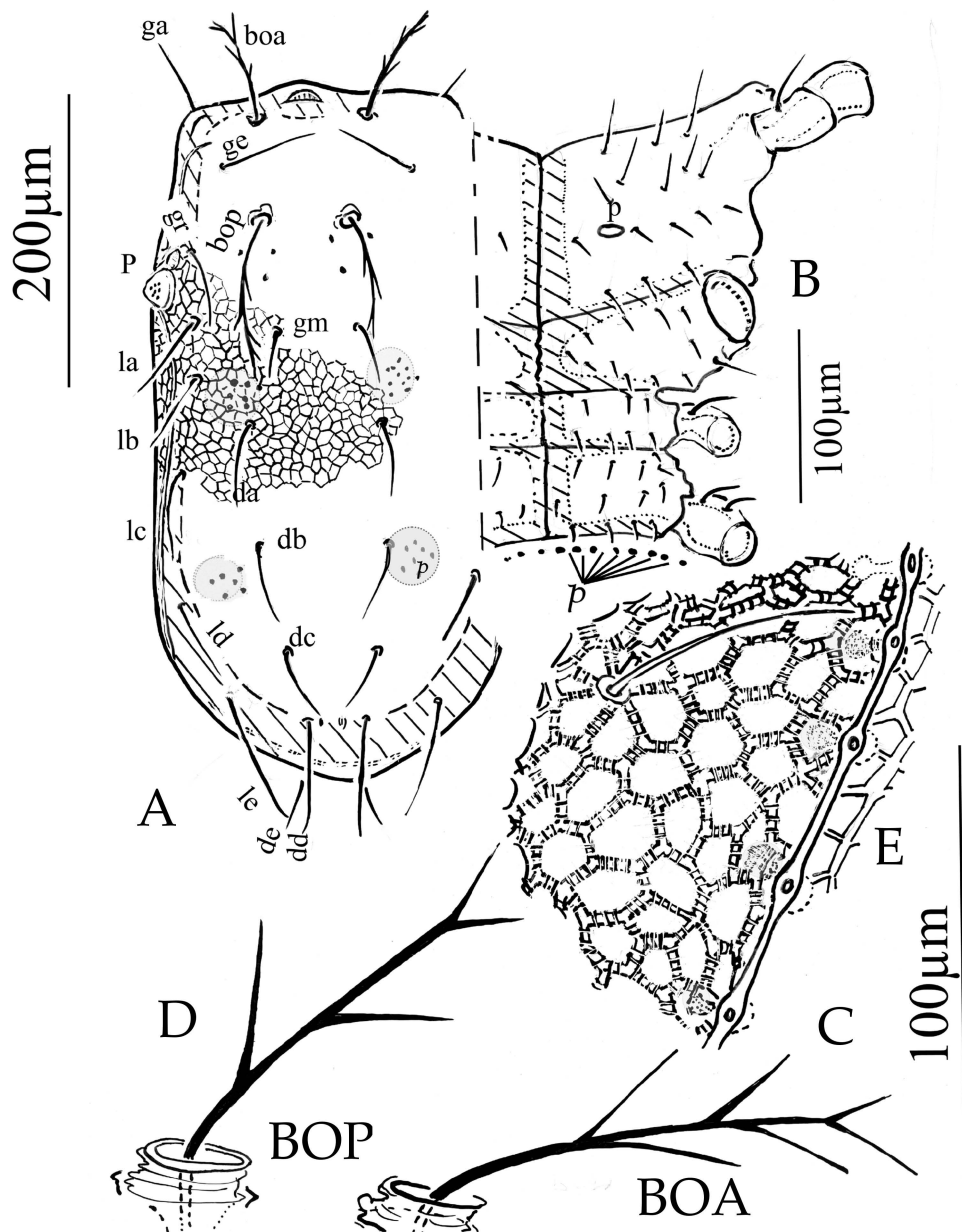


FIGURE 1: *Labidostoma (Labidostoma) intermedia* n. sp., female: A – dorsal shield; B – epimera (*p*: epimeral and post epimeral pores; C-D – dorsal trichobotria; E – detail of dorso-lateral line of pores.

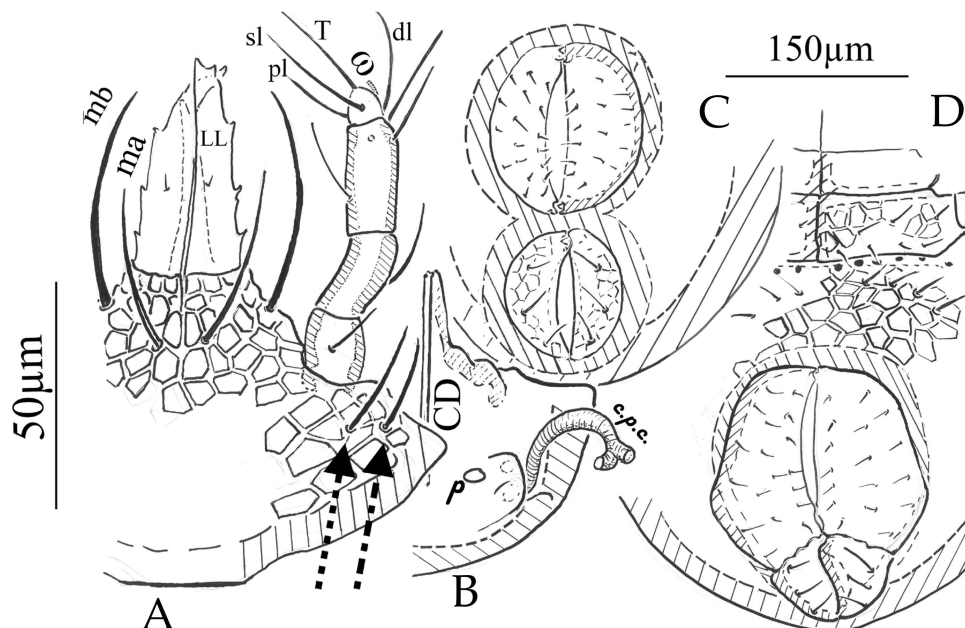


FIGURE 2: *Labidostoma (Labidostoma) intermedia* n. sp.: A – infracapitulum and palp ventral view; B – infracapitulum dorsal view, detail (c.p.c.: podocephalic canal, P: pore, CD: dorsal rail ("carène dorsal" in Grandjean 1942); C-D – anogenital region of male (C) and female (D).

Specimens in MB collection collected between Montpellier and Banyuls-sur-Mer.

2. **Asian specimens:** two specimens from Kazakhstan provided by Prof. André Yabretsov (Kiev) 1991 (MB collection).

RESULTS

Labidostoma (Labidostoma) intermedia n. sp.

Types: Holotype ♀, MNHN-Ac1152, Iran, Golestan Province, Gorgan (36°50'N, 54°30'E), Berlese extraction of soil, 1.03.2011. Allotype ♂, MNHN-Ac1153, Iran, Golestan Province, Gorgan (36°50'N, 54°30'E), Berlese extraction of soil. A reference collection is kept at the Zoology Museum of Tehran University (three females).

Female — Dorsal shield 570 – 670 µm long, 260 – 302 wide. Male similar.

Dorsal shield — (Figures 1A, 1C, 1D and 1E) Body elongated, covered by a reticular pattern even

in the central zone. As in many species the polygons become less regular and less distinct and increasingly granulate dorsally as well as in the posterior part. Two pairs of long trichobothria; *bop* longest. Aspidosomal setae: *ge* > *ga* = *gr* < *gm*, all simple. Usual paired dorsal and lateral setae, all simple, posterior setae (*dd*, *de*, and *le*) longest. Dorsal pores visible around *bop* and grouped in area posteriad to setae *gm* and latero-posterior to *db*. Anterior eye present, 23 µm in diameter, in subterminal position. One pair of large lateral pustules (diameter 34 µm) each close to the small lateral eyes. Lateral lyriform organ present, extending over three to five cuticular cells. The pustule cuts the lateral line of pores that are connected by a sclerotized "ridge" (figures 3A and 3B). The posterior part of this ridge (*arête* of Grandjean, *op. cit.*) follows the margin on the dorsal shield backward and continues from the right pustule to the symmetric pustule. From the oculo-pustular zone, the anterior branches are inclined toward the axis of the body and are long enough to

reach the aspidosomal setae *ge*. In some individuals the anterior ridge ends below the lateral ocular lenses, the posterior branch ends at the level of the pustule and sometimes tends to curve below this organ (figure 3B).

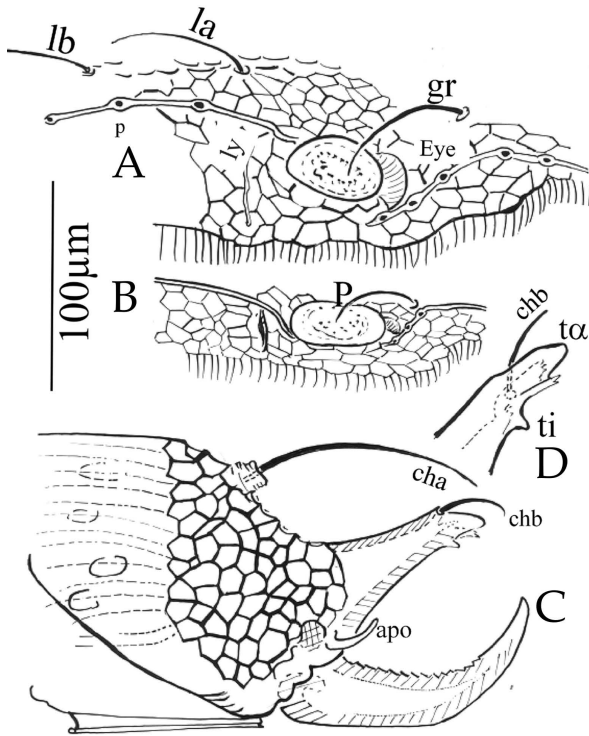


FIGURE 3: *Labidostoma (Labidostoma) intermedia* n. sp.: A-B – oculo-pustular zone; C-D – chelicera, lateral view and detail of terminal teeth of fixed digit (ventral view).

Ventral shield — (figure 1B) Entirely covered by ornamentation. Epimeral setae short ((18-24)-(14)-(9)-(12)). Usual coxal pore on epimera I. Fourteen pores on cuticle behind the fourth epimeral plate and a transverse line of eight setae (the number of pores differs between *integrum* and *caucasicum* with 10 and 12 pores respectively). Anogenital ring surrounding anal and genital shields in the female, distinct genital and anal rings in the male (figures 2C and 2D).

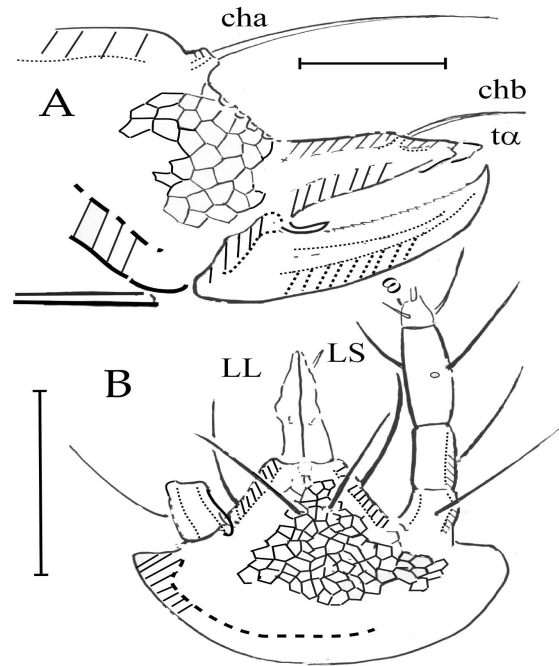


FIGURE 4: *Labidostoma integrum* from Kazakhstan: A – Chelicera antiaxial view; B – infracapitulum, ventral view.

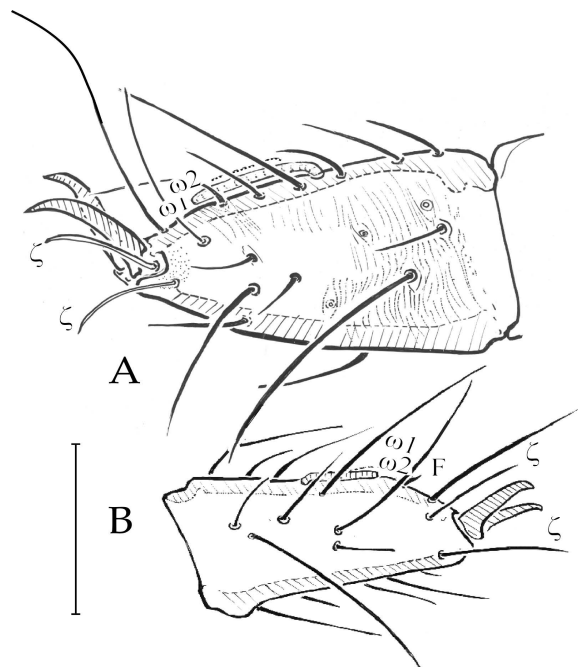


FIGURE 5: *Labidostoma intermedia* n. sp.: A – Tarsus I, external; B – paraxial view.

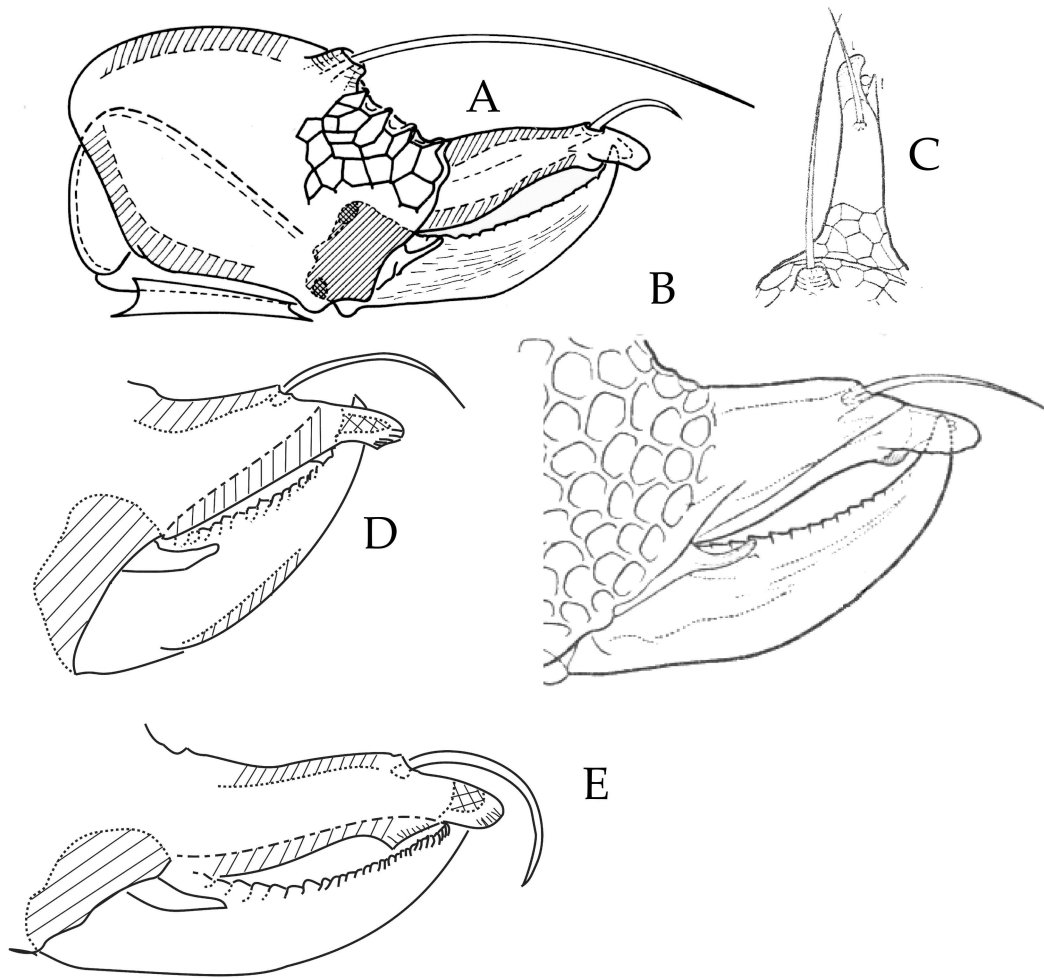


FIGURE 6: Compared cheliceral morphology in the *integrum*-species group: A – *Labidostoma integrum* (Aude, France, Bertrand coll.); B-C – *Labidostoma integrum* from Grandjean 1942 Modified (possible Algerian specimen); D-E – *Labidostoma integrum* (Romania) and *Labidostoma caucasicum* (Romania) (from Feider and Vasiliu, 1970, redrawn).

Infracapitulum — The labrum (dorsal lip) is shorter than the lateral lips, which are rather large, each with a minute seta. Setae *ma* and *mb*, plus two additional setae near insertion of the palp. Palps with usual chaetotaxy, dorsal solenidion. The presence of additional setae was noted on Grandjean's drawings for *integrum*; Feider and Vasiliu recorded two setae in Romanian specimens of *L. integrum*, whereas they have drawn three setae in *caucasicum*.

Such additional setae are absent on Kazakhstani specimens of *integrum* (fig. 5B).

Chelicerae — (figures 3C and 3D) The chelicerae differ essentially from those of the other species of the group by the shape of the paraxial tooth, which is less developed and not smooth. It differs clearly from the French (figure 6A), Algerian (figures 6B and 6C), Romanian (figure 6E) and Kazakhstani (figure 5A) specimens of *L. integrum* and

from *L. caucasicum* (figure 6D) by the teeth and denticles of the mobile digit. Note that the chelicerae of French specimens of *L. integrum* show an inferior tooth very similar to the drawings of Feider and Vasiliu (1970), but differ from the *integrum*'s chelicerae drawn by Grandjean (Figures 6A-6D). It may be supposed that Grandjean chose North African specimens because they were of a bigger size than French ones (Grandjean, 1942b).

Legs — Among the species-group, the first pair of legs is remarkable for its lengthened tibia, genu and mesofemur. *L. intermedia* n. sp. exhibits a relatively short genu, subequal in length to the mesofemur, the tibia being the longest article (ratio genual/tibia = 0.7 vs. 0.8 in *L. integrum*) (Table 2). Simple setae on leg I. Tarsi of PII, PIII and PIV with subterminal ventral setae plumose (= "scobales" sensu Feider and Vasiliu), other setae simple. Tarsus I with usual solenidia $\omega 1$ and $\omega 2$, and spine-like famulus, tarsal eupathidia present.

DISCUSSION

Validation of the new species. *Labidostoma* (*Labidostoma*) *intermedia* n. sp. is a new species because of four main differences, from previously described species, in terms of chelicerar morphology, the length of leg I articles, the number of post epimeral pores and the characters of the infracapitulum. Nevertheless, there is no doubt that the three species *L. (L.) integrum*, *L. (L.) caucasicum* and *L. (L.)*

intermedia are closely related: they are the only three sharing the same features in the latero-dorsal line of pores. The distribution of this subgenus is, as far we know, limited, confined to subtropical and Eurasian areas.

The future of the subgenus *Labidostoma* and the "integrum group of species". To consider the above three species as composing a species-group appeared justified. The individualized lateral line of pores makes this item of three species clearly recognizable. The congeneric species are consequently clearly excluded from this group of species: we cannot include, because of insufficient information, some species that were never examined on a lateral view (e.g. the African *Labidostoma schoutedeni* Cooreman, 1955 and *L. hoegei* Thor, 1931) nor, because they are not conform, some more recently described ones (e.g. Austral African species described by Bertrand and Theron, 1990).

Following a case-by-case careful approach, we hereby suggest that the integrum species group be recognized as including *L. (L.) integrum*, *L. (L.) intermedia* and *L. (L.) caucasicum* within *Labidostoma* (*Labidostoma*). The appropriateness of considering a higher-level must be kept in mind, if necessary.

The distribution of the three species *L. intermedia*, *L. integrum* and *L. caucasicum*: Notwithstanding gaps in our current knowledge, the information available allows us to outline the main distribution patterns: this group of species exists from the Atlantic

TABLE 2: *L. intermedia* n. sp. Length of leg articles (4 individuals) and contribution of tibia, genu and mesofemur to the total length of PI (2nd column).

	PI		PII	PIII	PIV
	% PI				
Tarsus	70		100	98	110
Tibia	145	31%	70	64	112
Genua	106	22%	45	36	52
Telofemur	41		87	65	91
Mesofemur	103	22%	35	24	44
Total	465	75%	337	287	409

shores to Asia. *L. integrum* is widely distributed (from North Africa, Mediterranean to Asian countries), *L. caucasicum* is limited between Caucasus and Eastern Mediterranean ridges, and the new species is Iranian (as far as we know). An analogous West to East distribution of related species is not exceptional and has already been observed. Among Labidostomatids, two examples are known: the "sister" species of *L. cornutum* (Canestrini & Fanzago, 1877): *L. carpathica* Storkan, 1939 (see Bloszyk, 1980), and *L. corsicum* Bertrand, 1982; and the similar pattern of distribution observed among the three European species of *Eunicolina* that are distributed from East to West along the Mediterranean Basin in the sequence *E. nova* Sellnick, 1931, *E. tuberculata* Berlese, 1911 and *E. travei* Coineau, 1964. Among the Anystidae, Coineau (1969) showed that vicariants were present among the Mediterranean Caeculidae. Thus, the *integrum* group adheres to a biogeographical pattern that was recurrently noticed in other more or less closely related mite groups and is consistent with vicariant radiation. These few examples pledge for continued studies in biogeographic distribution of edaphic organisms (Valdecasas *et al.*, 2006), notably on the interest of the early differentiated taxa, and of the integrated analysis of their distribution, that attests the resistance of these lineages to the more recent changes in environmental conditions during Tertiary and Quaternary Eras.

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Key to genera and subgenera with notes on the Labidostomatidae

A1. Multiple pustules on the body, each being uniporous; body heavily sclerotized, the leg segments with polygons, a hollow posterior to coxae IV with villose ornamentation, chelicerae often with sub terminal tooth prolonged in a curved blade, collected from litter and upper layers of soils in Europe and North America Genus *Eunicolina* ^a. (1)

A2. Very large lateral pustules. From Southern Hemisphere (2)

A3. No lateral pustule. Usually, variations in the composite ornamentation of the dorsum, soft cuticle between alveolate and more sclerotized zones, Southern Hemisphere Genus *Sellnickiella* ^c. (3)

A4. Not as above, if multiple gland like organs exist, they are less developed, and are limited in mediolateral position on the dorsal shield close to the lateral lenses, and/or in posterolateral position Genus *Labidostoma* ^d. (4)

A5. Fusiform in shape, dense and heavily sclerotized cuticle, reticulation with thick walls, strong and stout chelicerae, with several denticulations (serrate) on the fixed digit, eyes reduced or lacking Genus *Akrostomma* ^e

1. Genus *Eunicolina* *E. porifera* (Greenberg, 1952) described from North America, and three European species: *E. tuberculata*, *E. travei* and *E. nova*. *Eunicolina nova* was assigned to the genus *Grandjeanellina* by Feider and Vasiliu (1968b) ^a

2. Genus *Labidostoma*, Kramer 1879 subgenus *Atyeonella* ^b

3. Southern Hemisphere, with characteristic bifid famulus (tarsi I), with unequal branches subgenus *Sellnickiella* ^f
— Southern Hemisphere, simple famulus subgenus *Dicastrilla* ^g

4. Famulus: central branch ("fruit") rounded or elongated, surrounded by 5-6 branches, or fruit of varied shape (7)
— Famulus regressive, often hidden by dorsal setae, spine-like (5)

5. Anterior eye in subterminal position, body fusiform and elongated, absence of anterolateral projection on the dorsal shield (*cornua*) Subgenus *Labidostoma*^g (6)
— Anterior eye in terminal position, and distinctly forward the insertion of setae (*ga*) and (*boa*), famulus smooth distally (baculiform), strong fixed digit of the chelicerae subgenus *Pselistoma*

6. Lateral line of pores of dorsal shields tied with differentiated cuticle drawing a relief surrounding the dorsal shield, interrupted forward and laterally in the ocular zone .. *integrum* group of species^h. (8)
— Not as above *L. (L.)* spp.ⁱ

7. One pustule on each side of dorsal shield, rather large and generally multiporous; famulus with fruit irregular in shape, spine-like; frontal eye not in a terminal position, sometimes lacking (*glymma*). Legs: tibia and genu may be ornamented with alveoli similar to those of the dorsum or reticulate. Tibiae I and genua I long, of equal length, sometimes with reticulate ornamentation (*L. multisetosa* Shiba; 1969). Anterolateral projections more or less developed (*cornua*). Large body , chelicerae with proximal seta inserted at the top of a long tube, inferior tooth of fixed digit prolonged in a recurrent blade Subgenus *Cornutella* (syn. *Mahunkiella*)^j
— More or less regular shape of the fruit of famulus, rather rounded; one pair of multiporous gland-like organs, sometimes additional pustules (then uniporous) behind the lateral ones or even in the lateroposterior position; if the frontal eye exists, in terminal position above the chelicerae; genua of PI shorter than tibiae I; chelicerae with proximal seta inserted on a short tubercle subgenus *Nicoletiella*^k

The *integrum* group

8. Thin paraxial tooth, ending irregularly; not a curved blade but a small inferior tooth, (*ti*) *L. (L.) intermedia* n. sp.
— Not as above (9)

9. (*ti*) transformed in a well defined blade, ventral shield with a line of 12 pores behind the fourth pair

of coxae *L. (L.) caucasicum*
— (*ti*) not modified as much. Ventral shield with a row of 10 pores placed in one line posterior to the fourth pair of coxae *L. (L.) integrum*

Notes:

Notes on the genera and type species:

a – *Eunicolina tuberculata* Berlese 1911; distributed in the Northern Hemisphere, Mediterranean Basin and North America. *Grandjeanellina nova* (Sellnick, 1931): the genus *Grandjeanellina* was created by Feider and Vasiliu (1969) for this species, on the basis of the neochaetotaxy. However this hypertrichosis is not so exceptional and can affect the chaetotaxy in several species of *Labidostoma*. Until now the genus *Eunicolina* was only found in the North Hemisphere, Europe and North America (Greenberg, 1952).

b – *Atyeonella fictiluteum* (Atyeo & Crossley, 1961); Feider and Vasiliu erected *Atyeonella* to the generic level. Present in South Hemisphere: Australia, and South America (Bertrand 1990).

c – *Sellnickiella brasiliense* (Sellnick, 1922); *Sellnickiella* and *Dicastricella* lost the paired pustules; they are confined to the Southern Hemisphere; Southern America, Southern Africa, Australia, New Zealand.

d – *Labidostoma* Kramer, 1879; type species = *L. (L.) integrum* Berlese 1911. *L. luteum* is the most common species in Western Europe. Cosmopolitan genus. The genus is the most heterogeneous within the family.

e – *Akrostomma* Robaux, 1977; *Akrostomma grandjeani* Robaux, 1977; three described species (*grandjeani* Robaux, 1977, *coralloides* Bertrand and Coineau, 1978 and *coineaui* Bertrand, 1983; and the Italian *A. zangheri* (Lombardini, 1943) was probably never collected again afterwards. Remarkable primitive famulus.

Subgenera:

f – *Sellnickiella (Dicastricella) fusiformis* Bertrand, 1990. The two subgenera *Sellnickiella* and *Dicastricella* are gathered in the "Gondwanan" genus *Sellnickiella*.

If the subgenus *Sellnickiella* is distributed in different continents, the subgenus *Dicastricola* was only found in the western part of South America (Chile). The main difference is the famulus, bifid or not.

g – The subgenus *Labidostoma* (type *L. integrum* Berlese 1911) was created to separate the species with or lacking anterolateral projections of the dorsal shield. Experience showed that the *cornua* are more or less developed and that this character cannot alone be the main cause of the systematic division. However, the absence of *cornua* is often correlated (species similar to *integrum*) with a simple spine like famulus. The Holarctic species of the genus *Labidostoma* can be divided in species a) with simple famulus, simple *k*" seta on tibia I, lacking *cornua*, with a prolonged dorsal shield and a sub terminal frontal eye (= subgenus *Labidostoma*) and b) species with primitive complex famulus with fruit more or less modified and several branches, with the frontal eye in a terminal position, a forked seta *k*" on tibia I (= ssg. *Nicoletiella*) or: c), the frontal eye in a sub terminal position with irregular fruit of the famulus, tubercle proximal cheliceral seta long (= ssg. *Cornutella*).

h – A lineage clearly distinct in terms of morphology, the distribution of which must be further studied around the Mediterranean zone and western Asian countries.

i – Subgenus *Labidostoma*: assembly of species from the different continents.

j – *Labidostoma* (*Cornutella*.) *cornutum* (Canestrini et Fanzago, 1871). The subgenus *Cornutella* was used by Feider and Vasiliu (1969), then the subgenus *Mahunkiella* was erected for two oriental species. The chelicerae, the long genua of PI are similar among *L. cornutum*, *L. multisetosa* and *L. coreana*. Reticular pattern on legs in *multisetosa*.

k – *Labidostoma* (N.) *luteum* Kramer, 1879. Some species with additional gland like organ were identified (*L. jacquemarti* Coineau, 1964, *L. repetitor* Grandjean, 1942, *L. vialeae* Bertrand, 1982. Based on morphology, they are closer to *L. luteum* than to *L. denticulata*.

REFERENCES

- Alberti G., Storch V. 1977 — Zur Ultrastruktur der Coxaldrüsen actinotricher Milben (Acari, Actinotrichida) — Zool. Jahrb., Anatomie, 98: 394-425.
- Atyeo W. T., Crossley D. A. 1961 — The Labidostomidae of New Zealand (Acarina) — Rec. Dom. Mus., 4(4): 29-48.
- Błoszyk J. 1980 — Study on the family Nicoletiellidae (Acari, Prostigmata) — Prace kom. biol. Poznań, 54: 53-85.
- Błoszyk J., Konwerski S., Napierala A., Goldyn B., Gawronska K. 2007 — Spatial distribution and habitat preferences of *Labidostoma denticulata* (Acari: Prostigmata) in the Gorce National Park (southern Poland) — Biological Letters, 44(2): 115-125.
- Berlese A. 1911 — Acarorum species novae quindecim — Redia, 7: 429-435.
- Bernini F., Carnevale G., Bagnoli G., Stouge S. 2002 — An Early Ordovician oribatid mite (Acari: Oribatida) from the island of Öland, Sweden. — In Acarid Phylogeny and Evolution. Adaptations in mites and ticks (eds. F. Bernini *et al.*), pp. 45-47. Kluwer Academic Publishers, Dordrecht, The Netherlands.
- Bertrand M. 1982 — Contribution à l'étude des appendices des Labidostomidae (Acari, Prostigmata) — Acarologia, 23(3): 233-237.
- Bertrand M. 1988 — Les Labidostomidae Oudemans 1904 (Acariens, Actinedida) Morphologie, Biologie, Ecologie, Biogéographie — Thèse d'Etat, Université des Sciences et Techniques du Languedoc, Montpellier, Fra.: pp. 344
- Bertrand M. 1990a — La famille des Labidostomidae Oudemans, 1904 (Acari: Actinedida). Révision des genres et sous-genres et catalogue des espèces décrites — Acarologia, 31(1): 31-38.
- Bertrand M. 1990b — La durée de développement un facteur limitant de l'extension de l'aire de répartition : le cas de trois espèces européennes de Labidostomidae — In H. M. André and J.-Cl. Lions (eds.). L'ontogenèse et le Concept de Stase chez les Arthropodes / Ontogeny and Concept of Stase in Arthropods. AGAR Publishers, Wavre, Belgium: 123-128.
- Bertrand M. 1990c — Nouvelles espèces de Labidostomidae d'Amérique australe — Acarologia, 31(2): 177-185.
- Bertrand M. 1997 — *Sellnickiella* (*S.*) *biunguiculata* n. sp., a noteworthy species of Labidostomidae from Australia (Acari: Actinedida: Labidostomina) — Rec. West. Aust. Mus., Perth, 18: 323-328.
- Bertrand M., Corpuz Raros L.A. 1997 — Diversité du genre *Labidostoma* Kramer: nouvelles données apportées par l'étude de *Labidostoma* (*Labidostoma*)

- guadalupense* n. sp. des Philippines (Acari, Actiniedida, Labidostomatidae) — *Acarologia*, 38(4): 361-368.
- Bertrand M., Theron P. D. 1990 — Nouveaux Labidostomidae d'Afrique australe: le genre *Labidostoma* Kramer 1879 — *Acarologia*, 31(3): 247-257.
- Bertrand, M., Theron, P.D. 1992 — Nouveaux Labidostomidae d'Afrique australe: le genre *Sellnickiella* Feider et Vasiliu, 1969 — *Acarologia*, 33: 45-52.
- Boyer S. L., Clouse R. M., Benavides L. R., Sharma P., Schwendinger P. J., Karunaratna I., Giribet G. 2007 — Biogeography of the world: a case study from cyphophthalmid Opiliones, a globally distributed group of arachnids — *J. Biogeogr.*, 34(12): 2070-2085. doi:10.1111/j.1365-2699.2007.01755.x
- Brundin L. 1972 — Phylogenetics and Biogeography — *Systematic Zoology*, 21: 69-79. doi:10.2307/2412259
- Buitendijk A. M. 1952 — Voorloopige Catalogus van de Acari in de collectie-Oudemans — *Zool. Med.*, 24: 281-290.
- Coineau Y. 1969 — Contribution to the study of Caeculidae. Part 6 : *Microcaeculus sabulicola* redescription, chetotaxy and distribution — *Acarologia*, 9 (2): 207-221
- Cooreman J. 1955 — Exploration du Parc National Albert (Congo). 85 — Acari: 43-46.
- Dabert M., Witalinski W., Kazmierski K., Olszanowski Z., Dabert J. 2010 — Molecular phylogeny of acariform mites (Acari, Arachnida): Strong conflict between phylogenetic signal and long-branch attraction artifacts. — *Mol. Phylogenet. Evol.*, 56: 222-241. doi:10.1016/j.ympev.2009.12.020
- Dunlop J., Bertrand M. 2011 — Fossil Labidostomatid mites (Prostigmata, Labidostomatidae) from Baltic amber — *Acarologia*, 51(2): 191-193. doi:10.1051/acarologia/20112006
- Evans G. O. 1992 — Principles of Acarology. Cabi Publ. Cambridge, pp. 584
- Feider Z., Vasiliu N. 1968a — *Labidostoma nepalense* (Nicoletiellidae) une nouvelle espèce asiatique — *Acarologia*, 10(4): 630-644.
- Feider Z., Vasiliu N. 1968b — Un nouveau genre de la famille Nicoletiellidae Canestrini 1891 et description de l'espèce *Grandjeanellina nova* (Sellnick) 1931. *T. Mus. Hist. Natur. G. Antipa*, 3: 641-662.
- Feider Z., Vasiliu N. 1969 — Révision critique de la famille Nicoletiellidae — *Proceedings 2nd International Congress of Acarology 1967*, Akad. Kiado, Budapest, Hung., 201-207.
- Feider Z., Vasiliu N. 1970 — Espèces de Nicoletiellidae (Acariformes) de Roumanie — *Académie de la République socialiste de Roumanie. Livre du Centenaire Emile G. Racovitza 1868-1968*. 371-391.
- Feider Z., Vasiliu N. 1972 — Zoological collecting by the Hungarian natural history Museum in Korea. 6. Quelques Nicoletiellidae de Corée du Nord (Acari) — *Annal. Hist. Natur. Mus. Nat., Hungary* 64: 375-385.
- Gervais P. 1844 — In *Walckenaer: Histoire naturelle des Insectes. Aptères*, vol. 3, pp. 377-456.
- Grandjean F. 1941 — Observations sur les Acariens (6^e série). *Bull. Mus. Paris*, 2^e série, 13(6): 532-539.
- Grandjean F. 1942a — Observations sur les Labidostomidae. 2^e Série — *Bull. Mus., Paris*, 2^e série, 14(2): 118-125.
- Grandjean F. 1942b — Observations sur les Labidostomidae. 3^e Série — *Bull. Mus., Paris*, 2^e Série, 14(3): 185-192.
- Greenberg B. 1952 — New Labidostommidae with keys to the New World species (Acarina). — *J. New York Entomol. Soc.*, 60(4): 195-209.
- Iavorschi V. 1992 — *Labidostoma motasi* n.sp. (Nicoletiellidae) a new species of mite of Romania — *Travaux Inst. Spéol. "Emile Racovitza"*, Bucharest, 31: 47-51.
- Kramer P. 1879 — Neue Acariden — *Archiv Natur.*, 45, 1 Tafel I und II: 13-16.
- Krantz G. W., Walter D.E. Eds. 2009 — A Manual of Acarology, 3rd ed. Lubbock: Texas Technology University Press. pp. 807
- Lehtinen P. T., Niemi R. 1995 — The parthenogenetic mite *Labidostoma luteum* (Acarina: Actinotrichida: Labidostommidae) in Finland — *Entomol. Fennica* 6: 211-227.
- Mortimer E., Janssen B., Lee J.E. Marshall D.J., Convey P., Chown S.L. 2011 — Mite dispersal among the Southern Ocean Islands and Antarctica before the last glacial maximum — *Proc. Royal Soc., B.*: 1247-1255. doi:10.1098/rspb.2010.1779
- Müeller G. 2003 — Male genital system and spermiogenesis of *Nanorchestes amphibiis* (Acari: Endeostigmata: Nanorchestidae): anatomy, histology, and evolutionary implications — *J. Morphol.*, 257: 171-180. doi:10.1002/jmor.10117
- Oudemans A. C. 1906 — Das Tracheensystem der Labidostomidae und eine neue Klassifikation der Acari — *Zool. Anz.*, 29: 633-637.
- Pfliegler W., Bertrand M. 2011 — A new species of *Labidostomma* for the fauna of Hungary (Acari: Trombidiformes: Labidostomatidae) with an overview of the family — *Opusc. Zool., Budapest*, 42(2): 177-183
- Reck G. F. 1940 — Eine neue *Labidostoma* Art — *Mitt. Georg., Abt. Wissensch., Zoologie. URSS* 1(6): 435-446.
- Shiba A. 2004 — Species composition and distribution of labidostomid mites found in Japan (Proceeding of 12th Annual Meeting of the Acarological Society of Japan) [in Japanese] — *J. Acarol. Soc. Japan*, 13(1) 2004: pp. 98.

- Thor S. 1931 — Eine neue *Labidostoma* Art aus moos von Sudafrika. Zool. Anz., 93(1-2) 57-58.
- Valdecasas A. G., Camacho A. I., Peláez M. L. 2006 — Do small animals have a biogeography? — Exp. Appl. Acarol., 40(2): 133-144. doi:10.1007/s10493-006-9030-5
- Vistorin H. E. 1978 — Zur Verbreitung europäischer Nicoletielliden-Arten (Acari, Trombidiformes). Mitt. Naturwiss. Ver. Steiermark, Bd 108: 271-280.
- Walter D. E., Lindquist E. E., Smith I.M., Cook D. R., Krantz G. W. 2009 — Order Trombidiformes — In: Krantz G. W., Walter D. E. (Eds) A Manual of Acarology, 3rd ed., Texas Tech University Press. p. 233-420.
- Zhang Z-Q, Fan Q-H, Pesic V, Smit H, Bochkov A.V, Khaustov A-A, Baker A, Wohltmann A, Wen T., Am-

rine J.W, Beron P., LIN J., Gabrys G., Husband R. 2011 — Order Trombidiformes Reuter, 1909. In: Zhang, Z.-Q. (Ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. Zootaxa, 3148: 129-138.

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