

New Astigmatic Mites from the Coastal Area of Bermuda Islands¹⁾ (Acari: Hyadesiidae, Saproglyphidae, Acaridae)

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(With 38 figures)

Abstract

The present paper deals with a collection of Astigmatic mites collected by R. S. on the coastal area of Bermuda in 1977 and 1981. Four species are registered, of which three are new and are described. They belong to three families and three genera: *Amhyadesia bermudana* n. sp. and *A. atlantica* n. sp. (Hyadesiidae); *Neocalvolia inermis* n. sp. (Saproglyphidae); *Rhizoglyphus setosus* MANSON, 1972 (Acaridae). An ecological comparison of the four species, based on their zonation, is given.

Introduction

During research sojourns at the Bermuda Biological Station in 1977 and 1981 ecological investigations resulted in a rich air-breathing arthropod fauna in the littoral region of Bermuda Islands (Schuster 1983)²⁾. The collected material includes also Astigmatic mites which are presented in this paper.

Material and Methods

L o c a l i t i e s : The hyadesiids mentioned have been collected by R. S. in July/August 1977 and from July to September 1981 on the coast of various islands of the Bermuda archipelago (BE = registration number of littoral samples resp. sample-series): a) Main Island: SE-shore of Harrington Sound: BE-32 (27. 7. 1977), BE-33 (27. 7.), BE-34 (27. 7.), BE-49 (31. 7. 1977), BE-50 (31. 7.), BE-263 (13. 9. 1981); West Whale Bay: BE-211/16 (27. 8. 1981); Penhurst National Park: BE-243 (6. 9. 1981), BE-262 (13. 9. 1981); Horseshoe Bay: BE-244/46 (9. 9. 1981); Hungry Bay: BE-247/49 (9. 9. 1981); Crawl Hill: BE-264/65 (14. 9. 1981), BE-266/67 (14. 9.); Spanish Rock: BE-309 (26. 9. 1981); Walsingham Pond: BE-27/28 (25. 7. 1977); Howard Bay: BE-149/52 (29. 7. 1981). -- b) St. George's Island: Ferry Reach, Biological Station: BE-03 (12. 7. 1977), BE-235 (3. 9. 1981); Whalebone Bay: BE-22 (20. 7. 1977), BE-281b (18. 9. 1981);

1) Contribution number 915 from the Bermuda Biological Station for Research.

2) Supported by FONDS ZUR FÖRDERUNG DER WISSENSCHAFTLICHEN FORSCHUNG, Projekt 3364 (1977), and by STEIERMÄRKISCHEN WISSENSCHAFTS- und FORSCHUNGS-LANDESFONDS (1981)

Lovers Lake: BE-227/31 (31. 8. 1981). -- c) Somerset Island: Mangrove Bay: BE-221 (29. 8. 1981); Great Sound, Fort Scour Natural Park: BE-283/84 (19. 9. 1981). -- d) Ireland Island South: Pearson's Bay: BE-20 (19. 7. 1977), BE-21 (19. 7.); The Lagoon: BE-222 (29. 8. 1981). -- e) Burt Island, Great Sound: BE-57 (3. 8. 1977).

C o l l e c t i n g m e t h o d s : Samples of littoral substrata have been collected for extraction of the mites by Berlese-Tullgren-funnels. Manual collecting in the biotope was rare.

D e t e r m i n e d m a t e r i a l : The type specimens are mounted on microscopic slides (Hoyer-medium). They have been deposited in various collections (s. later).

Recorded Species

Family Hyadesiidae

Genus *Amhyadesia* FAIN & GANNING, 1979

The genus *Amhyadesia* FAIN & GANNING, 1979 is characterized in both sexes by the presence of a large punctate and sclerotized shield on the dorsal surface of the hysterosoma.

Until now two species have been described in this genus: *A. glynni* (MANSON, 1963) and *A. californica* FAIN & GANNING, 1979, both from the Pacific coast of U. S. A. We describe hereunder two new species in this genus from Bermuda, also in the Ne-arctic region.

1. *Amhyadesia bermudana* spec. nov.

F e m a l e (fig. 1, 2, 5-9): Holotype 405 μm long (idiosoma) and 270 μm maximum width. Measurements in 4 paratypes 372 x 245 μm ; 390 x 270 μm ; 430 x 295 μm ; 458 x 310 μm .
D o r s u m: Propodonal shield wider (90 μm) than long (15 μm in midline), with posterior border concave. Hysteronotum with a large median slightly punctate and not pitted shield; this shield reflects slightly ventrally. A system of oil-grooves is present on hysteronotum as in the other species of the genus. Orifice of bursa dorsal, situated 28 μm in front of posterior extremity. **V e n t e r :** Anus ventro-terminal. There are two pairs of unequal anal setae (12-15 μm and 30 to 50 μm long respectively) and 2 pairs of short genital setae. Genital suckers absent. Sternum free, 60 μm long. Epimeres III and IV fused to epimerite II which is long. Bursa long; spermatheca large with a basal sclerite shaped in an inverted T. **L e g s :** Tarsi I-IV 26 μm / 26 μm / 39 μm / 46 μm long respectively (apical spine and pretarsus not included). Claws I-II 12-13 μm long, their pretarsus 40 and 45 μm long. Claws III-IV 27 μm long, pretarsus 18 μm long. Gnathosoma 90 μm long, 66 μm wide (palps included). Grandjean's organ well developed, curved.

C h a e t o t a x y : Setae *vi* 105 μm ; *scx* about 60 μm ; *sci* thin, 45 μm ; *sce* thick, 140-160 μm ; *d1* very thin 20 μm ; *d2*

60 μm ; d_3 90 μm , slightly thickened basally; d_4 120 μm , similar to d_3 ; d_5 absent; l_1 21 μm ; l_2 15 μm ; l_3 27 μm ; l_4 42 μm ; l_5 ventral, 140-160 μm ; h 135 μm ; sh 21 μm ; a_1 16-18 μm ; a_3 40-50 μm . The a_2 is missing.

Leg chaetotaxy: Tarsi I-II with a strong apical spine, a small subapical spine and 6 simple setae. Tarsi III-IV with 3 subapical spines and 5 long simple setae. Tibiae I-II with a thick ventral spine; tibiae III-IV with a thin ventral spine. **Solenidiotaxy:** Tarsus I with ω_1 longer (42 μm) than ω_3 (28 μm).

Male (figs. 3, 4, 15-19): A paratype is 378 μm long and 230 μm wide. In two other paratypes 400 x 240 μm and 420 x 242 μm . Dorsum as in the female but the setae are slightly shorter. Seta scx 60 μm long, slightly barbed. **Venter:** Epimeres I and II fused behind. Anal setae as in female. Genital organ 48 μm wide, with 2 vestigial genital suckers on the anterior margin. **Legs:** Tarsi I-IV: 21 μm / 29 μm / 27 μm / 30 μm . Tarsus I very short and modified. Claws I-II 12 μm , claws III-IV 24 μm . Tarsi I, III and IV with a subapical ventral sucker; tarsus I without subapical spine; tarsi III-IV with only one subapical spine. **Chaetotaxy:** Setae vi 80 μm ; sce 135 μm ; sci 24 μm ; d_1 12-15 μm ; d_2 60 μm ; d_3 90-100 μm ; d_4 93 μm ; l_4 34 μm ; l_5 135 μm . Tibiae III and IV with a thin spine. **Solenidiotaxy:** Tarsi I-IV: 3 / 1 / 0 / 0. Tibiae I-IV: 1 / 1 / 1 / 1. Genu I with only one solenidion 33 μm long.

Tritonymph: Two tritonymphs measure (idiosoma) 315 x 216 μm and 321 x 220 μm . General characters as in the female but without vulve or spermatheca.

Protonymph: Idiosoma 240 x 170 μm . Differs from the tritonymph by the absence of coxal I-III setae, the presence of only one pair of ventral setae (for three pairs in tritonymph).

Larva: Idiosoma 225 x 155 μm . Similar to the protonymph but with 3 pairs of legs.

Remarks: *Amhyadesia bermudana* differs from *A. glynni* and *A. californica* by the non-pitted aspect of the hysterosomal shield and the presence of only two pairs of genital setae. Moreover it is distinguished from *A. glynni* by the relatively greater length of d_4 (subequal to d_3) and from *A. californica* by the non-spinous aspect of most of the dorsal setae.

Habitat: This new species has been found in many localities: Holotype and 3 paratypes females, 1 paratype male and 4 paratypes nymphs from Crawl Hill, Main Island, BE-264/65, 14. 9. 1981. -- Paratypes from other places: BE-03 37 females, 19 males, 16 tritonymphs, 2 protonymphs; BE-20 2 males and 1 nymph; BE-21 26 females, 7 males, 12 tritonymphs; BE-22 1 male; BE-27/28 1 tritonymph; BE-32 7 females, 1 male, 5 tritonymphs; BE-33 5 females and 1 larva; BE-34 24 females, 23 males, 10 trito-

nymphs, 8 protonymphs; BE-49 4 females, 2 males; BE-50 2 males; BE-57 25 females, 20 males, 33 tritonymphs, 4 protonymphs; BE-149/52 1 female; BE-211/216 1 female, 2 males, 1 tritonymph; BE-222 7 females and 1 male; BE-227/231 2 females, 1 male, 2 tritonymphs; BE-243 10 females, 7 males, 7 tritonymphs, 2 protonymphs, 1 larva; BE-244/46 2 females, 1 male; BE-247/249 2 females, 2 males and 1 tritonymph; BE-262 9 females, 18 males, 13 tritonymphs, 4 protonymphs; BE-263 2 females; BE-264/65 4 females, 2 males, 5 tritonymphs; BE-266/67 2 females, 4 males and 1 tritonymph; BE-284 6 females, 4 males, 1 tritonymph and 2 protonymphs.

D e p o s i t o f m a t e r i a l : Holotype (BE-264/65) and paratype male (BE-266/67) in: Zoologisches Institut und Museum der Universität Hamburg, Nr. A 7/83 and A 8/83; paratype male (BE-262) and paratype female (BE-264/65) in: Institute for Tropical Medicine "Prince Leopold", Anvers; paratype male (BE-266/67) and female (BE-243) in: British Museum, London, Nr. 1983. 4. 14. 2. and Nr. 1983. 4. 14. 3; paratype male (BE-34) in: Naturhistorisches Museum, Wien, Nr. 11781; rest in the collections of the authors.

2. *Amhyadesia atlantica* spec. nov.

This species is closely related to *A. bermudana*. It differs from the latter mainly by the following characters. In both sexes: absence of setae *a*₁; seta *a*₃ is thicker; seta *l*₅ is much thicker and situated at the end of the body, setae *l*₄ is longer and thicker, some dorsal setae are longer and thicker (*vi*, *sce*, *d*₂, *d*₃, *d*₄), claws I-IV are shorter, ventral setae of tibiae III-IV are thinner, tarsi III-IV shorter, constant presence of two solenidia on genu I. Propodonal shield relatively longer, with posterior border not concave. In the female the spermathecal sclerite is shorter and the copulatory papilla is situated more posteriorly, close to the posterior margin of the body.

F e m a l e (figs. 10-14, 20, 21): Holotype 396 µm long (idiosoma) and 243 µm maximum width. In three paratypes: 360 x 215 µm, 420 x 290 µm and 422 x 285 µm. Dorsum: Propodonal shield 33 µm long (in the midline) and 70 µm wide, with posterior margin irregularly convex. In a paratype 30 x 75 µm. Oil-grooves system as in *A. bermudana*. **V e n t e r :** Anus ventro-terminal. There is one pair (*a*₃) of anal setae, thick, very finely attenuated apically and 45 µm long, and two pairs of genital setae. Sternum and epimeres as in *A. bermudana*. Spermatheca with a short internal sclerite. Length of tarsi I-IV: 25 µm / 27 µm / 33 µm / 36 µm (apical spine and pretarsus not included). Claws I-II 9-10 µm. Claws III-IV 20-21 µm long. Gnathosoma 75 µm long, 62 µm wide at base. Grandjean's organ, long, curved inside; setae *scx* 65-75 µm long. **C h a e t o - t a x y :** Setae *vi* 135 µm; *sci* 80 µm relatively thick; *sce* thick 170 µm; *d*₁ thin 21-25 µm; *d*₂ 100-120 µm; *d*₃ thick 125 µm; *d*₄ thick 180 µm; *d*₅ absent; *l*₁ and *l*₂ thin 25-30 µm; *l*₃ 40 µm; *l*₄ 70 µm; *l*₅ terminal, with very thick base and 180 µm long; *h* 120 µm; *sh* 35 µm. Some of the long setae have a curved extremity but less constant than in *A. bermudana*. Leg chaetotaxy

as in *A. bermudana*. S o l e n i d i o t a x y : Tarsus I with ω_1 and ω_3 subequal (33 μm and 30 μm respectively). Genu 1 with two unequal solenidions.

M a l e : (fig. 22-27): A paratype is 345 μm long and 205 μm wide (idiosoma). D o r s u m : as in the female. V e n t e r : Epimeres I and II fused by thick sclerites. Anal and 15 setae as in female. Genital organ 38 μm wide. Tarsi I-IV: 22 μm / 25 μm / 19 μm / 18 μm . Suckers and spines on tarsi as in *A. bermudana*. Length of claws I-II 9 μm , of claws III-IV 18 μm . C h a e t o t a x y : Setae *vi* 105 μm ; *sce* 135 μm ; *sci* 30 μm ; *d3* 110 μm ; *d4* 150 μm ; 15 150 μm . The setae 15 have a swollen base and are terminal in situation. S o l e n i d i a of genu I: *sigma 1* is 5 μm long; *sigma 2* is 38 μm long.

T r i t o n y m p h : This tritonymph differs from that of *A. bermudana* by the absence of seta *a1*, the situation of setae 15 at the posterior border of the body and the smaller length of posterior claws (15 μm instead of 20-21 μm). Idiosoma 330 μm long and 240 μm wide.

P r o t o n y m p h and l a r v a : unknown.

H a b i t a t : The specimens were collected only from two islands. Holotype female, 2 paratypes females, 3 paratypes males, 1 paratype tritonymph from Penhurst Park, Main Island, BE-262, 13. 9. 1981. -- Paratypes from other places: BE-264/65 2 males, 2 females; BE-243 1 female; BE-20 2 females.

D e p o s i t of M a t e r i a l : Holotype (BE-262) and paratype male (BE-264/65) in Zoologisches Institut und Museum der Universität Hamburg, Nr. A 9/83 and A 10/83; paratype male and female (BE-264/65) in: Institute of Tropical Medicine "Prince Leopold", Anvers; paratype female (BE-264/65) in: Naturhistorisches Museum Wien, Nr. 11782; rest in the collections of the authors.

Family Saprogllyphidae

Genus *Neocalvolia* HUGHES, 1970

Neocalvolia inermis spec. nov.

F e m a l e (figs. 28-32): Holotype 270 μm long and 159 μm maximum width (idiosoma). Sejugal furrow well formed. In 5 paratypes 268 x 135 μm (ovigerous); 255 x 126 μm (ovigerous); 250 x 135 μm ; 245 x 130 μm (ovigerous); 225 x 120 μm .

D o r s u m : Cuticle poorly sclerotized, not striated. There is a poorly sclerotized propodonal shield. Eyes absent. V e n t e r : Sternum 26 μm . Epimeres II free. Epimeres III incompletely fused to each other by means of a transverse sclerite, fused in the midline with the small epigynium. Anus ventral. Copulatory pore terminal. Bursa very narrow, short. Tarsi I-IV: 31 μm / 30 μm / 33 μm / 40 μm . Pretarsi about 9 μm long, bearing a claw 7-8 μm long. Gnathosoma 45 μm long (palps in-

cluded) and 38 μm wide (at base). Cheliceral digits about 48 μm long. The two digits bear in their basal half two small unequal teeth.

Chaetotaxy: Setae *vi* 26 μm ; *sce* 75 μm ; *sci* 20 μm ; *d1* 22 μm ; *d2* 30 μm ; *d3* 42 μm ; *d4* 40 μm ; *d5* 50 μm ; *l1* 18 μm ; *l2* 26 μm ; *l3* 33 μm ; *l4* 24 μm ; *l5* 65 μm ; *h* 52 μm ; *sh* 21 μm . There are two pairs of anals, and three pairs of genitals. *Chaetotaxy* of legs (number of setae): Tarsi I and II with 9 setae: 3 apico-ventral and 1 apico-lateral short spines, and 5 thin and longer setae; tarsi III with 4 thin setae and 3 apical spines; tarsi IV with 3 thin setae and 3 spines. Tibiae 2 / 2 / 1 / 1. Genu 2 / 2 / 0 / 0. Femora 1 / 1 / 0 / 0. *Solenidia*: Tarsus I with 3 solenidia, tarsus II with one solenidion. Tibiae with 1 / 1 / 1 / 1 long solenidia. Genu 1 with 2 unequal solenidia.

Male (figs. 33-38): A paratype is 220 μm long (idiosoma) and 120 μm wide; in a paratype 210 x 117 μm . *Dorsum* as in the female. *Venter*: Epimeres I as in the female. Epimeres II arriving close to each other in the midline and united by means of a thin sclerotized line. Epimeres III-IV free. Genital organ complex in structure. Penis narrow, relatively long. Absence of adanal suckers. Chelicerae as in the female. Legs III and IV as in female; tarsi I and II with an apico-ventral copulatory sucker. *Chaetotaxy* as in female. Tarsi I-II with 5 thin setae and apparently 2 small apical spines. Tarsi III-IV as in female.

Immature stages: unknown.

Remark: This species is clearly distinct from the four other species known in the genus by the absence of eyes, the reduction of the teeth on the cheliceral digits and by the shape of the sexual organ in the male.

Habitat: Holotype and 11 paratypes female, 1 paratype male from Harrington Sound, Main Island, BE-263, 13. 9. 1981. -- Paratypes from other places: BE-211/16 9 females, 2 males; BE-221 2 males; BE-235 57 females, 15 males; BE-247/49 1 female; BE-262 5 females; BE-309 3 females.

Deposit of material: Holotype and paratype male (BE-263) in: Zoologisches Institut und Museum der Universität Hamburg, Nr. A 11/83 and A 12/83; paratype male (BE-221) and female (BE-263) in: Institute for Tropical Medicine "Prince Leopold", Anvers; paratype female (BE-263) in: British Museum, London, Nr. 1983. 4. 14. 4; paratype female (BE-263) in: Naturhistorisches Museum, Wien, Nr. 11783; rest in the collections of the authors.

Family Acaridae

Genus *Rhizoglyphus* CLAPARÈDE, 1869

Rhizoglyphus setosus MANSON, 1972

We attribute to this species two females, two males and one nymph found in locality BE-281b, St. George's Island.

Rh. setosus has been described from New Guinea. Our specimens agree fairly well with the paratypes of this species that we have examined.

D e p o s i t o f m a t e r i a l : All the specimens in the collections of the authors.

Ecology

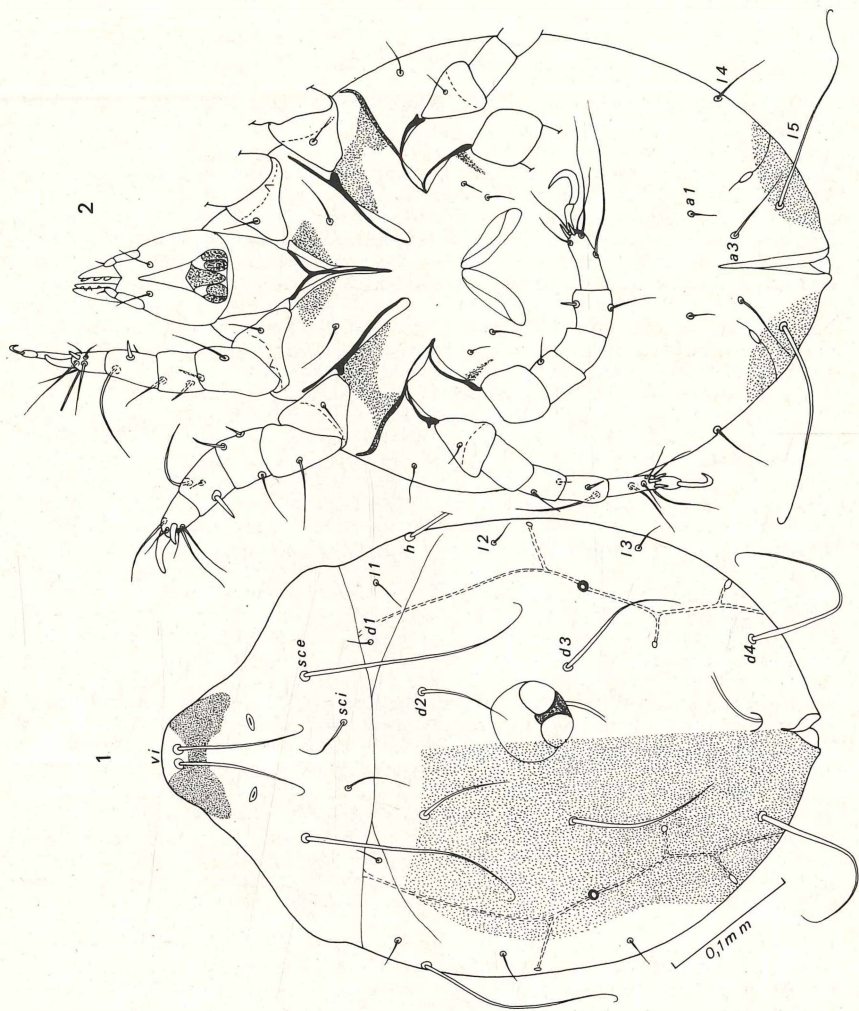
The following ecological remarks are the result of field studies in 1977 and 1981.

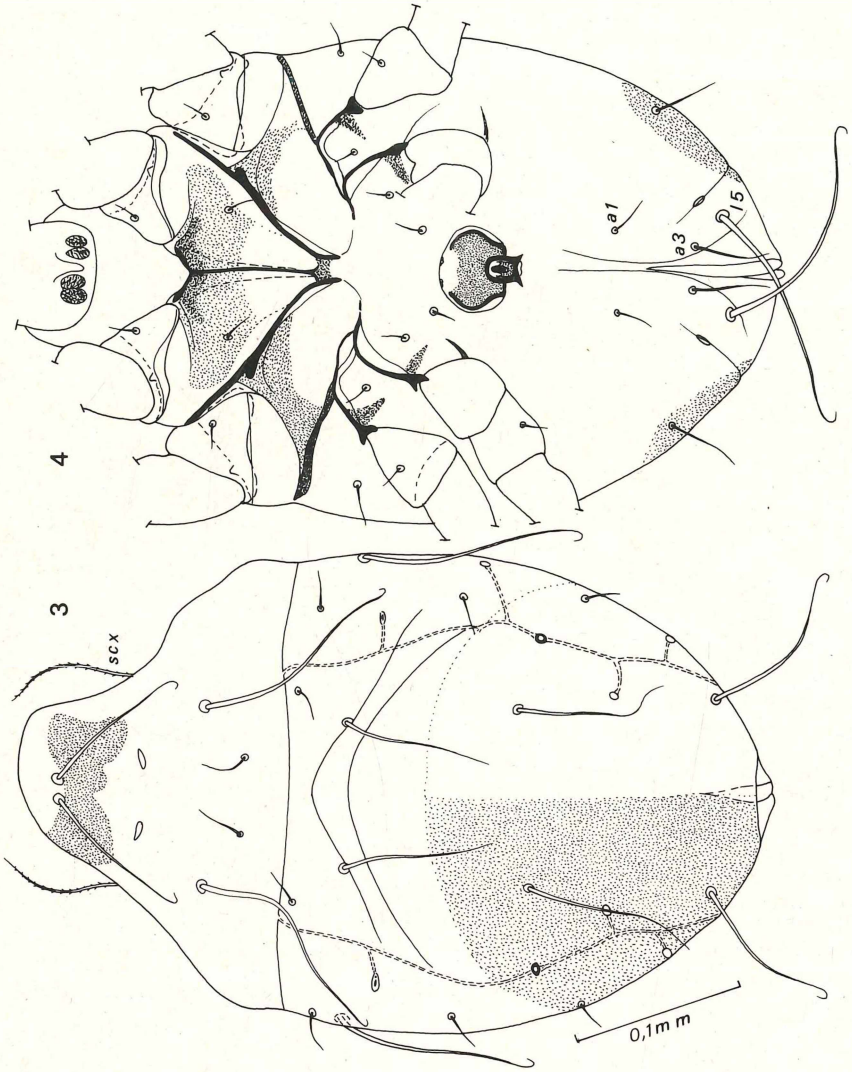
Amhyadesia bermudana: This species, widespread over the archipelago, lives in the intertidal area and in the lower part of the supralittoral zone of the rocky coast. It is to be found on the rock surface or in micro-fissures, but also on rocks which are covered by a dense upgrowth of algae or chthamalids. Another biotope which is colonized by *A. bermudana* is the mangrove (e. g. BE-227/31 or BE-247/49), where especially the algae on the air roots and on the base of the trunks of *Rhizophora mangle* and *Avicennia nitida* are the substratum preferred. A similar colonization is realized on the air roots of the "White Mangrove" ("Buttonwood"), *Conocarpus erecta*.

Amhyadesia atlantica: It is not a common species. The distribution over the archipelago is distinctly more restricted than in *A. bermudana*, until now there exist records only from two Bermudian islands and only from a few localities (rocks, not mangrove). It is an interesting fact, that each of these places is also inhabited by *A. bermudana*. *Amhyadesia atlantica* as well as *A. bermudana* are living in the intertidal and in the lower supralittoral region but the second species always in a much higher density. At the moment the results of the field studies do not allow to decide whether any distinct difference in the zonation between both species exists or not.

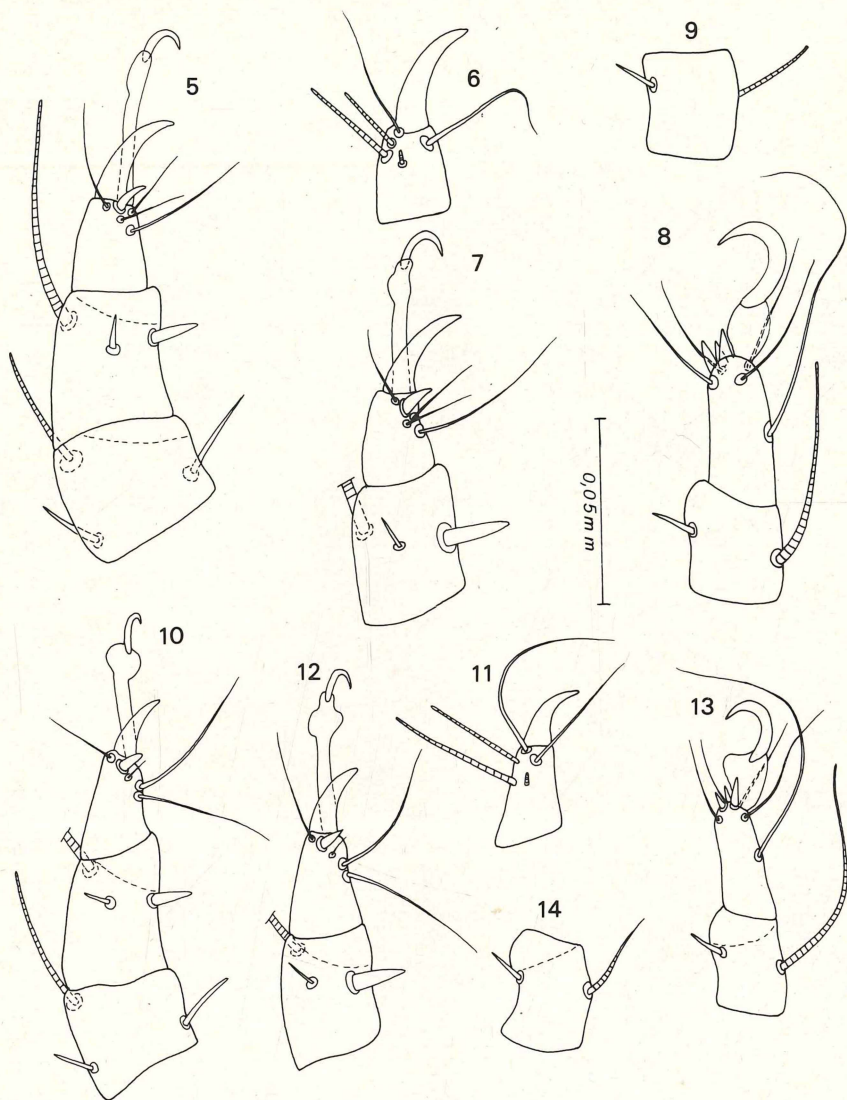
Neocalvolia inermis: The ecology of this species differs essentially from that of the two species of *Amhyadesia* mentioned before, which is shown by a comparison of the zonation: *Neocalvolia inermis* avoids the frequently overflowed intertidal area. It is restricted to the higher littoral region with a concentration in clusters of low, mosslike algae which are growing in crevices especially in the upper part of the supralittoral zone. This substratum is characterized by an occasional decrease of humidity. In this case the life conditions for *N. inermis* are quite different from that for hyadesiids.

Rhizoglyphus setosus: Until now only one record in Bermuda exists. Therefore it is not possible to classify the ecological demands of *Rh. setosus*. All the specimens were found in the upper supralittoral zone, just on the border to the full terrestrial area. The substratum was sand mixed with decomposing wrack of *Sargassum* between stones of different size; it was a relatively small place between littoral rocks.

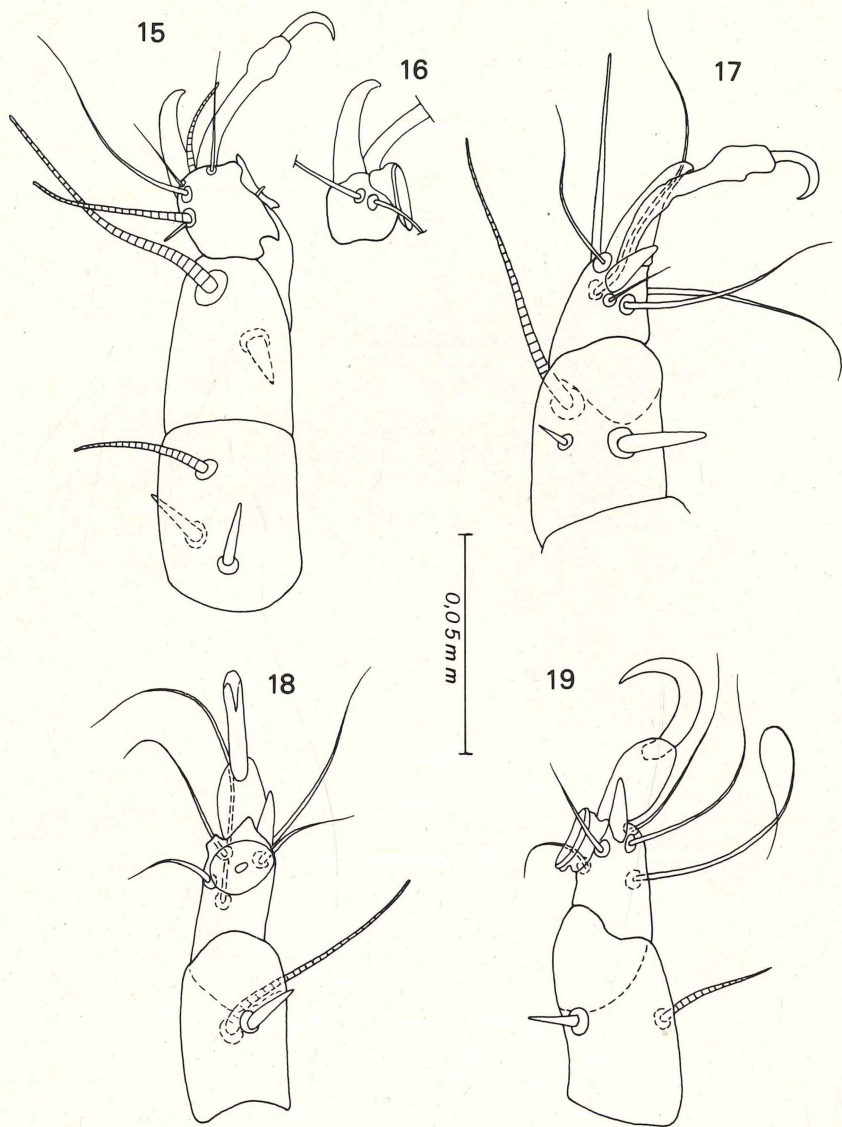




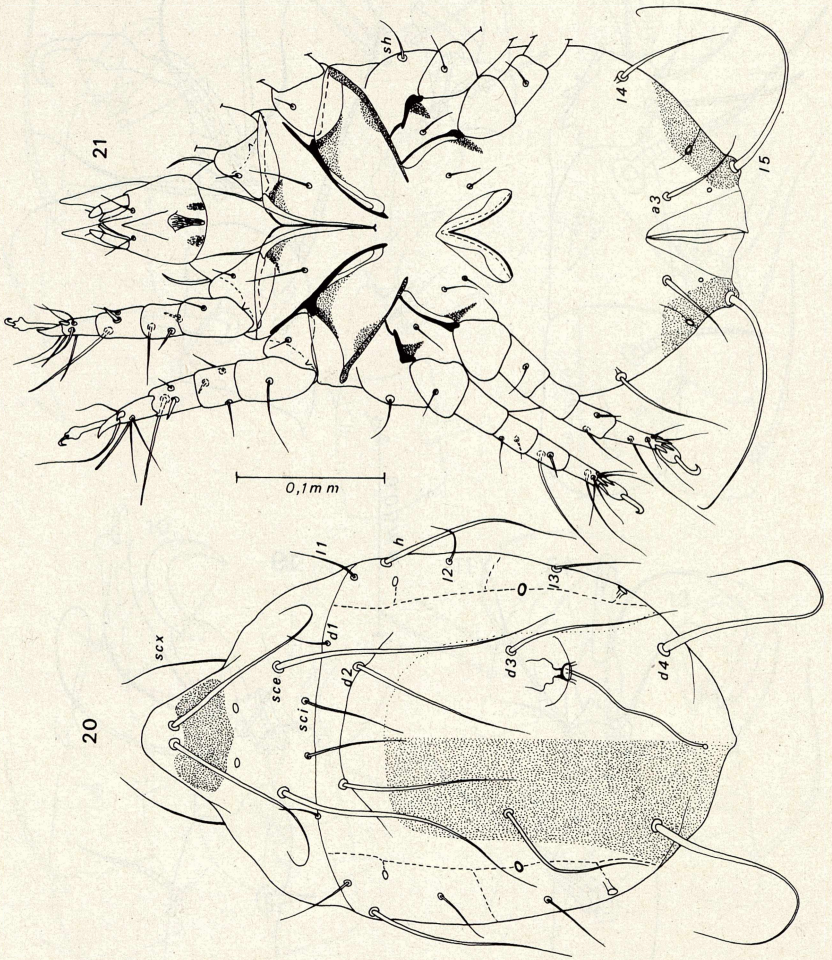
Figs. 1-4: *Ambyadesia bermudana* sp. n. Holotype female in dorsal (1) and ventral (2) view. Paratype male in dorsal (3) and ventral (4) view.

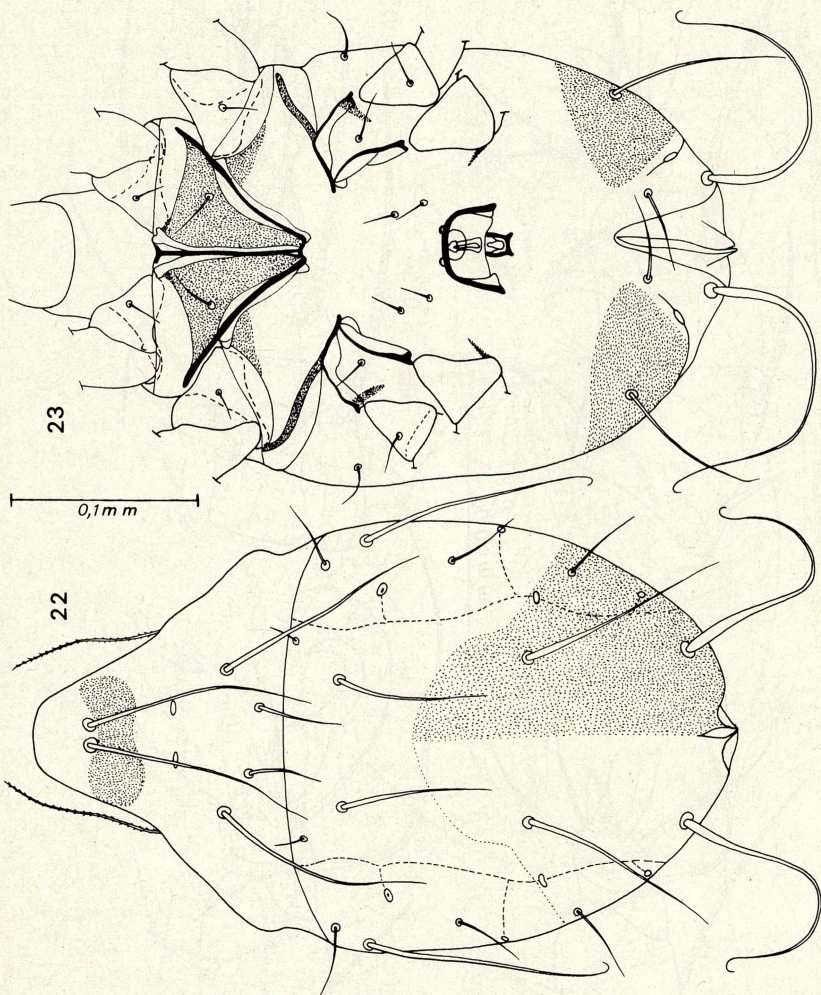


Figs. 5-14: Figs. 5-9. *Amhyadesia bermudana* sp. n. Female: leg I ventro-laterally (5); tarsus I dorso-laterally (6); tibia and tarsus II (7); tibia and tarsus III (8); tibia IV (9).- Figs. 10-14. *Amhyadesia atlantica* sp. n. Female: leg I ventro-laterally (10); tarsus I dorso-laterally (11); tibia and tarsus II (12); tibia and tarsus III (13); tibia IV (14).

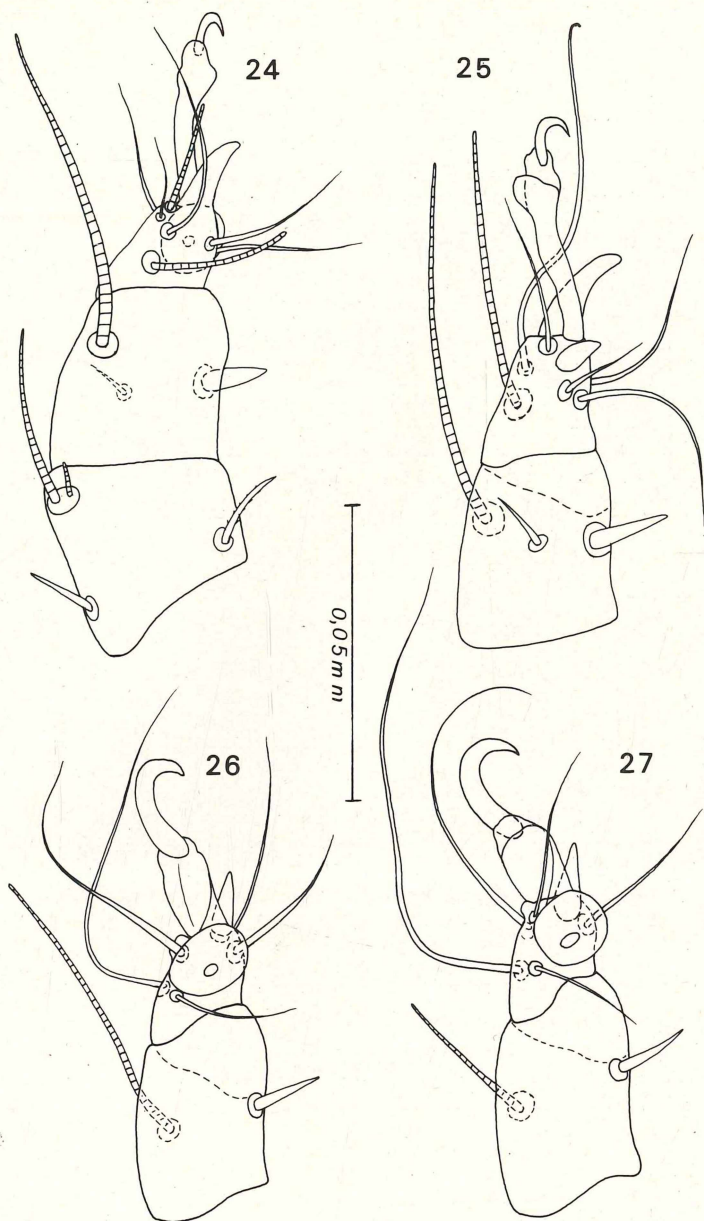


Figs. 15-19: *Amhyadesia bermudana* sp. n. Male: leg I in dorso-lateral view (15); tarsus I in dorso-ventral view (16); tibia and tarsus II (17), III (18) and IV (19).

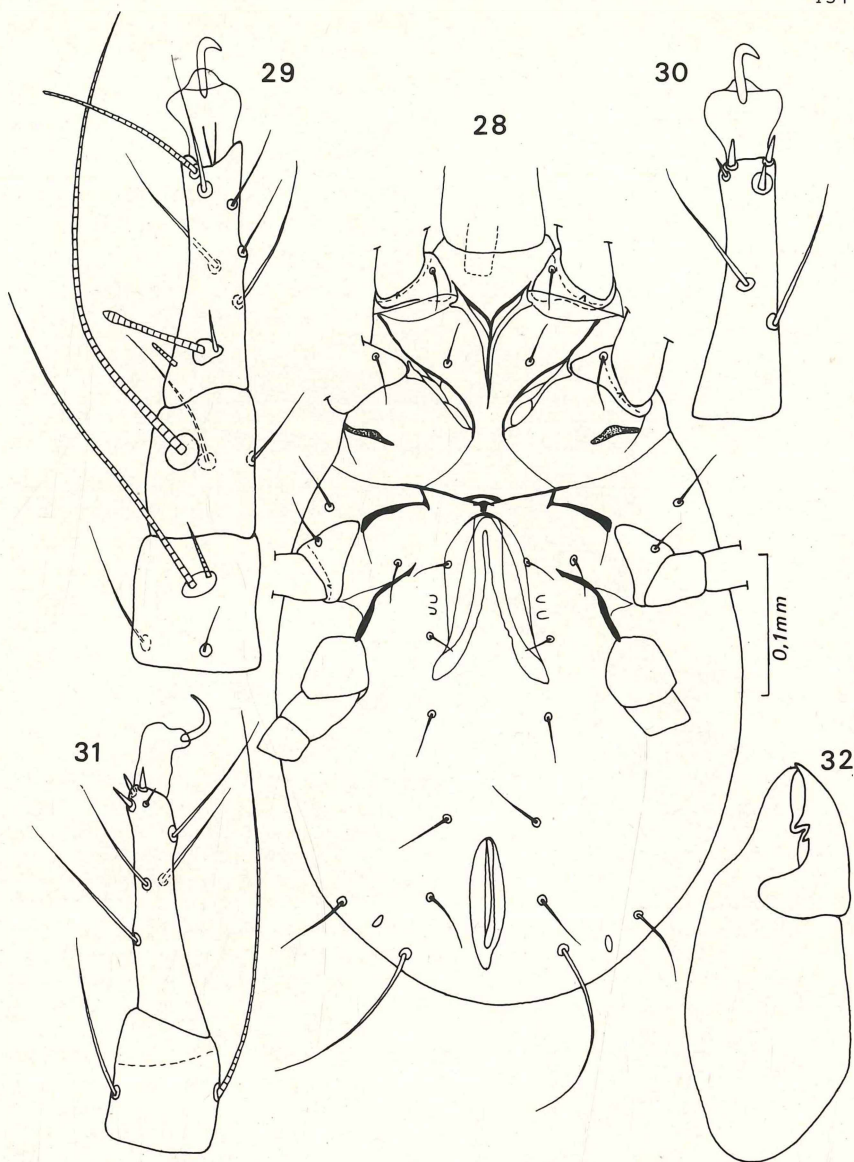




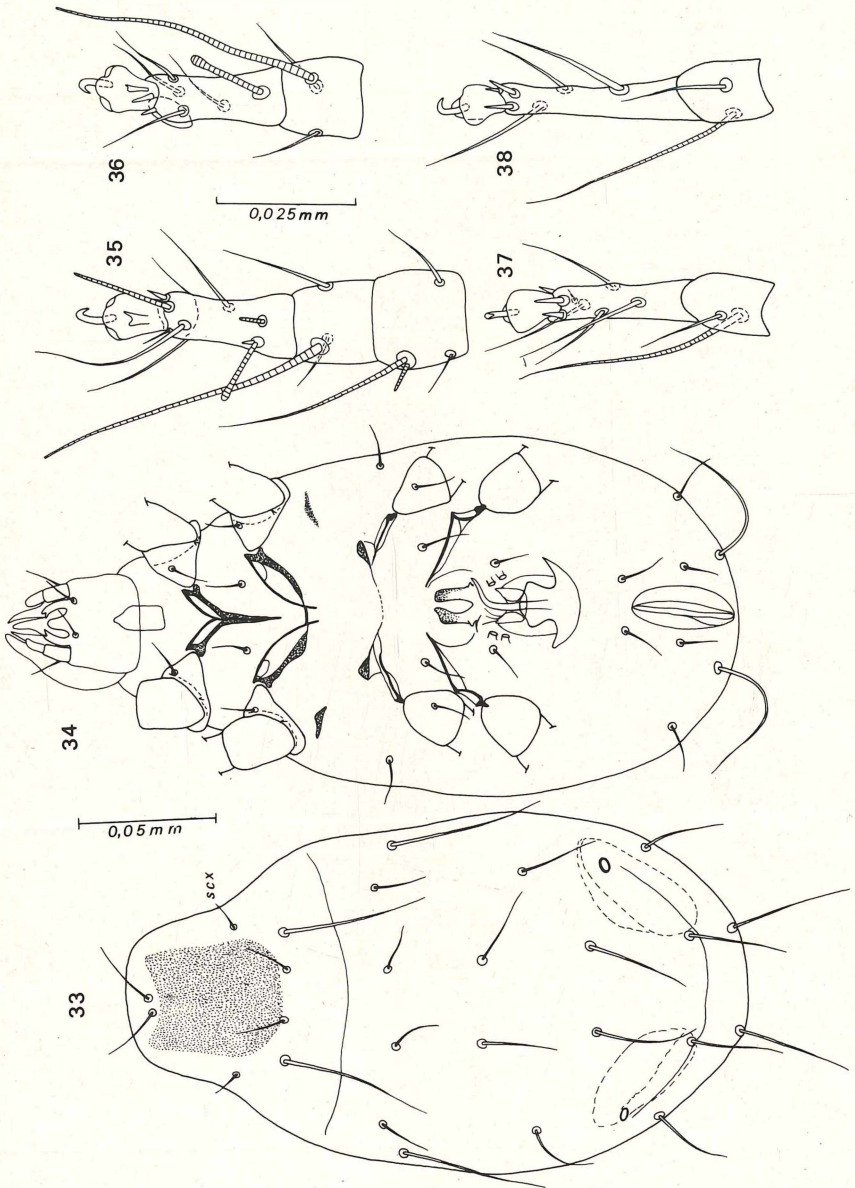
Figs. 20-23: *Amhyadesia atlantica* sp. n. Holotype female in dorsal (20) and ventral (21) view. Male in dorsal (22) and ventral (23) view.



Figs. 24-27: *Amhyadesia atlantica* sp. n. Male: tarsus, tibia and genu I (24); tarsus and tibia II (25), III (26) and IV (27).



Figs. 28-32: *Neocalvolvia inermis* sp. n. Holotype female in ventral view (28); leg I dorsally (29); tarsus I ventrally (30); tibia and tarsus III (31); chelicera (32).



Figs. 33-38: *Neocalvolia inermis* sp. n. Male: body in dorsal (33) and ventral (34) view; genu, tibia and tarsus II (36), III (37) and IV (38).

Zusammenfassung

Im Verlauf ökologischer Untersuchungen über die luftatmende Litoral-fauna der Bermudas wurden von R. S. unter anderem auch astigmaten Milben gefunden, deren Bearbeitung nunmehr vorgelegt wird. Es handelt sich dabei um vier Arten aus drei verschiedenen Gattungen und Familien; drei Arten sind neu, sie werden beschrieben: *Amhyadesia bermudana* und *A. atlantica* n. sp. (Hyadesiidae); *Neocalvolia inermis* n. sp. (Saproglyphidae); *Rhizoglyphus setosus* MANSON, 1972 (Acaridae). Die letztgenannte, aus Neuguinea beschriebene Art ist damit zum ersten Mal für die Bermudas nachgewiesen. Der ökologische Vergleich der vier Arten basiert im wesentlichen auf Resultaten, die im Verlauf von Freilanduntersuchungen über die kleinräumige Verteilung im Litoral eruiert wurden.

Aknowledgements

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