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HALACARIDAE (ACARI) FROM ROTTNEST ISLAND: DESCRIPTION OF TWO AGAUE SPECIES

By I. BARTSCH

SUMMARY: Two species of Agaue, A. scita n. sp. and A. subglabra n. sp., are described. Agaue scita is closely related to the Antarctic A. agauoides, and A. subglabra is most similar to the eastern African species A. hypertrophica.

WESTERN AUSTRALIA
AGAUE NEW SPECIES
DESCRIPTION
BIOGEOGRAPHY


AUSTRALIE OCCIDENTALE
AGAUE
ESPÈCES NOUVELLES
DESCRIPTION
BIOGÉOGRAPHIE


INTRODUCTION

Agaue is a cosmopolitan genus occurring both in tropical and polar waters. Though the number of studies on the halacarid fauna of the southern hemisphere is still small compared with the collecting activities in the northern oceans, most of the 36 species described are recorded from the southern hemisphere. In a collection of halacarid mites from Rottnest Island, Western Australia, five species of Agaue were found. Three species, Agaue brevipes Bartsch, 1999, A. circellaris Bartsch, 1999 and A. temipes Bartsch, 1999, inhabitants of the epihota on the leaves of the seagrass Amphibolis sp., have been recorded recently (BARTSCH, 1999). The two other species, Agaue scita and A. subglabra, are described in this paper.

MATERIAL AND METHODS

The halacarids were collected by the author in January 1991 on Rottnest Island, Western Australia. The mites were cleared in lactic acid and mounted in glycerine jelly. Drawings were prepared using a camera lucida. The holotypes are deposited in the Western Australian Museum (WAM).

Abbreviations used in the descriptions are: AD, anterior dorsal plate; AE, anterior epimeral plate; ds-1 to ds-6, first to sixth pair of dorsal setae; GA, genitoanal plate; GF, genital foramen; GO, genital opening; OC, ocular plate(s); P-1 to P-4, first to fourth palpal segment; pas, parambulacral setae; PD, posterior dorsal plate; PE, posterior epimeral plate(s); pgs, perigenital setae; sgs, subgenital setae.

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DESCRIPTIONS

Genus *Agaue* Lohmann, 1889

*Diagnosis*: Idiosoma and legs often with cerotegument in shape of delicate membranes or large lamellae which have a plain, filamentous or honeycomb-like structure. Dorsum with *AD*, *OC*, *PD*, and six pairs of dorsal setae; second, third and fourth pair often enlarged; ds-6 (adanal setae) on anal plate. The majority of species with 3 pairs of gland pores. *AE* with 3 pairs of ventral setae; *PE* with 1-3 dorsal setae anterior to leg III, 0-1 dorsal setae anterior to leg IV, and 3 ventral setae. Female *GA* with 3-10 (rarely more) pairs of perigenital setae and 0-2 pairs of subgenital setae. Male *GA* with 50-200 *pgs* arranged in a dense ring around the *GO*; and 5 pairs of spur-like *sgs*.

Gnathosoma slender. Rostrum parallel-sided, often much longer than gnathosomal base. Tectum scaliiform. Distal pair of maxillary setae inserted near base of rostrum. Rostral setae minute, spur-like or fuscate, often vestigial. Palps slender, extending to or just beyond tip of rostrum. *P-2* long, with one distidorsal seta; *P-3* with 0-1 distidorsal seta. *P-4* with 4 setae. Chelicerae slender.

Legs slender, tibiae often club-shaped. Tarsi of most species with large membranes of claw fossae. Tibiae I to IV each with 4-6 slender ventral setae; setae on tibia I neither spiniform nor bipectinate. Tarsi I to IV each with 3 dorsal setae. Solenidia of tarsi I and II on dorsolateral and dorsomedial membranes of claw fossae, respectively. Tarsus I with one ventral seta; tip of tarsus with cluster of eupathidia. Tarsus II with ventral eupathidia and *pas*. Tarsi III and IV each with pair of *pas*. Claws large. Median sclerite present, often with a minute tooth.

With one larval and two nymphal stages during ontogenetic development.

*Agaue scita* n. sp.  
(Figs 1-22)

*Material examined*: Holotype male (WAM 99/209), Western Australia, Rottnest Island, Nancy Cove, corals (*Pocillopora* sp.), 0.5 m water depth, 20 Jan. 1991.

*Description*: MALE. Length of idiosoma 620 μm, width 370 μm. Dorsum and legs with prominent cerotegumental lamellae. Lamellae with filaments, but without honeycomb-like ornamentation. Cerotegumental lamellae arising both from plates and from membraneous integument (Fig. 1). Membraneous integument between plates strongly folded (Fig. 4). Plates smooth except for lateral portions of *AD* and *PD* and median portion of *OC* which are pierced by numerous delicate pores. Lateral portions of *AE* fused dorsally (Fig. 3). *AD* adjacent to, but not fused with, dorsal portion of *AE*. Anterior margin of idiosoma with cerotegumental lamellae (Fig. 1), anterior lamella about 40 μm high, lateral lamellae 8 μm high. *AD* 136 μm long, 124 μm wide; raised cerotegumental lamellae shaped as walls of posteriorly open 'cup' (Fig. 5). Single specimen at hand with black spot at inner end of 'cup'. When focussed on base of lamellae, a distinct panelling is visible. *OC* triangular, 98 μm long, 93 μm wide; cornaeae and medial sclerite fused to form a ring-like structure; enclosed faint eye pigment. Cerotegumental lamellae on *OC* crescent. *PD* 298 μm long, 167 μm wide. Longitudinal cerotegumental lamellae arising from lateral margins of *PD* and adjacent membraneous integument; lamellae posteriorly fused. Number and arrangement of cerotegumental lamellae which arise from membraneous integment as follows: (1) an unpaired lamella posterior to *AD*, 20 μm wide; (2) a pair of transverse lamellae, 50 μm wide, between cup-shaped cerotegument of *AD* and crescent lamella of *OC*; (3) a pair of short longitudinal lamellae level with insertion of leg III; and (4) a smaller pair posterior to that. Two latter pairs of cerotegument adjacent to lamellae of *PD*. Anal plate with sheet-like cerotegument. Setae ds-1 30 μm long, inserted within anterodorsal portion of *AE*; ds-2, ds-3 and ds-4 approximately 60 μm long, surrounded by thin cerotegumental layer; setae inserted in membraneous integument. Setae ds-5 25 μm long, in lateral margin of *PD*, lateral to area with delicate pores; ds-6 45 μm long and covered by thin cerotegumental layer. First pair of gland pores in medial margin of dorsal portion of *AE*. Two pores within margin of ring-shaped corneal sclerite; posterior pore with transverse internal membrane. *PD* with pair of gland pores distinctly posterior to ds-5.
In ventral aspect, cerotegument present in form of:
(1) conspicuous marginal lamellae arising from dorso- and ventromarginal portions of $AE$ and $PE$, between insertions of legs II and III; (2) delicate and slightly reticulate superficial layers on dorsomarginal portion of $PE$, posterior to insertion of legs III; (3) small dorsomarginal lamellae level with insertion of legs IV; and (4) dense lamellar processes flanking trochanters IV. Surface of ventral portions of $AE$, $PE$ and $GA$ delicately porose. $AE$ 179 µm long, 341 µm wide; with camerostomal membrane. Trochanters I and II flanked by epimeral membranes. Posterior margin of $AE$ excavate (Fig. 2). $AE$ with 3 pairs of ventral setae; $PE$ with one long dorsal seta and 3, much shorter, ventral setae. $GA$ 217 µm long, 174 µm wide. Anal plate with 50 µm high lamella (Fig. 6). Genital foramen 55 µm long, $GO$ 45 µm long. $GO$ surrounded by 85 slender pgs. Area with perigenital setae slightly raised. Genital sclerites with 5 pairs of spur-like subgenital setae (Fig. 7). Spermatopositor 82 µm long, 75 µm wide (from apical margin to end of basal furca) and only slightly extending beyond ring of pgs.

Gnathosoma 167 µm long, rostrum 80 µm long, almost as long as gnathosomal base. Both pairs of maxillary setae at base of rostrum (Fig. 9). Rostral
FIGS 10-16: Agane scita n. sp., male.


Sulcus short, extending posteriad slightly beyond rostral setae. Two pairs of minute spur-like rostral setae removed from rostral tip. Palp 82 μm long (Fig. 8), 21 μm wide, not surpassing rostrum. Dorsal seta on P-2 large, 30 μm long. P-3 6 μm long, 9 μm wide, dorsal seta 8 μm long. P-4 25 μm long; dorsal and ventral setae delicately pectinate, the other setae more slender. Apex of P-4 with setula and 2 spurs. Chelicerae 160 μm long, claw 27 μm long, basally with approximately 7 tines, apically smooth.

Legs shorter than idiosoma. Telofemora I to IV 3.0, 3.0, 2.7, and 2.9 times longer than high. Clavate tibiae I and II shorter than telofemora I and II; tibiae III and IV slightly longer than telofemora III and IV. Legs characterized by prominent cerotegumental lamellae (Figs 10-13). Trochanters I and II with very short lamellae, other leg segments with prominent dorsal and ventral lamellae; on the telofemora, genua and tibiae, these lamellae extend beyond distal end of leg segments and form large medial and lateral cero-
TEGUMENTAL ARTICULAR LAMELLAE. TROCHANTERS III AND IV AND BASIFEMORA II TO IV WITH VENTRAL, DORSAL AND TRANSVERSE LATERAL CEROTEGUMENTAL LAMELLAE. LAMELLAE ON BASIFEMUR I SHORTER THAN ON BASIFEMUR II. DORSAL CEROTEGUMENTAL LAMELLAE ON TELOFEMORA I TO IV AS HIGH AS, OR HIGHER THAN, THESE SEGMENTS; HEIGHT OF VENTRAL LAMELLAE ON TELOFEMORA II TO IV EQUAL TO HEIGHT OF TELOFEMORA. CEROTEGUMENTAL ORNAMENTATION ON TROCHANTERS, BASI- AND TELOFEMORA OF LEGS IV MORE ELABORATE THAN ON LEGS III (FIG. 14). HEIGHT OF DORSAL AND VENTRAL LAMELLAE ON TIBIAE I AND II LESS THAN THE HEIGHT OF THESE SEGMENTS; HEIGHT OF DORSAL LAMELLAE ON TIBIAE III AND IV EXCEEDING HEIGHT OF THESE TIBIAE (FIGS 12, 13). TARSI I AND II (FIGS 15, 16) WITH SHORT DORSAL CEROTEGUMENTAL LAMELLAE, TARSII III (FIG. 21) AND IV WITH RECTANGULAR DORSAL LAMELLAE. LEG SEGMENTS CONSPICUOUSLY THICK-WALLED (FIGS 17-20). LEG CHAETOXY, FROM TROCHANTER TO TIBIA: LEGS I AND II, 1, 2, 5, 5, 12; LEG III, 2, 2, 3, 4, 8; LEG IV, 1, 2, 3, 3, 9. ALL SETAE SLENDER, SMOOTH. TIBIAE I AND II EACH WITH 2 VENTROMEDIAL, 3 VENTRAL, 2 LATERAL AND 5 DORSAL SETAE; TIBIA III WITH 4 VENTRAL, 2 LATERAL AND 2 DORSAL SETAE; TIBIAE IV WITH 4 VENTRAL, 2 LATERAL AND 3 DORSAL SETAE. TARSII WITH LARGE MEMBRANES OF CLAW FOSSAE; LATERAL AND MEDIAL SETAE OF THE 3 FOSSARY SETAE INSERTED ON THESE MEMBRANES. LATERAL MEMBRANE OF CLAW FOSSA ON TARSUS I WITH 15-µM LONG SOLENIIDON; VESTIGIAL FAMULUS REPRESENTED BY ITS AFFERENT CANAL (FIG. 15). SOLENIIDON ON TARSUS II 12 µM LONG, ON INSIDE OF MEDIAL MEMBRANE OF CLAW FOSSA (FIG. 16). TARSUS I WITH ONE VENTRAL SETA AND 16 EUPATHIDIA (PAS INCLUDED). TIP OF TARSUS II WITH A PAIR OF EUPATHIDIA AND A PAIR OF
doubled pas. Tip of tarsi III and IV each with a pair of pas.

Accessory processes on claws with approximately 5 tines. Inner flank of claw with pecten of delicate tines (Fig. 22). No tines in basal and middle part of claw shaft. Median sclerite lacks dent-like process.

Remarks: The most prominent characters of Agaue scita are the large cerotegumental lamellae and the conspicuous ring-like corneal sclerite. Large lamellae are present on the idiosoma and telofemora of several species of Agaue, but none of these species have tibial lamellae as large as those of A. scita.

Agaue scita resembles the Antarctic species A. agauoides (Lohmann, 1907) in having the AD separated from the anteriorly fused dorsal portion of the AE; the first pair of gland pores in the margin of the dorsal portion of the AE; corneae and internal sclerite fused to a ring (ring not figured in LOHMANN, 1907: Pl. 35, fig. 1; BARTSCH, 1990: fig. 1; BARTSCH, 1993: fig. 37A); and large cerotegumental lamellae. The two species are closely related. Distinguishing characters are: AD of A. agauoides without cup-shaped cerotegumental lamella and tibiae with inconspicuous lamellae. Cerotegumental lamellae rather similar to those on A. scita are also present in A. adriatica Viets, 1940, but in A. adriatica the gland pores insert on the AD and the two corneae are distinctly delimited. Agaue nationalis (Lohmann, 1893) seems to be similar to A. adriatica, A. agauoides and A. scita, but the descriptions (LOHMANN, 1893; NEWELL, 1947) give no reliable information on the shape of the AD or the position of the gland pores.

Agaue subglabra n. sp. (Figs 23-34)

Material examined: Holotype female (WAM 99/210), Western Australia, Rottnest Island, Duck Point, hapteres of algae, 7 m depth, 9 Jan. 1991.

Description: FEMALE. Length of idiosoma 490 µm, width 290 µm. Cerotegumental covering lacks filaments. Integument of dorsal plates pierced by delicate pores. Parallel striae of membraneous integument straight. AD elongate, 160 µm long, 134 µm wide, with small anterior cerotegumental dot and posterior ridge in shape of an inverted V (Fig. 23), beneath which a reticulate pattern is visible. OC 82 µm long, 60 µm wide. Raised area with two corneae and cerotegument. Pore canaliculus and gland pore lateral and posterolateral to posterior cornea. PD 238 µm long, 152 µm wide. Two longitudinal cerotegumental ridges fused posteriorly. Integument of PD, medial and lateral to lamellae, pierced by canaliculi; area beneath cerotegument with reticulate pattern. First pair of gland pores at anterolateral angles of AD. PD with pair of pores near posterior margin. Dorsal setae short, 10-12 µm long; ds-1 close together, immediately anterior to cerotegumental "V"; ds-2, ds-3 and ds-4 within membraneous integument between AD and OC, AD and PD, and OC and PD, respectively; ds-5 on PD medial to pair of cerotegumental ridges; ds-6 on anal plate.

Dorsal, marginal and ventral portions of ventral plates covered by cerotegument. Posterior portion of PE extended by cerotegumental lamella. Cerotegument of venter thin and delicately reticulate. AE 167 µm long, 254 µm wide, with 3 pairs of setae (Fig. 24). PE with 3 dorsal and 3 ventral setae. GA 184 µm long, 130 µm wide. GF 65 µm long, 42 µm wide; foramen constricted by anterior and posterior membranes; GO 46 µm long. Genital sclerites lack sgs. Thirteen perigenital setae immediately adjacent to GF; none outlying. Ovipositor extending beyond GA (Fig. 24). Distance between anterior margin of GA and GF equal to half length of GF.

Gnathosoma slender, 218 µm long, i.e. slightly less than half length of idiosoma. Rostrum elongate, 152 µm long, distinctly longer than gnathosomal base (Fig. 26). Tectum scaliform. Basal pair of maxillary setae on gnathosomal base 80 µm long; distal pair of setae 60 µm long, on base of rostrum. Tip of rostrum with furcate rostral setae (Fig. 25). Palps slender, 170 µm long, extending slightly beyond tip of rostrum. P-1 to P-4 15, 102, 17, 39 µm long, respectively. P-2 and P-3 each with dorsal seta; P-4 basally with 3 setae, in the middle with one seta, and apically with setula and 2 spurs. Chelicera slender, 230 µm long; tines on claw increasing in size basally.

Legs shorter than idiosoma. Legs I, III and IV similar in length. Cerotegumental lamellae plain. Basifemora III and IV with short dorsal and ventral cerotegument. Telofemora I to IV with long dorsal and short ventral lamellae. Telofemora I to IV 3.1,
FIGs 23-30: Agae subglabra n. sp., female.


2.6, 2.6, 2.6 times longer than high (Figs 27-30). Telofemora I and II longer than tibiae; telofemora III and IV as long as tibiae. Leg chaetotaxy, from trochanter to tibia: leg I, 1, 2, 5, 4, 11; leg II, 1, 2, 5, 4, 11; leg III, 2, 2, 3, 4, 8; leg IV, 0, 2, 3, 3, 8-9. Tibiae I and II (Figs 27, 28) each with 2 ventral, 2 ventromedial, 2 lateral, and 5 dorsal setae; tibia III (Fig. 29) with 4 ventral, one lateral, and 3 dorsal setae; tibiae IV...
Several species of *Agaue* have 3 dorsal setae on the PE. The species *A. corollata* Bartsch, 1978, *A. obscura* Bartsch, 1978, *A. verrucosa* Bartsch, 1982 and *A. villosa* (Lohmann, 1907) bear 3 dorsal setae on the PE, but they lack cerotegumental lamellae. The adults of *A. hirtella* Bartsch, 1982 and *A. uncinata* Bartsch, 1990—species presently known only from the deutonymphs (BARTSCH, 1982, 1990)—are expected to have 3 dorsal setae on the PE; *A. hirtella* and *A. uncinata* also lack cerotegumental lamellae. *A. parva* (Chilton, 1883) and *A. temuurostris* (Lohmann, 1907) are easily discriminated from *A. subglabra* by the much larger size and the ornamentation of the cerotegumental lamellae on the telofemora. *A. californica* (Hall, 1912), *A. setalis* Newell, 1984 and *A. variabilis* MacQuitty, 1984 have, in addition to the 3 dorsal setae anterior to leg III, one dorsal seta anterior to leg IV. Re-examination of *A. marginata* Viets, 1950, housed in the Zoological Museum in Hamburg, showed that this species also bears a dorsal setae anterior to the insertion of leg IV. The PE of the species *A. heterunguis* Newell, 1984, *A. insignata* Bartsch, 1979, *A. kurilensis* Makarova, 1977, *A. longiseta* Newell, 1951 and *A. magellanica* Newell, 1971 have 3 setae anterior to the insertion of leg III, but no seta anterior to leg IV. In contrast to *A. subglabra*, the claws of *A. heterunguis* lack an accessory process; the female genital foramen of *A. magellanica* is near the anterior margin of the GA, and the female GA of *A. insignata*,
A. kurlensis and A. longiseta bears peripheral genital setae. Though not mentioned in the descriptions, A. debilis (Lohmann, 1907) and A. hamiltoni Womersley, 1937 might have three dorsal setae on the PE; A. debilis is distinctly larger than A. subglabra; the shape of the AD of A. hamiltoni is different from that of A. subglabra.

**DISCUSSION**

Thirty-six Agae species have been recorded previously (Table 1), and in this paper two new species, A. scita and A. subglabra, are described. Species not included in Table 1, but listed in Viets (1956) or in subsequent papers, are as follows:

*Agaue affinis* Sokolov, 1962, an Antarctic species (Sokolov, 1962) which, according to Newell (1984), belongs to *Thalassarachna*, but, according to Bartsch (1990), is synonymous with *A. parva*.

*A. consobrina* André, 1933, described on the basis of a deutonymph (André, 1933), is conspecific with *A. agauoides* (Newell, 1984).

*A. longissima* Sokolov, 1962, known from a deutonymph (Sokolov, 1962), is synonymous with *A. tenuirostris* (Newell, 1984).

*A. olivacea* (Grube, 1872), recorded from the French coast of the English Channel (Grube, 1872). The identity of this species may be clarified once the fauna of the English Channel is better known.

*A. pilosa* (Gimbel, 1919), a species synonymous with *A. parva* (Newell, 1984).

The cosmopolitan genus *Agaue* is recorded from shallow coastal waters, as well as from deep-sea basins. According to the published collection data, species of *Agaue* do not live in regularly emerged and desiccating habitats. Intertidal records are from habitats which generally also have a high water content during low tide, such as coralline algae. The majority of the species lives in the sublittoral and bathyal zones. Reliable records of *Agaue* species are summarized in Fig. 35. Records of species from depths greater than 1000 m are indicated by circles. These include: *A. abyssorum*, taken in the Bay of Biscay at 400-1410 m (Trouessart, 1896); *A. corollata*, present in several Atlantic deep-sea basins, at depths from 2000 to 4220 m (Bartsch, 1978, 1982); the closely related *A. verrucosa* from the Argentine Basin and Western Antarctica, from 1200-2700 m depth (Bartsch, 1982, 1990); and *A. parva*, common in littoral waters but also extracted from a sample taken from 805-1060 m depth (Newell, 1984).

As demonstrated in Table 2 and Fig. 35, the number of known species from the northern hemisphere is lower than that from the South. Littoral species of European and North African waters are *A. adriatica*, *A. chevreuxi* and *A. panopae* (Viets, 1956; Mari & Moresi, 1990); species from the eastern coast of

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**Table 1**: Species of *Agaue*. References to reliable descriptions and informations are given in square brackets.

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Central and North America are *A. arubaensis* and *A. nationalis* (LOHMANN, 1893; NEWELL, 1947; BARTSCH, 1984). The most northerly records of *Agauae* from the European Atlantic coast are from northern France, viz. *A. chevreuxi* and a species probably conspecific with *A. adriatica* (TROUSSART, 1889; MARI & MORSELLI, 1990). No species are known from the littoral and sublittoral of the boreal North America and the Arctic North Atlantic. In contrast to the shallow-water species, the deep-sea species *A. corollata* is very widely distributed, being known from various deep-sea basins from almost 60°N to 15°S, and 12°E to 70°W (BARTSCH, 1978, 1982). Boreal waters of the North Pacific are inhabited by *A. gracilirostris*, *A. kurilensis*, *A. longiseta* and *A. variabilis* (SOKOLOV, 1952; MAKAROVA, 1977; NEWELL, 1951; MACQUITY, 1984). *A. californica* and *A. variabilis* are present along the western coast of North America, from California to Washington State and from Mexico to Oregon, respectively (MACQUITY, 1984).

When considering the distribution of the genus *Agauae*, it is necessary to keep in mind that the map (Fig. 35) and Table 2 mirror the present-day records, which are dependent on sampling activity. With respect to the halacarid fauna in general, the fauna of the North Atlantic has been studied rather intensely, whereas the number of collections from the North Pacific is limited. In the southern hemisphere, the area best known is Antarctica and the adjacent subantarctic islands. The first records, from the beginning of this century, are based on material taken during European Antarctic expeditions (LOHMANN, 1907; TROUSSART, 1907a, b, 1914; GIMBEL, 1919). The sampling activities in the southern hemisphere are rather sporadic, and future collections will certainly result in records of many more species.

Most striking in the distribution of the genus *Agauae* are the absence of records from higher latitudes of the Atlantic Ocean and the higher number of species in the southern than in the northern hemisphere. The absence of *Agauae* in the cold Atlantic Ocean is certainly not due to intolerance to the low temperatures of that region, but might be due to the age of the Atlantic Ocean. In the Lower Jurassic, almost 180 million years ago, the break-up of Pan-
gaea initiated the birth of the southern hemisphere (HOWARTH, 1981). At the beginning of the Tertiary, 65 million years ago, North America had drifted away from Europe, but large parts of the continental shelf areas were land (ADAMS, 1981). According to geological data, the North Atlantic is relatively young compared with other oceans. Whereas the coastlines of eastern Asia, western North America and the southern continents were easily reached by Panthalassic and Tethyan species, access to the North Atlantic was restricted. Species that colonized the eastern North Atlantic are probably descendants of western Tethyan species which reached the Atlantic via the Mediterranean. Species of the western North Atlantic might have reached the Atlantic via a passage between North and South America.

In contrast to the shallow-water North Atlantic species which, according to present-day data, did not spread northward, the deep-sea species Agave corollata was transported to several deep-sea basins (Fig. 35). Species closely related to A. corollata (BARTSCH, 1982, 1987, 1990) are known from South Atlantic and Antarctic shelf areas, which might be evidence of a migration of A. corollata from South to North, from the cold-water shelf to the cold deep-sea. The corollata species-group would thus follow the route emphasized by KUSSAKIN (1973), who said that the deep-sea isopod fauna originated from the polar regions, i.e. mainly from the Antarctic shelf fauna, which has migrated into the oceans' depths since the Late Cretaceous. However, according to more recent investigations, only a restricted number of deep-sea isopod taxa are likely to be descendants of cold-water shelf species (BRANDT, 1992). The lack of records of deep-sea Agave from oceans other than the Atlantic Ocean is certainly due to absence of adequate samples.

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REFERENCES


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TABLE 2: Agave species of the northern and southern hemispheres


