Aduncospiculum halicti n. gen., n. sp. (Diplogasterida : Diplogasteroididae), an associate of bees in the genus *Halictus* (Hymenoptera : Halictidae)

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SUMMARY

Aduncospiculum halicti n. gen., n. sp., a phoretic associate of *Halictus* spp. (Hymenoptera : Halictidae), is described and illustrated from the nests of *Halictus* spp., and from laboratory cultures of the nematode established from dauer juveniles (JIII) isolated from the Dufour's glands of adult *Halictus*. Dimorphism of the buccal cavity was observed in adult *A. halicti* n. sp. females from older cultures and from bee nests. Mating studies confirmed that the two female morphotypes are *A. halicti* n. sp. Biometrics of adults of *A. halicti* n. sp. recovered from *Halictus* nests in Davis, California and cultured isolates from adult *Halictus* from Davis and Hightstown, New Jersey were compared. Biometrics of *A. halicti* n. sp. from 14 and 37 day old cultures on *Candida membranaefaciens* were also compared.

RÉSUMÉ

Aduncospiculum halicti *n. gen., n. sp. (Diplogasterida : Diplogasteroididae), associé aux abeilles du genre* Halictus *(Hymenoptera : Halictidae)*

Aduncospiculum halicti n. gen., n. sp., un associé phorétique de *Halictus* spp. (Hymenoptera : Halictidae) est décrit et illustré sur des animaux provenant de nids de *Halictus* spp. et d'élevages établis au laboratoire à partir de « dauer larvae » (J III) isolées des glandes de Dufour de *Halictus* adultes. Il a été observé un dimorphisme de la cavité buccale chez les femelles adultes provenant d'élevages âgés ou des nids de l'abeille. Des essais de croisement ont confirmé que ces deux morphotypes appartiennent à *A. halicti* n. sp. Les données biométriques concernant les adultes de *A. halicti* n. sp. provenant de nids d'abeilles (Davis, Californie) ou d'élevages de *Halictus* adultes de Davis ou de Highstown (N. Jersey) ont été comparées. Ces mêmes données ont été également comparées sur des *A. halicti* n. sp. provenant d'élevages, sur *Candida membranaefaciens*, après 14 et 37 jours.

Giblin, Kaya and Brooks (1981) and Giblin and Kaya (1981) isolated and cultured a diplogasterid from the reproductive tracts of *Halictus* spp., which reportedly resembled *Acrostichus* Rahm, 1928. Careful study of this nematode has revealed that it is sufficiently different in morphology and biology from other nematodes to justify establishment of a new genus and is described herein as *Aduncospiculum halicti* n. gen., n. sp.

We discovered during this study that stomatal dimorphism exists in females of *A. halicti* n. sp. and conducted mating experiments to confirm that this is an intraspecific phenomenon. Scanning electron microscope (SEM) and light microscope comparisons were made between the two different female morphs of *A. halicti* n. sp.

Comparisons were made of the morphometric variability in adults of *A. halicti* n. sp. isolated as dauer juveniles (JIIIs) from *H. ligatus* Say from two different locations and cultured on *Candida membranaefaciens* at 25° for 14 and 37 days. Also, comparisons were made between *A. halicti* n. sp. from cultures and from nests of *Halictus* spp.

Materials and methods

Dauer juveniles (JIII) of *A. halicti* n. sp., isolated from the Dufour's gland of an infested female of *H. ligatus* from Davis, Yolo Co., California on April 25, 1980 were established on *C. membranaefaciens* grown on potato dextrose agar (PDA). Type adults of *A. halicti* n. sp. were collected from a nine day old sub-culture, and heat killed, fixed and processed into glycerol as described by Giblin and Kaya

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(1983 *a*). Measurements were made with a camera lucida. Spicule measurements were made along the chord, from the apex of the capitulum to the most distal point of the lamina.

A. halicti n. sp. adults were also collected from the cell of a pharate adult of *H. farinosus* Smith from Davis on May 29, 1982. These nematodes were heat killed, preserved and measured in formalin-glycerol (Southey, 1970). Dauer juveniles (JIII) of *A. halicti* n. sp. were isolated from the Dufour's gland of a *H. farinosus* female from Davis on May 29, 1982, heat killed, and drawn and measured in water mounts.

Mating studies were conducted to determine if the buccal cavity dimorphism observed in *A. halicti* n. sp. was intraspecific. Crosses were made with nematodes from a 30 day old culture of *A. halicti* n. sp., isolated from the Dufour's gland of a *H. ligatus* female from Grants Pass, Josephine Co., Oregon, onto *C. membranaefaciens* on PDA. *C. membranaefaciens* was streaked onto PDA and incubated for three to five days before inoculation with nematodes. All cultures and crosses were incubated at 25°. Test crosses included one trial of 25 eurystomatous females and 25 males (all males observed thus far have been stenostomatous) and three trials of ten stenostomatous females and ten males. A 2 cm core sample of each culture was taken at 18 day and 24 day intervals, and *ca* 100 adult nematodes each were examined for the proportion of eurystomatous and stenostomatous forms.

In addition to the culture of *A. halicti* n. sp. from Davis, a culture was established from JIIIs isolated from the Dufour's gland of a *H. ligatus* female from Hightstown, Mercer Co., New Jersey. An undetermined number of *A. halicti* n. sp. from a culture from a given location were placed onto three to five day old *C. membranaefaciens* and cultured for 14 and 37 days, respectively. Adults of both sexes and buccal cavity forms, if present, from a given location and culture time were measured in water mounts. Comparisons were made between the morphology and biometrics of *A. halicti* n. sp. from the two different collection sites and from the two different culture times.

Statistical comparisons between the biometrics of the type specimens and specimens from the different populations of *A. halicti* n. sp., cultured for different lengths of time, and specimens from the *H. farinosus* nest, were made with a one-way analysis of variance (ANOVA) and separation of means was done with Duncan's Multiple Range test. Cultured adults of *A. halicti* n. sp. were heat killed, fixed and prepared for photomicrographs and for SEM observations and comparisons as described by Giblin and Kaya (1983 *a*).

Aduncospiculum n. gen.

Diagnosis

Diplogasteroididae : Cuticule with prominent longitudinal and fine transverse striations. Six lips, each with apical papilla. Males and females without supplementary head papillae. Amphidial apertures circular. Females with stomatal dimorphism. Males stenostomatous only. Stenostomatous males and females ; stoma cylindrical, stomatal length/width ratio 1.5-3.0, stoma composed of lightly cuticularized cheilostome, six distinct prorhabdions in prostome, pro- and mesorhabdions separate and parallel, dorsal pro- and mesorhabdions shorter than subventral ones, dorsal metarhabdion with large tooth which extends into the prostome, subventral telorhabdions sclerotized. Eurystomatous females ; head end broad and flattened, stoma barrel-shaped, stomatal length/width ratio less than 1.3, cheilostome not visible, twelve distinct prorhabdions in prostome, mesostome distinct, each metarhabdion with a tooth. All females diovarial, ovaries reflexed and nearly meet in region of vagina. Females with reniform "spermatheca". Males with single testes, reflexed apically. Spicules paired, ventrally arcuate, hooked distally. Gubernaculum more than 0.5 length of spicule, complicated. Nine pairs genital papillae, tail with spicate terminus. Female tail conoid with acute terminus.

Saprobiont from bee cells, dauer juveniles carried in Dufour's gland of bee host.

Types species

Aduncospiculum halicti n. gen., n. sp.

Relationships

Aduncospiculum n. gen. probably belongs to the family Diplogasteroididae as defined by Paramonov (1964) because of the shape of the stenostomatous buccal cavity in males and females, and because males do not possess four supplementary papillae on the head (confirmed on *A. halicti* n. sp. with light and SEM observations). *Aduncospiculum* n. gen. is closest to *Filipjevella* Lazarenskaja, 1965. Both genera share strong similarities in cuticular appearance, morphology of the stenostomatous buccal cavity ; in females, possession of a reniform "spermatheca", reflexed ovaries that nearly meet at the midbody ; and in males because of the possession of paired arcuate spicules, and a large gubernaculum. *Aduncospiculum* n. gen. can be distinguished from *Filipjevella* in both sexes by tail length ; members of *Filipjevella* have long filiform tails ($c < 5.5$), whereas *Aduncospiculum* n. gen.

have short conoid tails (c > 6). Females of *Aduncospiculum* n. gen. express stomatal dimorphism, wich has not been observed in *Filipjevella.* Males of *Aduncospiculum* n. gen. possess a characteristically shaped gubernaculum (see Fig. 1 C), and spicules with strongly hooked distal tips. The distal tips of *Filipjevella* spicules are never hooked. *Filipjevella* are saprobionts associated in the galleries of tree inhabiting beetles, whereas *Aduncospiculum* n. gen. is closely associated with soil dwelling bees.

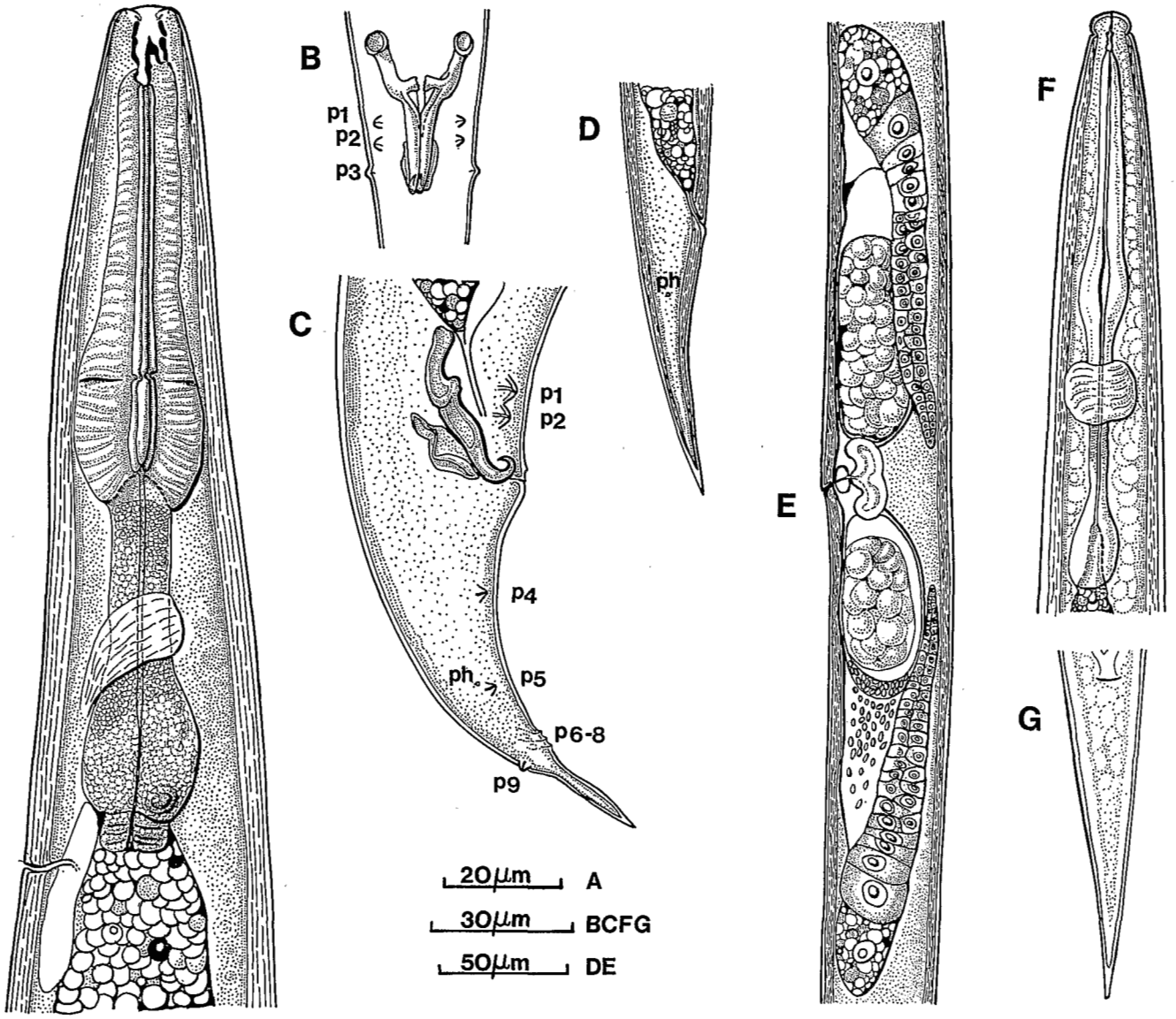

Fig. 1. *Aduncospiculum halicti* n. gen., n. sp. A : Adult (stenostomatous) cephalic region and esophagus (lateral) ; B : Spicule (ventral) ; C : Male tail (lateral) ; D : Female tail (lateral) ; E : Female midbody (lateral) ; F : Dauer (JIII) cephalic region and esophagus ; G : Dauer (JIII) tail (ventral). (P1-P3) : preanal papillae ; (P4-P9) ; postanal papillae ; (Ph) ; phasmid.

Table 1: Comparisons of the Morphometrics of Three Populations of Aduncospiculum halicti n.gen., n.sp.

Origin	Halictus ligatus from Davis, Calif. (type population)						Halictus farinosus nest from Davis, Calif.			Halictus ligatus from Hightstown, New Jersey			
Culture time	9 days (type specimens) Glycerol		14 days Water		37 days Water		Formalin-glycerol			14 days Water		37 days Water	
Mountant	Stenostomatous	Stenostomatous	Stenostomatous	Eurystomatous	Stenostomatous	Stenostomatous	Eurystomatous	Stenostomatous	Stenostomatous	Stenostomatous	Stenostomatous	Eurystomatous	Stenostomatous
Sex	Female	Male	Female	Female	Female	Male	Female	Female	Male	Female	Male	Female	Male
n	11	11	11	11	11	11	11	11	11	11	11	11	11
L(µm) x±S.D. (range)	1016^{AB} ±64 930-1080	950^{a} ±49 880-1020	1099^{a} ±144 850-1260	976^{a} ±89 770-1070	920^{BC} ±81 830-1080	824^{C} ±137 690-1130	816^{C} ±48 730-890	826^{C} ±82 690-940	738^{b} ±68 600-800	1018^{AB} ±97 880-1140	952^{a} ±97 820-1110	805^{C} ±113 670-1020	838^{C} ±111 720-1030	770^{b} ±59 700-900
Body diam. (µm)	56^{BCD} ±6 47-65	53^{bc} ±7 43-64	71^{A} ±10 54-84	63^{ABC} ±9 52-78	55^{CD} ±12 43-76	41^{d} ±5 34-48	60^{ABCD} ±6 48-70	64^{ABC} ±10 48-80	50^{C} ±6 42-57	69^{AB} ±9 59-85	63^{a} ±8 49-77	51^{b} ±14 35-75	54^{CD} ±9 42-67	41^{d} ±4 35-48
a	166^{ABC} ±6 153-173	158^{ab} ±2 154-160	162^{a} ±7 154-182	172^{AB} ±11 163-193	164^{ABC} ±9 150-177	155^{ab} ±9 140-168	178^{A} ±9 163-188	161^{C} ±19 136-190	151^{b} ±10 136-170	170^{ABC} ±9 154-183	162^{a} ±7 151-175	178^{A} ±12 157-197	163^{BC} ±11 150-183	164^{a} ±12 150-190
Tail (µm)	133^{A} ±4 127-140	109^{Ab} ±4 101-113	144^{A} ±15 126-168	120^{a} ±5 109-126	117^{B} ±10 100-133	118^{B} ±11 103-133	97^{C} ±8 83-110	95^{C} ±10 80-106	83^{C} ±12 67-100	133^{AB} ±13 118-153	111^{ab} ±10 100-122	101^{C} ±8 92-108	103^{C} ±23 67-130	99^{b} ±15 69-130
a	18^{A} ±1 16-20	18^{ab} ±2 15-21	15^{B} ±2 13-19	17^{bc} ±1 16-19	15^{BCD} ±1 13-16	15^{B} ±2 13-19	13^{CD} ±1 12-15	13^{D} ±1 12-15	15^{C} ±2 13-19	15^{BC} ±2 13-18	15^{C} ±1 14-17	16^{AB} ±3 14-19	16^{B} ±1 14-17	19^{a} ±2 16-21
b	6.1^{A} ±0.3 5.7-6.7	6.8^{A} ±0.3 5.6-6.5	6.8^{A} ±0.5 5.6-7.5	6.0^{AB} ±0.5 5.0-6.6	5.2^{B} ±0.3 4.6-5.9	5.0^{BCD} ±0.7 4.2-6.5	4.6^{CD} ±0.3 4.2-5.0	5.2^{B} ±0.6 4.4-6.0	5.0^{B} ±0.4 4.3-5.5	6.0^{A} ±0.4 5.4-6.7	5.9^{a} ±0.4 5.3-6.5	4.5^{D} ±0.4 3.9-5.3	5.1^{BC} ±0.4 4.6-5.6	4.8^{b} ±0.3 4.1-5.2
c	7.6^{BC} ±0.5 6.7-8.4	8.7^{ABC} ±0.8 8.2-9.4	7.7^{ABC} ±0.8 6.7-9.5	8.1^{bc} ±0.5 7.1-8.8	7.4^{ABC} ±0.4 7.3-8.4	7.0^{C} ±0.7 6.2-8.5	7.0^{C} ±0.6 6.8-8.6	7.5^{C} ±0.6 6.8-8.6	8.4^{A} ±0.5 7.5-8.9	8.7^{A} ±1.0 7.9-10.5	9.3^{A} ±1.3 7.7-11.5	7.7^{ABC} ±0.5 6.8-8.6	8.6^{ab} ±0.5 7.7-9.1	7.9^{ABC} ±0.7 7.1-9.6	8.4^{AB} ±1.4 6.9-10.9	8.0^{bC} ±1.2 5.8-10.4
v	53^{D} ±1 52-56	- - - -	54^{BCD} ±2 50-56	- - - -	55^{ABCD} ±1 53-56	54^{CD} ±1 52-56	- - - -	56^{A} ±1 54-57	56^{AB} ±1 54-56	- - - -	- - - -	55^{ABC} ±3 51-60	56^{A} ±1 54-58	56^{A} ±1 55-58	- - - -
Stoma length (µm)	9^{CD} ±1 8-11	8^{b} ±1 7-8	8^{ab} ±1 7-9	8^{ab} ±1 6-10	12^{A} ±1 10-14	9^{B} ±1 8-11	9^{B} ±1 8-10	11^{B} ±1 8-13	9^{B} ±1 7-10	10^{BC} ±1 8-11	9^{a} ±1 8-10	12^{A} ±1 11-13	8^{D} ±1 7-9	8^{b} ±1 7-10
Stoma width (µm)	4^{BC} ±1 4-5	4^{a} ±1 3-4	4^{BC} ±1 4-5	4^{a} ±1 3-4	11^{A} ±1 10-13	4^{C} ±1 3-4	4^{B} ±1 3-4	12^{A} ±1 11-13	4^{BC} ±1 3-5	5^{B} ±1 4-6	4^{a} ±1 3-5	12^{A} ±1 10-13	4^{BC} ±1 3-5	4^{a} ±1 3-5
Stoma L/W ratio	2.2^{AB} ±0.2 1.7-2.4	2.1^{b} ± 0.1 1.9-2.2	1.9^{B} ±0.2 1.5-2.2	2.2^{ab} ±0.3 1.9-2.6	1.1^{C} ±0.1 0.8-1.3	2.4^{A} ±0.4 1.8-3.0	2.5^{a} ±0.3 2.1-3.0	0.9^{C} ± 0.1 0.7-1.1	2.1^{B} ±0.2 1.9-2.4	2.1^{B} ±0.2 1.7-2.4	2.3^{ab} ±0.3 1.8-2.8	2.3^{ab} ±0.3 1.8-2.6	1.0^{C} ±0.1 0.9-1.2	2.1^{AB} ±0.3 1.8-2.5	2.1^{b} ±0.1 1.5-2.9
Spicule (µm)	- - - -	- - - -	38^{ab} ±1 36-40	- - - -	- - - -	37^{ab} ±2 33-42	- - - -	- - - -	36^{ab} ±2 33-38	- - - -	37^{ab} ±2 32-39	- - - -	- - - -	38^{b} ±2 33-39

Aduncospiculum halicti n. gen., n. sp.

(Figs 1-5)

Measurements and description

Female

Stenostomatous form (Holotype): L = 1.08 mm; W (width) = 65 µm; a = 17; E (distance from anterior end to esophago-intestinal junction) = 170 µm; b = 6.4; tail = 134 µm; c = 8.1; c′ = 4.1; V = 53%.

Body cylindrical, tapered anteriorly. Cuticle with prominent longitudinal and fine transverse striations. Prominent longitudinal striations begin about 20 µm behind anterior-end. Six lips, each with apical papilla. Amphidial apertures circular. Stoma cylindrical, 9 µm deep, 4 µm wide, length/width ratio = 2.3 (see Table 1 for variation in type specimens), cheilostome shallow, prostome distinct with six prorhabdions, mesostome distinct, dorsal pro- and mesorhabdions shorter than subventral ones, dorsal metarhabdion with large tooth, distal part of tooth protrudes into prostome, subventral telorhabdions sclerotized. Pro- and metacorpus muscular, with sclerotized lining, postcorpus glandular, without valve. Cardia visible. Nerve ring near midisthmus, excretory pore at level of esophago-intestinal junction. Ovaries paired, reflexed, nearly meeting at vagina. Vulva with two flaps. Reniform "spermatheca" (38 × 22 µm) at junction of ovaries. Anus dome-shaped in ventral view, followed by refractile protruberance. Phasmids visible in some specimens, 1/3 of tail length behind anus. Tail conoid with acute terminus.

Eurystomatous form, (see Table 1 for measurements): Cuticles, esophagi, paired ovaries, "spermathecas", vulvas, anuses, and tail shapes are identical in stenostomatous and eurystomatous females. Head end broad and flattened, with six labial papillae, amphids obscure. Stoma barrel-shaped, *ca* 12 µm deep, *ca* 12 µm wide, length/width ratio *ca* 1.0 (see Table 1 for variation). Cheilostome not visible, twelve distinct prorhabdions in prostome, mesostome distinct, small denticles sometimes visible on subventral mesorhabdions, dorsal metarhabdion with large tooth, subventral metarhabdions, each with medium sized tooth anteriorly, and with a denticle posteriorly, telorhabdions not visible.

Male

(Allotype): L = 1.00 mm; W = 57 µm; a = 18; E = 158 µm; b = 6.3; tail = 109 µm; c = 9.2; c′ = 3.0; spicule = 36 µm. Adult male and stenostomatous female cuticular features and cephalic regions similar. Gonad reflexed apically,

reflex *ca* 96 µm long. Spicules, amber colored, paired, and arcuate with distal tip hooked. Gubernaculum amber colored, complicated, 20 µm long. Nine pairs of pre and postanal papillae ; two pairs subventral preanal papillae (P 1 and P 2), one pair lateral preanal papillae (P 3), one pair subventral postanal papillae (P 4), one pair lateral postanal papillae (P 5), cluster of three pairs of ventral papillae (P 6-P 8), and one pair subdorsal postanal papillae (P 9). Phasmids usually anterior and dorsal to P 5, in some specimens posterior and dorsal to P 5.

Tail conoid, with spicate terminus, terminus variable in length (20-32 µm long), bursa not present.

Dauer juvenile (JIII)

(n = 20 : L = 337-443 µm (389 ± 26) ; W = 13-28 µm (17 ± 3) ; a = 20-31 (24 ± 3) ; E = 100-124 µm (114 ± 5) ; b = 3.0-4.0 (3.4 ± 0.3) ; distance anterior end excretory pore = 75-95 µm (85 ± 9) ; tail = 50-60 µm (55 ± 3) ; c = 6.2-8.0 (7.0 ± 0.5) ; gonad length = 10-14 µm (12 ± 1) ; c' = 3.2-6.1 (4.6 ± 0.8).

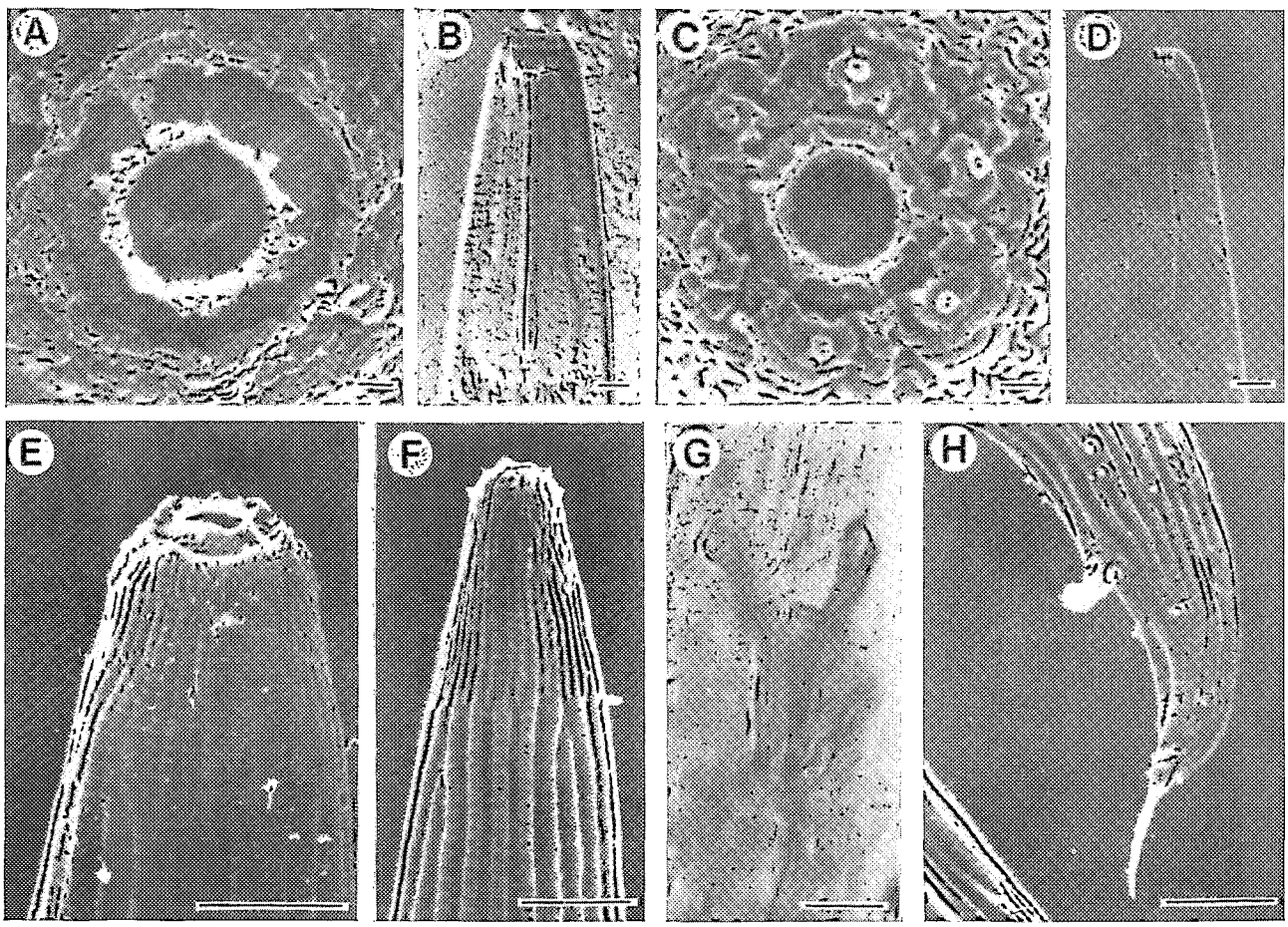

Fig. 2. *Aduncospiculum halicti* n. gen., n. sp. (A, C, E, F, H : SEM photomicrographs ; B, D, and G : photomicrographs). A : Face view (eurystomatous female) ; B : Cephalic region (eurystomatous female) ; C : Face view (stenostomatous female) ; D : Cephalic region (stenostomatous female) ; E : Cephalic region (eurystomatous female) ; F : Cephalic region (stenostomatous female) ; G : Spicules (ventral) ; H : Male tail (subventral. See Figure 1 for legend. (A, C : bar = 1 µm) (B, D, E, F, G, H : bar = 10 µm).

TYPE MATERIAL

Holotype (female) : Collected 25 April 1980 by Robin M. Giblin. Deposited at the University of California, Davis (UCNC 2029). Paratypes same data as holotype. Deposited at the University of California, Davis ; USDA Nematode Collection, Beltsville, Maryland ; Nematology Department, Rothamsted Experimental Station, Harpenden Herts., England ; Lab. voor Nematologie, Binnehaven 10, Wageningen, Netherlands (at least 1 male and 1 female each location).

TYPE HABITAT

Associated as dauer juveniles (JIII) in the Dufour's gland of a reproductive female of *Halictus ligatus* Say from Davis, Yolo County, California.

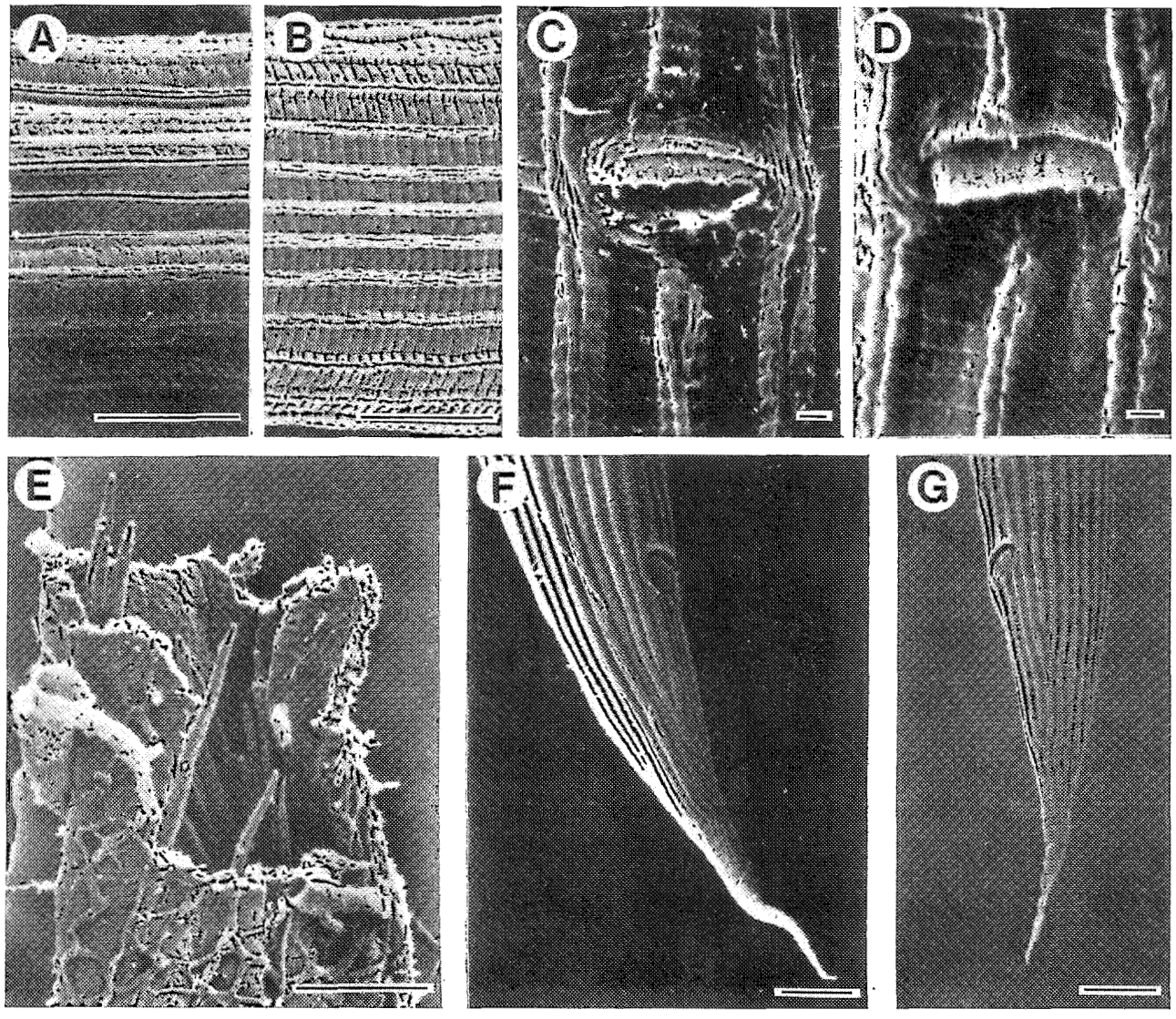

Fig. 3. *Aduncospiculum halicti* n. gen. sp. (SEM photomicrographs). A : Cuticle (eurystomatous female) ; B : cuticle (stenostomatous female) ; C : Vulva (eurystomatous) (ventral) ; D : Vulva (stenostomatous) (ventral) ; E : Dufour's gland of *Halictus ligatus*, opened to expose dauer juveniles (JIII) of *A. halictus* ; F : Tail (eurystomatous female) (lateral) ; G : Tail (stenostomatous female) (lateral). (C, D : bar = 1 µm) (A, B, F, G : bar = 10 µm) (E : bar = 100 µm).

TYPE CULTURE

Type specimens harvested from a nine day old type culture grown on *Candida membranaefaciens* on PDA at 25°.

Biology of *A. halicti* n. sp.

A. halicti n. sp. developed from J 2 to adult in four days on *Escherichia coli* on nutrient agar (NA) at 25° and generation time (J 2-J 2) was *ca* eight days (Giblin, unpub. obs.). *A. halicti* n. sp. was successfully cultured on *E. coli* on NA and/or pollen plates (Giblin, Kaya & Brooks, 1981), *Saccharomyces cerevisae* on PDA (Giblin, unpub. obs.), and *C. membranaefaciens* on PDA. Qualitatively, *A. halicti* n. sp. grew and reproduced best on *C. membranaefaciens* on PDA (Giblin, unpub. obs.).

Dauer juveniles (JIII) of *A. halicti* n. sp. have been recovered from free flying adult bee hosts (in the Dufour's glands of adult females (Fig. 3 E) and in the penises and/or genital capsules of adult male bees), in the brood cells of *Halictus* containing the pupal, pharate adult or new adult, and/or in older cultures (Giblin & Kaya, 1983 *b*). JIIIs are morphologically distinct from the J 3 stage. The JIII has a dome-shaped head, the stoma is collapsed anteriorly, the esophagus and intestine are less distinct than in propagative forms of *A. halicti* n. sp., and the exsheathed cuticle of the previous molt is usually retained (Figs 1 F-G).

A. halicti n. sp. persist as JIIIs in the Dufour's gland of overwintering female bees. In the spring, these infested Halictine queens probably deposit the JIII stage of the nematode in the cell lining of newly constructed cells, where the JIIIs molt through to adults and propagate on organisms, such as yeasts, which contaminate the bee cell. Dauer juveniles begin to appear in the cells concurrent with the pupal stage of the bee and migrate into emerging adult workers or reproductive females or male bees. *A. halicti* n. sp. is distributed throughout much of North America with its bee hosts (*Halictus* spp.) (Giblin & Kaya, 1983 *b*).

The mating of eurystomatous females and stenostomatous males produced 50% stenostomatous females and 50% stenostomatous males at eighteen days and produced 1% adult eurystomatous females, 53% stenostomatous females and 46% stenostomatous males at 24 days. On the average, crosses of stenostomatous females and males produced 54% stenostomatous females and 46% stenostomatous males at eighteen days, and produced 2% adult eurystomatous females, 48% stenostomatous females and 50% stenostomatous males at 24 days.

These results demonstrate that the eurystomatous form, which appears only in adult females, is indeed *A. halicti* n. sp. and is present in low proportions as cultures age. *Mesodiplogaster lheritieri* (Maupas, 1919) Goodey, 1963, *M. maupasi* (Potts, 1910), Goodey, 1963 and *Koerneria hylobii* (Fuchs, 1915) Meyl, 1961 also have two different stomatal forms. Goodey (1963) reports that buccal cavity dimorphism is peculiar to *Mesodiplogaster*. We suggest, in light of the low proportions of eurystomatous forms of *A. halicti* n. sp. produced in culture, that stomatal dimorphism in diplogasterids may be more common than previously believed.

Comparisons of Biometrics of *A. halicti* n. sp.

Comparisons of biometrics of the two different cultured populations, type specimens and *A. halicti* n. sp. from the nests of *Halictus farinosus* are presented in Table 1.

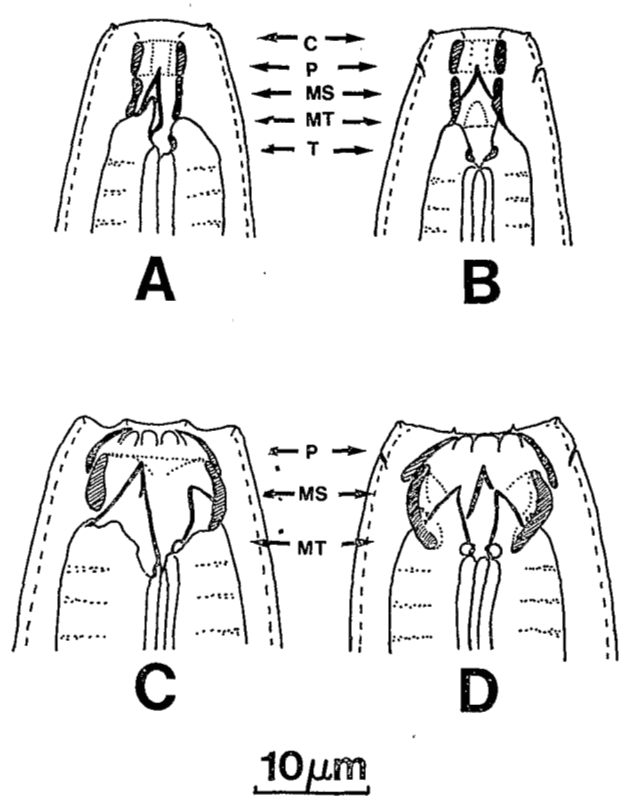

Fig. 4. Stomatal forms of *Aduncospiculum halicti* n. gen., n. sp. A : Stenostomatous female (lateral) ; B : Stenostomatous female (ventral) ; C : Eurystomatous female (lateral); D : Eurystomatous female (ventral). (C) : cheilorhabdion ; (P) : prorhabdion ; (MS) : mesorhabdion ; (MT) : metarhabdion ; (T) : telorhabdion.

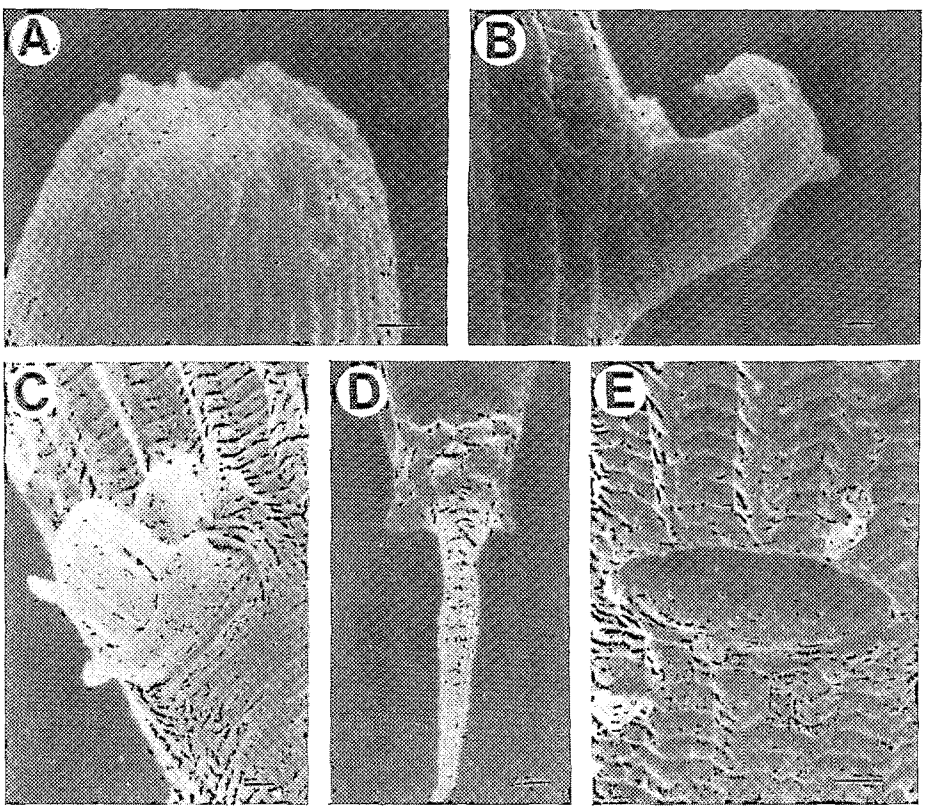

Fig. 5. *Aduncospiculum halicti* n. gen., n. sp. (SEM photomicrographs). A : Female head showing circular amphid (sublateral) ; B : Distal part of spicule and gubernaculum (lateral) ; C : Distal part of spicule and gubernaculum (subventral) ; D : Tail terminus showing ventral papillae (P6-8), and subdorsal papillae (P9) (ventral) ; E : Female anus (ventral). (A-E : bar = 1 μm).

Eurystomatous females are very similar in morphology (Figs 3 A-D & 3 F-G) and morphometrics to stenostomatous females recovered from 37 day cultures (Tab. 1), except for differences in stomatal morphology. Eurystomatous females always had significantly ($P < 0.01$) wider stomas, and had significantly smaller ($P < 0.01$) stoma length/width ratios than stenostomatous females (Table 1, Figs 2 B & D, 4 A-D).

Stenostomatous males and females of *A. halicti* n. sp. from fourteen days cultures from Davis and Hightstown were significantly longer and wider and had longer tails ($P < 0.01$) than adults from 37 days cultures (Tab. 1). The morphometrics of males and stenostomatous and eurystomatous females of *A. halicti* n. sp. from bee nests were similar to their respective forms from 37 days cultures from Davis and Hightstown, and as above, were significantly different ($P < 0.01$) from male and female nematodes from fourteen days cultures (Tab. 1). Thus, culture time appears to have an effect on the morphometrics of *A. halicti* n. sp.

Even though there were differences between the morphometrics of geographic isolates of *A. halicti* n. sp., mating studies have confirmed that they are all the same species (Giblin & Kaya, 1983 *b*). The morphometrics presented in Table 1 should represent much of the variation present in contemporary populations of *A. halicti* n. sp.

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