

## Morphometrics and SEM Illustrations of Three Species of *Ogma* Southern, 1914 (Nematoda: Criconematidae) from Spain

P. CASTILLO,<sup>1</sup> N. VOVLAS,<sup>2</sup> AND A. GOMEZ-BARCINA<sup>1</sup>

**Abstract:** *Ogma civellae* (Steiner, 1949) Raski & Luc, 1987, *O. cobbi* (Micoletzky, 1922) Siddiqi, 1986, and *O. palmatum* (Siddiqi & Southey, 1962) Siddiqi, 1986 are reported in natural habitats in southeastern Spain. Each is briefly described using light microscopy, and the original descriptions are amplified and supplemented by scanning electron microscopy (SEM) observations. Measurements with standard deviations and SEM illustrations are included for each species and compared with previous data.

**Key words:** morphometry, *Ogma civellae*, *O. cobbi*, *O. palmatum*, plant-parasitic nematode, scanning electron microscopy (SEM), Spain, taxonomy.

In a nematode survey of two natural habitats in southeastern Spain, some of the soil samples contained abundant females of three species of the genus *Ogma* Southern, 1914. These species were identified as *O. civellae* (Steiner, 1949) Raski & Luc, 1987, *O. cobbi* (Micoletzky, 1925) Siddiqi, 1986; and *O. palmatum* (Siddiqi & Southey, 1962) Siddiqi, 1986. Each is typified, among other features, by different cuticular ornamentations, permitting the opportunity for a comparative morphometric and scanning electron microscope (SEM) study.

### MATERIALS AND METHODS

Nematodes were extracted from soil samples by centrifugation. Specimens for light microscope study were killed by gentle heat, fixed in a 4% solution of formaldehyde, then processed to glycerin by Seinhorst's rapid method. Glycerin totomounts were measured with either a precision curvimeter or ocular micrometer at 1,250 $\times$ . Specimens were prepared for SEM by Wergin's methods (10), coated with gold, and observed with a JEOL 50 A stereoscan at 10 kV of accelerating voltage.

### SYSTEMATICS

*Ogma civellae* (Steiner, 1949)  
Raski & Luc, 1987  
(Fig. 1)

**Female:** Morphometrics of 10 females in Table 1. Body stout, almost straight. Body annuli retrorse, each bearing a continuous fringe of spines varying from simple or bifurcate in consecutive rows anterior to vulva, to palmate projections in alternate rows behind vulva (Fig. 1). Lip region with two annuli, first wider than second, 22 (19–24) and 20 (18–21)  $\mu$ m wide, respectively. Lip region consisting of six well-developed pseudolips, submedian lobes absent (Fig. 1C). Vulva located on 5–7th annulus from terminus; vulval lips not prominent, posterior slightly overhanging anterior. Anus indistinct even by SEM, located on fourth annulus from tail terminus.

### Habitat and locality

Specimens collected from mud on the riverbed of the Jandula at Sierra Morena, Andujar, southeastern Spain.

### Remarks

*Ogma civellae* is one of the most widely distributed species of the genus *Ogma*. It was first described (and redescribed) in Beltsville, Maryland, USA (3,9), and subsequently recorded from several hosts in different parts of the world: on african vi-

Received for publication 2 January 1990.

<sup>1</sup> Centro de Investigacion y Desarrollo Agrario, Camino del Purchil s/n, Apartado 2027, 18080 Granada, Spain.

<sup>2</sup> Istituto di Nematologia Agraria, C.N.R., Via G. Amendola 165/A, 70126 Bari, Italy.

The authors thank M. A. Gonzalez Pais for her technical assistance.

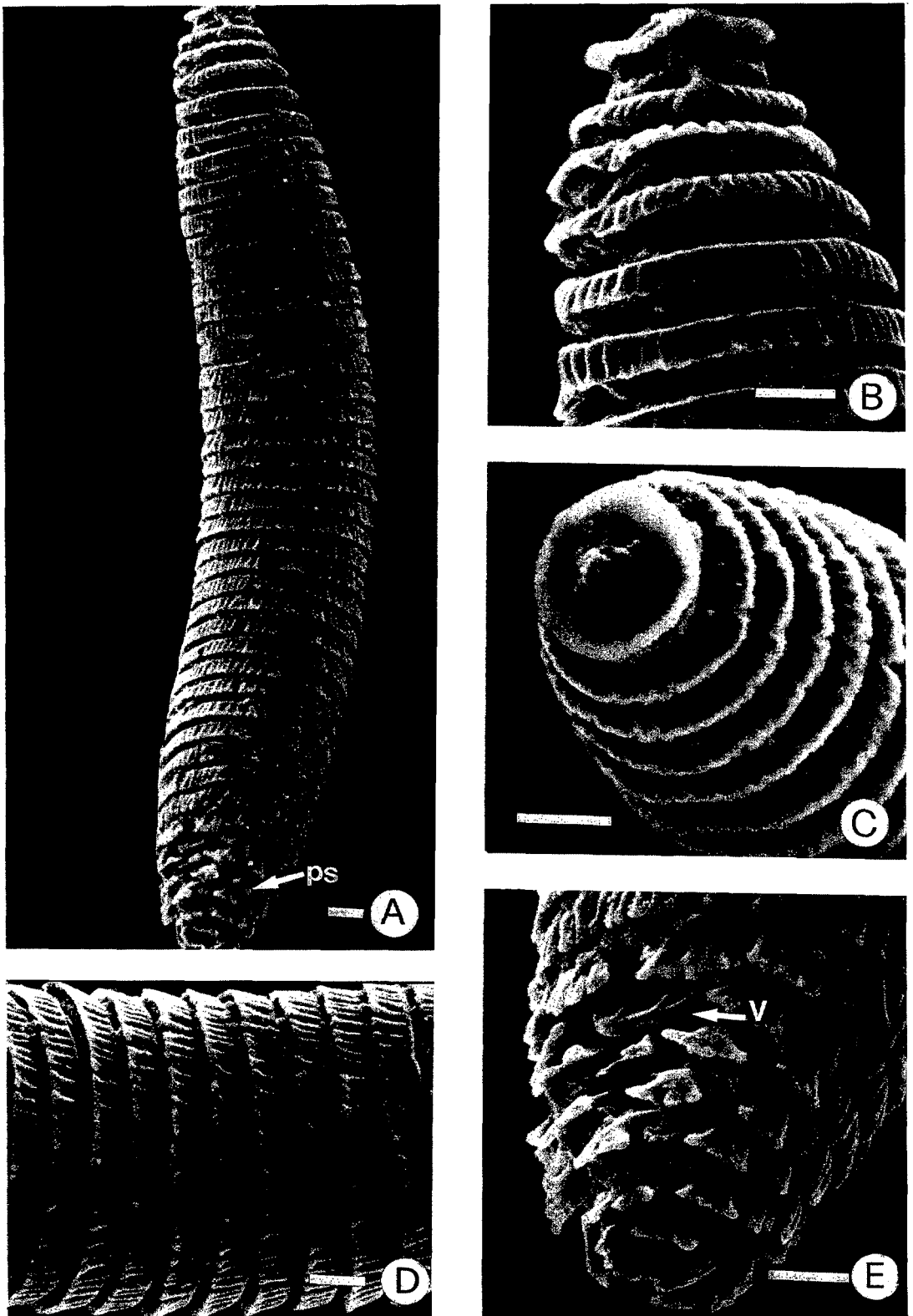


FIG. 1. SEM micrographs of *Ogma civellae*. A) Entire female. B) Anterior body region. C) En face view. D) Detail of annuli at midbody region. E) Posterior body region. Scale bars = 10 μm. ps = posterior spine, v = vulva.

TABLE 1. Morphometrics of 10 *Ogma civellae* females (measurements in  $\mu\text{m}$ ).

|                | Average $\pm$ SD  | Range     | CV % |
|----------------|-------------------|-----------|------|
| L              | 469.8 $\pm$ 66.10 | 397–627   | 14.1 |
| a              | 7.6 $\pm$ 0.99    | 6.6–9.3   | 13.0 |
| b              | 3.6 $\pm$ 0.54    | 3.1–4.7   | 14.8 |
| V              | 91.1 $\pm$ 0.74   | 90–92     | 0.8  |
| G <sub>1</sub> | 57.1 $\pm$ 13.29  | 40–86     | 23.3 |
| c (n = 1)      | 15.7              | —         | —    |
| c' (n = 1)     | 1.0               | —         | —    |
| Stylet         | 82.7 $\pm$ 3.64   | 76–87     | 4.4  |
| Stylet % L     | 17.9 $\pm$ 2.73   | 12.9–20.6 | 15.2 |
| Stylet % Esoph | 62.6 $\pm$ 4.40   | 56.2–69.0 | 7.0  |
| Conus (CP)     | 70.3 $\pm$ 3.71   | 66–78     | 5.3  |
| CP % St        | 85.1 $\pm$ 2.56   | 81.9–89.6 | 3.0  |
| CP % Esoph     | 53.2 $\pm$ 4.51   | 47.9–61.9 | 8.5  |
| R              | 51.8 $\pm$ 1.99   | 48–55     | 3.8  |
| RSt            | 11.6 $\pm$ 1.07   | 10–13     | 9.3  |
| REsoph         | 16.1 $\pm$ 1.73   | 14–18     | 10.7 |
| RB             | 9.8 $\pm$ 0.79    | 9–11      | 8.0  |
| RV             | 5.7 $\pm$ 0.67    | 5–7       | 11.8 |
| RVan (n = 1)   | 3                 | —         | —    |
| Ran (n = 1)    | 4                 | —         | —    |
| VL/VB          | 0.98 $\pm$ 0.10   | 0.9–1.2   | 9.4  |
| Esophagus      | 129.3 $\pm$ 12.15 | 101–144   | 9.4  |
| Nerve ringe    | 106.3 $\pm$ 8.01  | 88–116    | 7.5  |
| Maximum width  | 62.0 $\pm$ 4.88   | 53–67     | 7.9  |

TABLE 2. Morphometrics of 10 *Ogma cobbi* females (measurements in  $\mu\text{m}$ ).

|                | Average $\pm$ SD  | Range     | CV % |
|----------------|-------------------|-----------|------|
| L              | 472.3 $\pm$ 26.64 | 434–508   | 5.6  |
| a              | 11.4 $\pm$ 0.82   | 10.2–12.6 | 7.2  |
| b              | 3.4 $\pm$ 0.21    | 3.0–3.7   | 6.1  |
| V              | 86.2 $\pm$ 0.67   | 85–87     | 0.8  |
| G <sub>1</sub> | 50.1 $\pm$ 3.14   | 45–54     | 6.3  |
| c              | 10.5 $\pm$ 0.30   | 10.2–10.8 | 2.9  |
| c'             | 1.68 $\pm$ 0.04   | 1.6–1.7   | 2.7  |
| Stylet         | 105.2 $\pm$ 2.09  | 103–108   | 2.0  |
| Stylet % L     | 87.8 $\pm$ 1.05   | 86.4–89.8 | 1.2  |
| Stylet % Esoph | 66.0 $\pm$ 2.54   | 63.6–70.3 | 3.8  |
| Conus (CP)     | 92.4 $\pm$ 2.50   | 89–97     | 2.7  |
| CP % St        | 87.8 $\pm$ 1.05   | 86.4–89.8 | 1.2  |
| CP % Esoph     | 66.0 $\pm$ 2.54   | 63.6–70.3 | 3.8  |
| R              | 64.5 $\pm$ 1.35   | 62–66     | 2.1  |
| RSt            | 17.4 $\pm$ 0.84   | 16–18     | 4.8  |
| REsoph         | 21.3 $\pm$ 0.82   | 20–22     | 3.9  |
| RB             | 7.9 $\pm$ 0.87    | 7–9       | 11.1 |
| RV             | 10.9 $\pm$ 0.74   | 10–12     | 6.8  |
| RVan           | 3.2 $\pm$ 0.45    | 3–4       | 14.0 |
| Ran            | 8.0 $\pm$ 0.71    | 7–9       | 8.8  |
| VL/VB          | 1.6 $\pm$ 0.10    | 1.5–1.8   | 6.6  |
| Esophagus      | 140.3 $\pm$ 4.45  | 133–147   | 3.2  |
| Maximum width  | 41.5 $\pm$ 2.07   | 38–44     | 5.0  |
| ABW            | 26.6 $\pm$ 2.07   | 24–29     | 7.8  |
| Tail length    | 45.2 $\pm$ 2.59   | 42–48     | 5.7  |

ollets in Quebec, Canada; on peach and juniper in Nainital and Uttar Pradesh, India; from Iran; in citrus orchards at Yochi and Issinden, Japan; on *Asparagus* sp. at Armenia, USSR; on olive at Fiumefreddo, Italy; and on several cultivated plants and localities from Spain.

In general morphology as well as measurements, these specimens fit well with previous data on *O. civellae*, although they are in the highest range for stylet length, vulva position, and total body annuli. SEM observations agree with those obtained by Ebsary (1).

*Ogma cobbi* (Micoletzky, 1925)

Siddiqi, 1986

(Fig. 2)

*Female*: Morphometrics of 10 females in Table 2. Body straight, tapering slightly toward anterior end and rapidly behind vulva to conoid tail. Lip region with two annuli, 16–17 and 14–15  $\mu\text{m}$  wide, respectively; first collar-like, both with short fringes (Fig. 2A, C, E). Pseudolips six, well developed, submedian lobes absent; oral

disc enclosed by a dorsal and ventral ridge (Fig. 2A, C). Body annuli retrorse, without anastomoses, bearing spines regularly arranged in 12 longitudinal rows. Spines conoid-rounded with smooth surfaces, most are simple, some bifurcated, none trifurcated. Vulva slit-like, closed, with well-developed vulval lips (Fig. 2D, F); located on tenth to twelfth annulus from tail end, anus on seventh to ninth annulus.

#### *Habitat and locality*

Specimens collected around the roots of gall oak (*Quercus faginea* Lam.) at Torre del Vinagre, Sierra de Cazorla, Jaen, Spain.

#### *Remarks*

Measurements as well as general morphology closely conform to the type material and that of Mehta and Raski (7). This SEM study confirms the morphology of spines along body, where only slight differences in length occur between the anterior and posterior regions. Our SEM face view agrees well with that by Loof (6) of

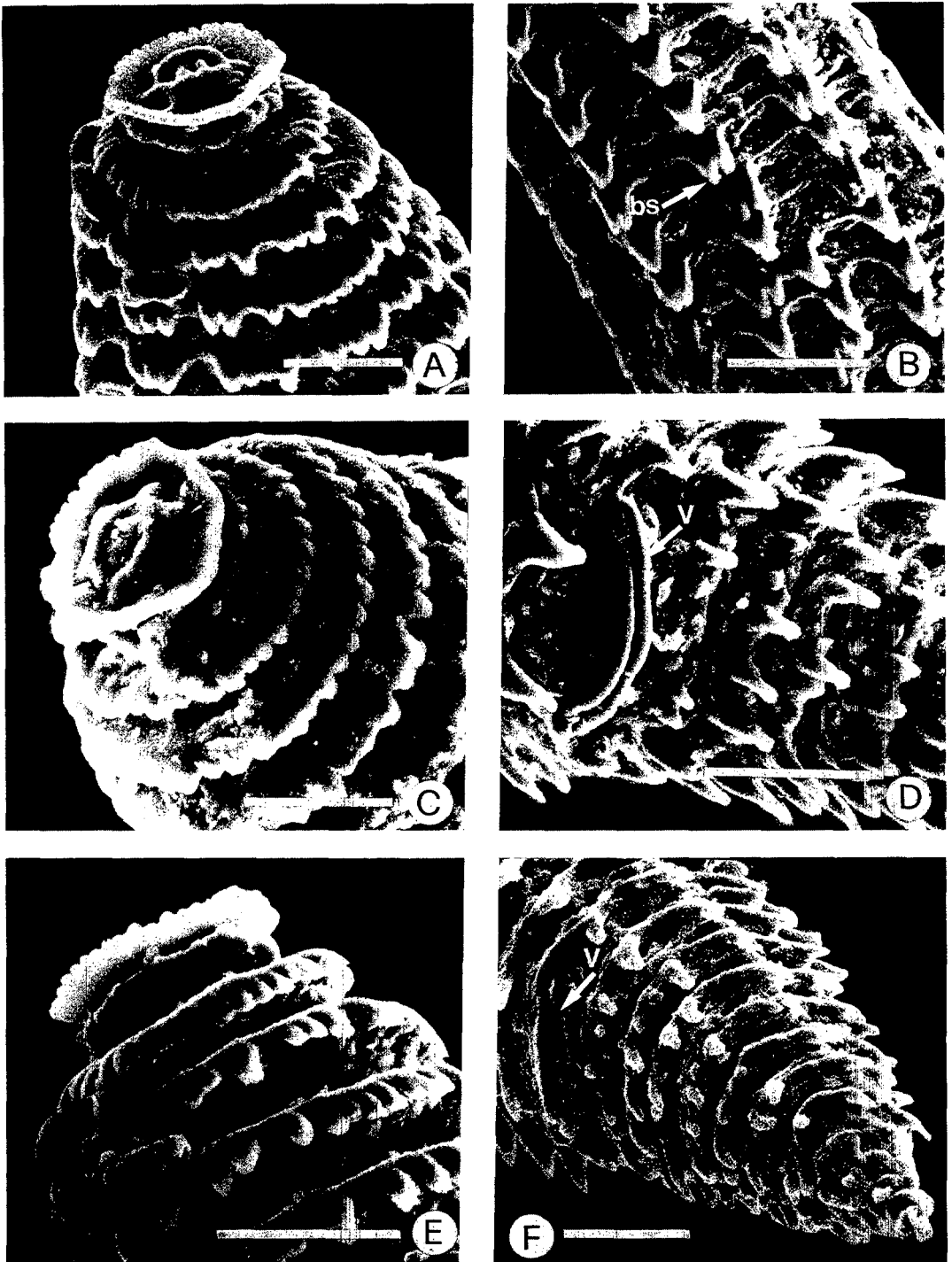


FIG. 2. SEM micrographs of *Ogma cobbi*. A, C) En face view. B) Detail of annuli at midbody region. D, F) Posterior body region. E) Anterior body region. Scale bars = 10  $\mu\text{m}$ . bs = bifurcate spine, v = vulva.

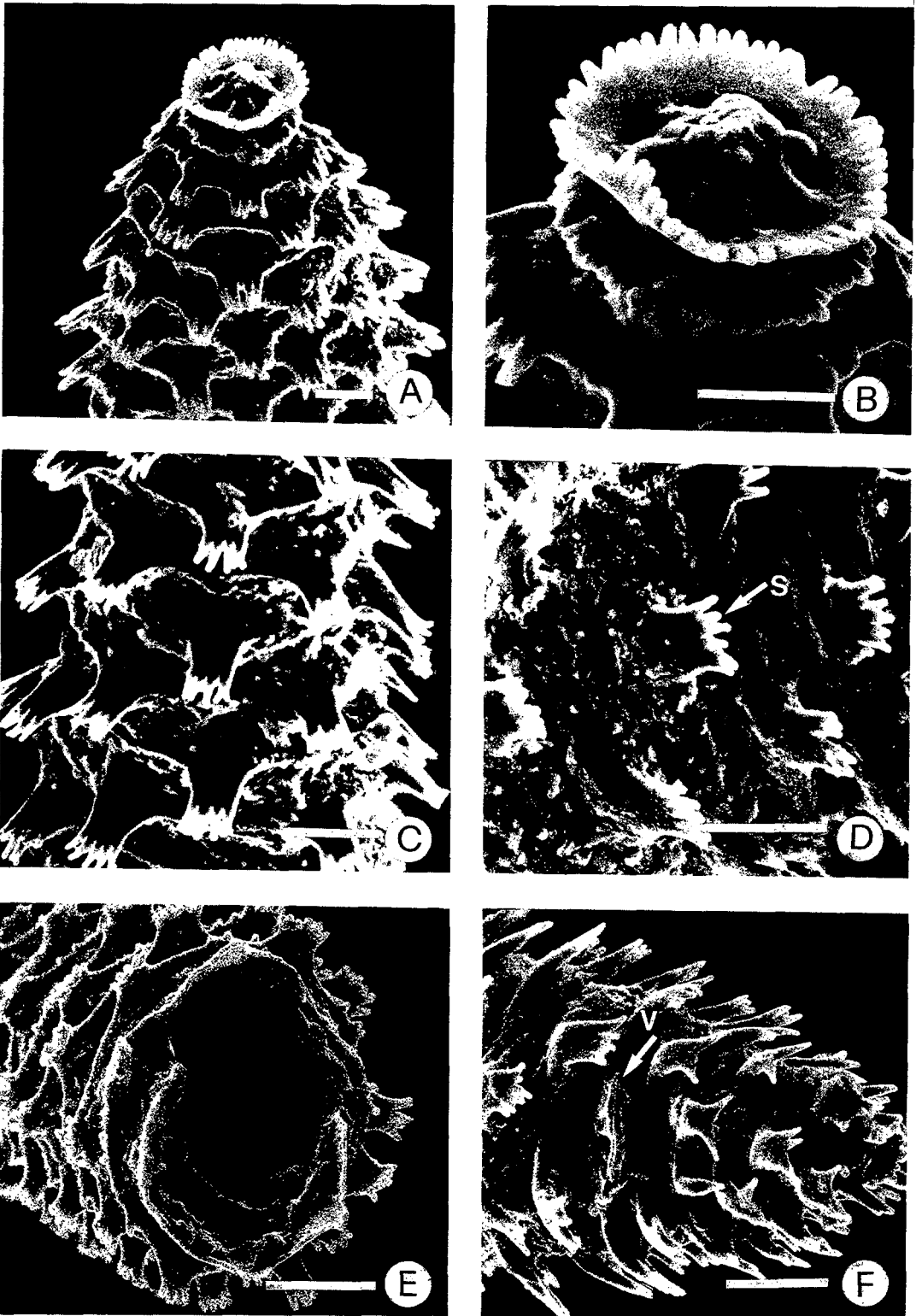


FIG. 3. SEM micrographs of *Ogma palmatum*. A) Anterior body region. B) En face view. C, D) Detail of annuli at midbody region. E) Cross-section at midbody region. F) Posterior body region. Scale bars = 10  $\mu$ m. S = spine, V = vulva.

topotypes from Gribsee, Denmark. Mehta and Raski (7) studied several populations of this species and found great variability in number of rows of spines (11–15). Our specimens have fewer (10–11) longitudinal rows than the topotypes but show the most important feature which characterizes this species; spines mostly simple with only some divided in two projections.

*Ogma cobbi* is distributed in several European countries and North America, but it is not common in any of them. It was recorded by Andrassy in 1987 in Kiskunsag National Park, Hungary, from a mixed oak–poplar grove and wet sandy soil.

*Ogma palmatum* (Siddiqi & Southey, 1962)  
Siddiqi, 1986  
(Fig. 3)

*Female:* Morphometrics of 10 females in Table 3. Body thick, straight or slightly curved ventrally. First annulus forwardly directed, with continuous fringe of short crenations (Fig. 3A, B),  $23 \pm 1.5 \mu\text{m}$  (21–25) wide. Second annulus narrower than first,  $20 \pm 0.9 \mu\text{m}$  (19.5–22) wide, with similar ornamentation. Six well-developed pseudolips present, submedian lobes absent (Fig. 3B). Body annuli retrorse, without anastomoses, each bearing eight rows of spines which alternate regularly with those on adjacent annuli (Fig. 3A, C, D). Spines variable in number and form of projections, with two or three projections (Fig. 3A), to palmate with five or six (Fig. 3D). Spines are wider and longer on posterior than on anterior region (Fig. 3F, A). Vulva slit-like, closed, with short vulval lips (Fig. 3F); located on fifth to seventh annulus from posterior end of body. Anus indistinct even with SEM, when observed, occurring on third or fourth annulus from posterior end.

#### *Habitat and locality*

Same as for *O. civellae*.

#### *Remarks*

This species is quickly identified because of its irregular palmate spines. Measurements as well as general morphology close-

TABLE 3. Morphometrics of 10 *Ogma palmatum* females (measurements in  $\mu\text{m}$ ).

|                | Average $\pm$ SD  | Range     | CV % |
|----------------|-------------------|-----------|------|
| L              | 538.4 $\pm$ 35.46 | 484–594   | 6.6  |
| a              | 9.1 $\pm$ 0.69    | 8.1–10.6  | 7.6  |
| b              | 4.0 $\pm$ 0.29    | 3.6–4.5   | 7.2  |
| V              | 92.2 $\pm$ 1.03   | 91–94     | 1.1  |
| G <sub>1</sub> | 54 $\pm$ 14.92    | 37–78     | 27.8 |
| c (n = 1)      | 25.2              | —         | —    |
| c' (n = 1)     | 0.7               | —         | —    |
| Stylet         | 84.8 $\pm$ 4.61   | 77–91     | 5.4  |
| Stylet % L     | 15.8 $\pm$ 0.88   | 14.5–17.6 | 5.6  |
| Stylet % Esoph | 63.4 $\pm$ 3.83   | 58.8–69.0 | 6.0  |
| Conus (CP)     | 71.7 $\pm$ 4.14   | 65–77     | 5.8  |
| CP % St        | 84.5 $\pm$ 1.21   | 82.5–87.0 | 1.4  |
| CP % Esoph     | 53.6 $\pm$ 3.49   | 49.6–58.8 | 6.5  |
| R              | 51.9 $\pm$ 1.59   | 50–55     | 3.1  |
| RSt            | 10.5 $\pm$ 0.53   | 10–11     | 5.0  |
| REsoph         | 14.5 $\pm$ 1.08   | 13–16     | 7.4  |
| RB             | 10.8 $\pm$ 0.92   | 10–12     | 8.5  |
| RV             | 5.3 $\pm$ 0.48    | 5–6       | 9.1  |
| RVan (n = 2)   | 1.5               | 1–2       | 47.1 |
| Ran (n = 2)    | 3.5               | 3–4       | 20.2 |
| VL/VB          | 1.1 $\pm$ 0.13    | 0.9–1.3   | 11.7 |
| Esophagus      | 133.4 $\pm$ 7.72  | 126–154   | 5.8  |
| Nerve ring     | 107.4 $\pm$ 4.10  | 101–115   | 3.8  |
| Maximum width  | 59.0 $\pm$ 5.89   | 48–65     | 10.0 |

ly conforms with data in the literature (2,5,8). SEM confirmed the notable variations in palmate spines, as noted by Jairajpuri (5), even within a specimen. SEM observations of the face agree with those by De Grisse and Lagasse (4) who first demonstrated the absence of submedian lobes and the presence of six pseudolips. As also found by Mehta and Raski (7), *O. palmatum* commonly occurred in large numbers with *O. civellae* in the same sample. The species has a world-wide distribution, but it is not common. Since 1971 it has been recorded only by Bello, Coiro and Rey on grape in Cembra, Trentino, Italy in 1988.

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