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A new species of sea-anemone in the genus *Paranemonia* Carlgren (Anthozoa, Actiniaria) from the Aegean Sea

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Paranemonia vouliagmeniensis sp.n. is described from Vouliagmeni lake, a land-locked, brackish water lake near the Saronikos Gulf, Greece. It differs from *Paranemonia cinerea* (Contarini, 1844) in being viviparous and in the size range of the nematocysts.

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Introduction

In 1984 an extensive collection of sea-anemones from the Aegean Sea was made by one of the authors (C. Chintiroglou) and most of these have been described by Doumenc *et al.* (1985). In addition, in the neighbourhood of the Saronikos Gulf (Greece) there is an unusual lake derived from sea water in which an undescribed species of anemone is abundant, the subject of the present paper.

Vouliagmeni Lake was formed during an earthquake (about 2000 years ago) when the ceiling of a cavern, excavated by underground warm water, collapsed. It is characterised by hydrogen sulphide-rich mud (Papapetrou-Zamanis 1969). The lake is 260 m long and 145 m wide. Its average depth is 11 m and the greatest 90 m (underwater cavern). There is no evident communication between the lake and the sea, but the as yet unknown underwater cavern could be the place of water exchange. The temperature varies between 22.5 and 24.9°C and the salinity is about 14.5‰. Water movement is minimal, except in the cavern. The substrate consists of mixed calcareous deposits and gravel with sandy and muddy sediments. The mud releases hydrogen sulphide. For these reasons (stability of temperature, hydrogen sulphide) the Vouliagmeni Lake is a well known tourist and therapeutic place.

The sea-anemone found in this lake is shown here to belong to the genus *Paranemonia* Carlgren, 1900. It differs from *P. cinerea* (Contarini, 1844) in being viviparous (large embryos found in the tentacles) and in the size range of the nematocysts.

Description

Paranemonia Carlgren, 1900

Definition. Actiniidae with broad pedal disk. Column smooth, low. Margin and fosse present or absent. Sphincter sometimes absent otherwise endodermal, diffuse. Tentacles long, in comparison to body height, may or may not be retractile; longitudinal muscles and radial muscles of oral disk ectodermal. Siphonoglyphs 0–2. Mesenteries regularly or irregularly arranged with at least the first two cycles perfect. Stronger mesenteries fertile, with possible exception of the directives (when present). Mesenteries of younger cycles grow from base upwards toward margin so that there are more mesenteries at the base than at the margin, especially in older specimens.

Retractor muscles diffuse, weak. Parietobasilar muscles diffuse. Basilar muscles well developed.

Cnidome: spirocysts, basitrichs and microbasic amastigophores (p-rhabdoids A, *sensu* Schmidt).

Type species. Anemonia cinerea Contarini, 1844 (by monotypy).

Remarks. Paranemonia was defined by Carlgren (1900) as having considerably more mesenteries at the base than at the margin. Schmidt (1972: 74), however, has shown that in the type species *P. cinerea* the mesenteries grow from the base upwards, although occasionally in individual specimens the number of mesenteries is the same at the base and margin. It is possible that sexually reproduced individuals may at first have the same number of mesenteries proximally and distally. If later the number of mesenteries at the base increases faster than that at the margin, a difference between base and margin of up to a complete cycle may result.

The presence of an endodermal sphincter suggests that a margin and fosse are likely features of this genus, but in full expansion both margin and fosse may disappear. It is therefore considered that the presence or absence of a margin and fosse is not of generic importance, though reference to it is now included in the definition.

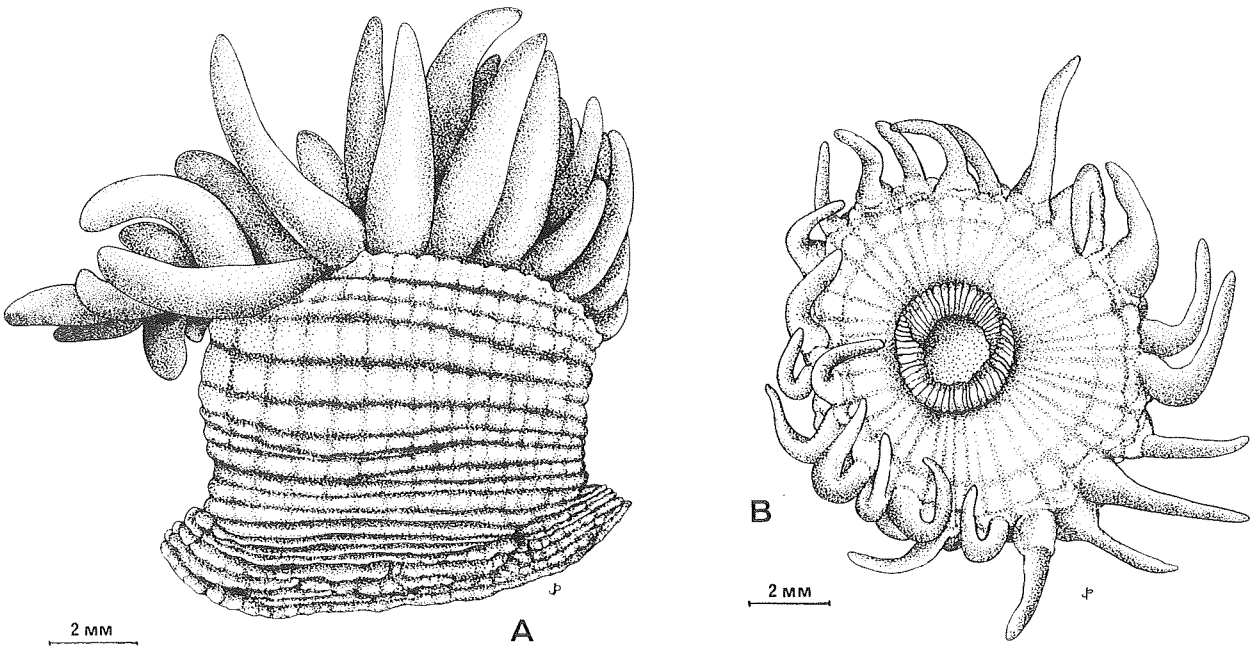

Fig. 1. Paranemonia vouliagmeniensis sp.n.—*A*. Column and tentacles.—*B*. Oral disk.

Although *P. cinerea* habitually reproduces by longitudinal fission, it also appears to be dioecious and oviparous (Schmidt 1972: 75). Whether a species reproduces fissiparously, oviparously or viviparously is considered a specific and not a generic character.

In summary, the definition of the genus has been amended to reflect both the presence or absence of a distinct margin and fosse and the regular and irregular arrangement of the mesenteries.

Paranemonia vouliagmeniensis sp.n. (Figs. 1–3)

Type material. Holotype, 31 Oct. 1984, Vouliagmeni Lake (Greece): in Muséum National d'Histoire Naturelle, Paris (MNHN-Cat. no. 389). Paratypes, 3 specimens, 31 Oct. 1984: 2 of which in MNHN (Cat. nos. 404–405) and 1 in British Museum (Natural History) (Cat. no. 1986.3.1.1).

Description (Fig. 1)

Column short, smooth. Margin distinct, slightly crenulate in contraction, without spherules; fosse shallow. Disk flat with mouth raised on a definite cone. Tentacles, inner longer than outer; tapered.

Anatomy (Fig. 2). Sphincter diffuse endodermal, strong (Fig. 2A). Tentacle muscles ectodermal (Fig. 2B). In large specimens the mesenteries are hexamerously arranged in 3–4 cycles, at least 12 pairs perfect with up to the first three cycles fertile, except perhaps the directives. In young specimens gonads and filaments may occur on the first cycle only. Mesenteries of the fourth cycle, when present, are to be found in all stages of development, from small gussets of tissue at the limbus to extending partly up the column and others reaching the margin; pairs of the latter with or without associated tentacles. Filaments absent from fourth cycle. The relation of tentacles to the number of mesenteries at the base found in the five specimens examined is given in Table I. Retractor muscles diffuse, weak; parietobasilar muscles weak with the inner edge free from the mesentery (Fig. 2C), basilar muscles well developed. Two prominent siphonoglyphs present supported by directives. The species is viviparous (Fig. 2D). One specimen contained many embryos in the enteron and in the tentacles at all stages of development, from little more than a sphere of cells to an individual with 12 tentacles.

Cnidome (Table II and Fig. 3). Fig. 3 represents the nematocyst signature of this species. The heterotrichs of the column are confined to the region of the limbus and probably serve a purpose similar to that of the acrorhagi (marginal spherules) of various genera of Actiniidae, e.g. *Actinia*.

Colour. Disk and tentacles pale green or delicate pink, central part of disk orange to orange-brown. Column orange and light brown.

Size. Average height 0.9 cm; average diameter 0.6 cm.

Distribution. Recorded only from Vouliagmeni Lake, East of Saronikos Gulf, Aegean Sea (Greece).

Table I. *Relation of the number of tentacles to the number of mesenteries at the base in* Paranemonia vouliagmeniensis *sp.n.*

Tentacles	No. of mesenteries at base	Difference
40	40	0
52	76	24
52	80	28
58	76	18
57 + 7*	88	24

* 7 apparent spherules here counted as tentacles.

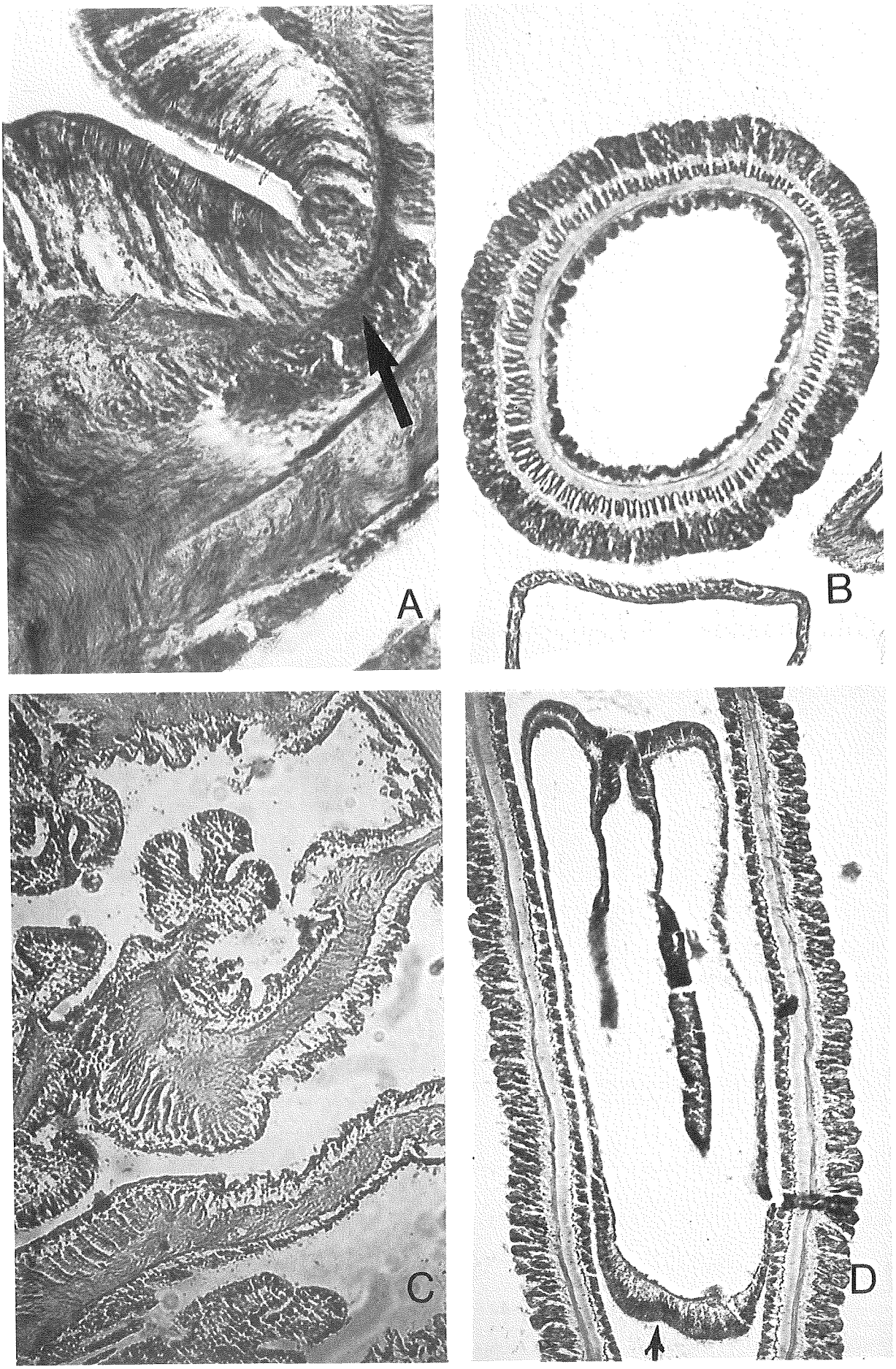

Fig. 2. Paranemonia vouliagmeniensis sp.n.—*A*. Vertical section showing diffuse endodermal sphincter (*arrow*).—*B*. Transverse section of tentacle.—*C*. Transverse section of mesenteries, showing diffuse retractor muscles and parietal muscles.—*D*. Vertical section of tentacle with enclosed embryo; *arrow* indicating aboral part.

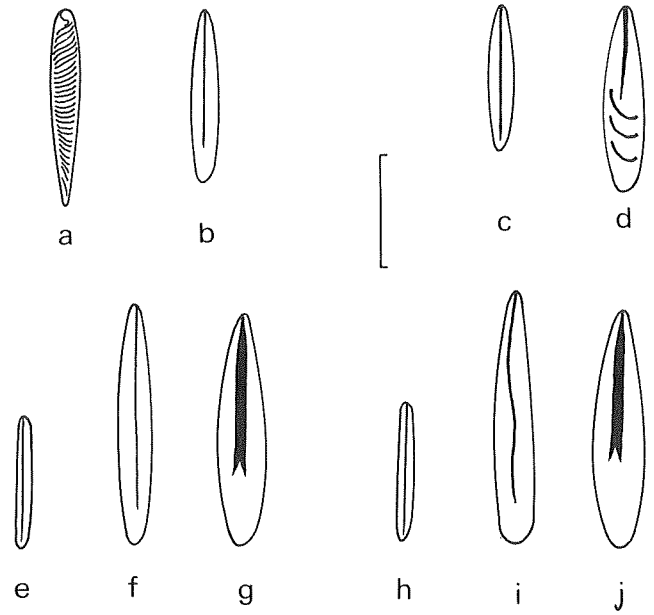

Fig. 3. Paranemonia vouliagmeniensis sp.n. (nematocyst signature) (see also Table II).—*a–b*. Tentacle.—*a*. Spirocyst.—*b*. Basitrich.—*c–d*. Column.—*c*. Basitrich.—*d*. Heterotrich (lower column only).—*e–g*. Actinopharynx.—*e*. Basitrich.—*f*. Basitrich.—*g*. Microbasic amastigophores.—*h–j*. Filament.—*h*. Basitrich.—*i*. Basitrich.—*j*. Microbasic amastigophore.
Scale 10 μm.

Table II. *Size ranges of cnidae (in μm) of three specimens of* Paranemonia vouliagmeniensis *sp.n.*

Location/cnidae	Holotype	Paratype MNHN 404	Paratype BHMH 1986.3.1.1
Tentacles			
Spirocysts	12.6–23.8 × 2.0–3.3	10.0–26.5 × 2.6–3.3	14.0–23.8 × 2.6–3.3
Basitrichs	12.6–20.0 × 2.0–2.6	10.0–17.9 × 2.0–2.6	10.6–20.0 × 2.0–2.6
Column			
Basitrichs	11.3–15.2 × 2.0	10.0–13.3 × 2.0–2.6	12.6–16.6 × 2.0–2.6
Heterotrichs*	13.3–21.2 × 3.3–4.6	16.6–20.0 × 3.3–4.0	18.5–23.8 × 3.3–4.6
Actinopharynx			
Basitrichs (1)	10.6–15.2 × 2.0–2.6	10.6–13.2 × 2.0–2.6	10.0–13.3 × 2.0
Basitrichs (2)	18.5–25.8 × 2.6–3.3	18.5–23.2 × 2.6–3.0	16.6–25.2 × 2.6
Microbasic amastigophores	20.0–23.8 × 4.0	19.2–23.2 × 4.0–4.6	20.0–25.2 × 3.3–4.0
Filaments			
Basitrichs (1)	10.0–15.9 × 2.0	10.6–14.0 × 2.0	12.0–13.3 × 2.0
Basitrichs (2)	20.5–26.5 × 4.0–4.6	21.8–27.8 × 4.0–4.6	21.2–26.5 × 4.0–4.6
Microbasic amastigophores	18.5–23.2 × 4.0–4.6	20.0–23.2 × 4.0	20.0–23.8 × 3.3–4.6

* Heterotrichs occur near the limbus only.

Table III. *Comparison of cnida size ranges between* Paranemonia cinerea *(Contarini) and* P. vouliagmeniensis *sp.n.*

Location/cnidae	*P. cinerea* (Carlgren 1945)	*P. cinerea* (Schmidt 1972)	*P. vouliagmeniensis* (overall range; 3 specimens examined)
Tentacles			
Spirocysts	23.0 × 2.8	15.6–28.6 × 2.6–3.9	10.0–26.5 × 2.0–3.3
Basitrichs	25.4–35.2 × 2.8–3.5	26.0–32.5 × 2.6–3.8	10.0–20.0 × 2.0–2.6
Column			
Basitrichs	12.0–14.9 × 2.0–2.6	13.0–18.2 × 2.0–3.3	10.0–16.6 × 2.0–2.6
Heterotrichs			13.3–23.8 × 3.3–4.6
Actinopharynx			
Basitrichs (1)	24.0–35.2 × 3.5–4.2	20.8–28.5 × 2.3–2.6	10.6–15.2 × 2.0–2.6
Basitrichs (2)	24.0–35.2 × 3.5–4.2	20.8–28.5 × 2.3–2.6	16.6–25.8 × 2.6–3.3
Microbasic amastigophores	19.7–21.1 × 4.2–5.0	16.9–19.5 × 3.9–5.2	19.2–25.2 × 4.0
Filaments			
Basitrichs (1)		9.1–10.4 × 2.0–2.6	10.0–15.9 × 2.0
Basitrichs (2)	28.2–35.2 × 3.5–5.5	26.3–32.5 × 3.3–3.9	20.5–27.8 × 4.0–4.6
Microbasic amastigophores	16.9–21.8 × 3.5–4.2	18.2–22.1 × 3.9–6.5	18.5–23.8 × 4.0–4.6

Discussion and ecological remarks

One specimen (paratype) has seven apparent spherules on or near the margin, one of which is tentaculate with a bifurcated tip. However, the nematocysts of these spherules are of the same types and size ranges as those of the tentacles. The types and size ranges of nematocysts found in the remainder of this specimen are the same as those for the other specimens without spherules. All other characters agree. It is thus considered that this specimen is aberrant. The presence of a smooth column and margin and more mesenteries proximally than distally suggests that this species is referable to *Paranemonia*. The presence of a diffuse sphincter and the stronger mesenteries being fertile are also consistent with the definition of that genus. The viviparous reproduction and the regular anatomy of specimens are not consistent with the type species *P. cinerea*. In addition, the size ranges of the basitrichs in the tentacles and filaments are much smaller than those in *P. cinerea* (cf. Table III). It is therefore considered that the present material is not conspecific with the latter.

In Vouliagmeni Lake, *P. vouliagmeniensis* lives at depths between 0.10 and 11 m, attached on gravels, the phanerogam *Zostera noltii* and the algae *Chaetomorpha crassa*, *Polysiphonia tenella*, *P. variegata* and *Cladophora sp. Paranemonia vouliagmeniensis* lives in aggregations; in some areas the density is 625 anemones per m^2. It seems to be associated with *Cerastoderma edule* and *Abra ovata* (Mollusca, Pelecypoda). A probably new crustacean, *Sphaeroma* sp. (Crustacea, Isopoda), also seems associated for feeding reasons. The occurrence of two new species associated in such a particular ecological condition is so interesting that other studies would be necessary to understand the origin and the mode of their parallel speciation.

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References

Carlgren, O. 1900. Ostafricanische Aktinien.—*Mitt. naturh. Mus. Hamb. 17:* 21–144.

Carlgren, O. 1945. Further contributions to the knowledge of the cnidom in the Anthozoa especially in the Actiniaria.—*Acta Univ. lund.* N.F. Avd. 2 *41* (9): 1–20.

Contarini, N. 1844. *Trattato delle attinie.* Venezia.

Doumenc, D., Chintiroglou, C. & Koukouras, A. 1985. Actinies de la mer Egée: méthodes d'identification, zoogéographie.—*Bull. Mus. natn. Hist. Nat., Paris 4*(7), section A, *3:* 497–529.

Papapetrou-Zamanis, A. 1969. Le lac de Vouliagmeni (Attiki).—*Annls géol. Pays hell. 21:* 210–216.

Schmidt, H. 1972. Prodromus zur einer Monographie der Mediterranean Aktinien.—*Zoologica, Stuttg. 42*(2) 121: 1–146.