

## FRUIT AND SEED MORPHOLOGY IN PARONYCHIA MILLER FROM SOUTH-WEST SPAIN

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### Abstract

Fruits and seeds of the *Paronychia* taxa present in the Southwest of Spain were examined with a scanning electron microscope and light microscope. It has been observed in the utricles a greater density of papillae in *P. argentea* and *P. echinulata* as compared to *P. capitata* where appears smooth or scarcely papillate. With respect to the seeds the surface of the cells is rugulate in *P. argentea* while in *P. echinulata* and *P. capitata* is smooth. Finally it is commented the dispersion system and the possible epicuticular waxes presence.

### Introduction

The genus *Paronychia* Miller is formed by 109 species distributed by America, Europe, Asia and North of Africa, being the main centre of distribution the region mediterranean where are located about 50% of the total.

Within the family *Caryophyllaceae* belongs to the tribe *Paronychieae* and due to the fact that its seeds present the strongly curved embryo PAX & HOFFMANN (1934, sec. CHAUDHRI, 1968) included it in the subtribe *Paronychiinae*. CHAUDHRI (1968) continuing to SHINNERS (1962) merges *Siphonychia* with *Paronychia* envisaging eight genus within the subtribe *Paronychiinae*, instead of the nine that they have been come indicating traditionally.

In the Iberian Peninsula CHAUDHRI (1990) recognizes nine species, three of which are present in the Southwest of Spain. DEVESA (1987) indicates also these three species: *P. echinulata* A. O. Chater, *P. argentea* Lam., both belonging to the subgenus *Paronychia*, and *P. capitata* (L.) Lam. included in the subgenus *Anoplonychia* (Fenzl) Chaudhri.

The genus comprises annual o perennial plants, erect or decumbent and frequently woody at the base. The leaves are opposite, with scarious stipules. The flowers are pentamerous in terminal, subterminal or pseudo-axillary glomerules. The sepals are equal or unequal, sometimes awned, with or without membranous margin. There are 3 - 5 stamens. The ovary is one-ovuled, and the fruit is an utricle.

The studies accomplished in this genus are scarce. From the karyological viewpoint emphasizes the work that KÜPFER (1974) developed about *P. kapela* (Hacq.) Kerner where he established the karyotype of the different subspecies and DIOSDADO & PASTOR (1994) describe about size, asymmetry and morphology of the chromosomes in six species in this genus from the South of Spain. In relation to the palynological studies, CANDAU (1978) describes the pollen morphology of 10 genera of the subfamily *Paronychiodeae*, where *Paronychia* is included. Concerning fruits and seeds morphological studies there is a revision of the *Paroychiinae* by CHAUDHRI (1968), where however the techniques of scanning electron microscopy is not used.

## Material and methods

The studied material comes from populations recently collected, whose origin is indicated in the Appendix.

The fruits were soaked in FAA during a minimum of 48 h, and then fixed in 70% ethanol.

For the morphological study of the utricles was used fixed material, treated and not treated with critical point. In order to observe the epidermal cells in the seeds study, was taken dry material and was dehydrated through an ethanol series, and then treated with xylene during 5 - 8 hours and was let to dry. The samples, both fruits as seeds, were mounted on stubs using double-sided adhesive tape. Then they were coated with gold-palladium in a vacuum evaporator and observed with a PHILIPS LX-20 Autoscan SEM. In order to prove if exists variability intra and interpopulational were clarified and softened, in lactic acid, several utricles of each population to compare the epidermis. These samples were mounted on tapes in lactic acid and were observed to the optical microscope (MO), where the measures of the trichomes were effected.

The length and width data are based on a sampling from 50 to 150 capsules or seeds per taxa.

The terminology basically follows FONT QUER (1977) and STEARN (1992).

A list of representative voucher specimens is held in the Herbarium of the Vegetal Biology and Ecology Department of the University of Seville.

## Results

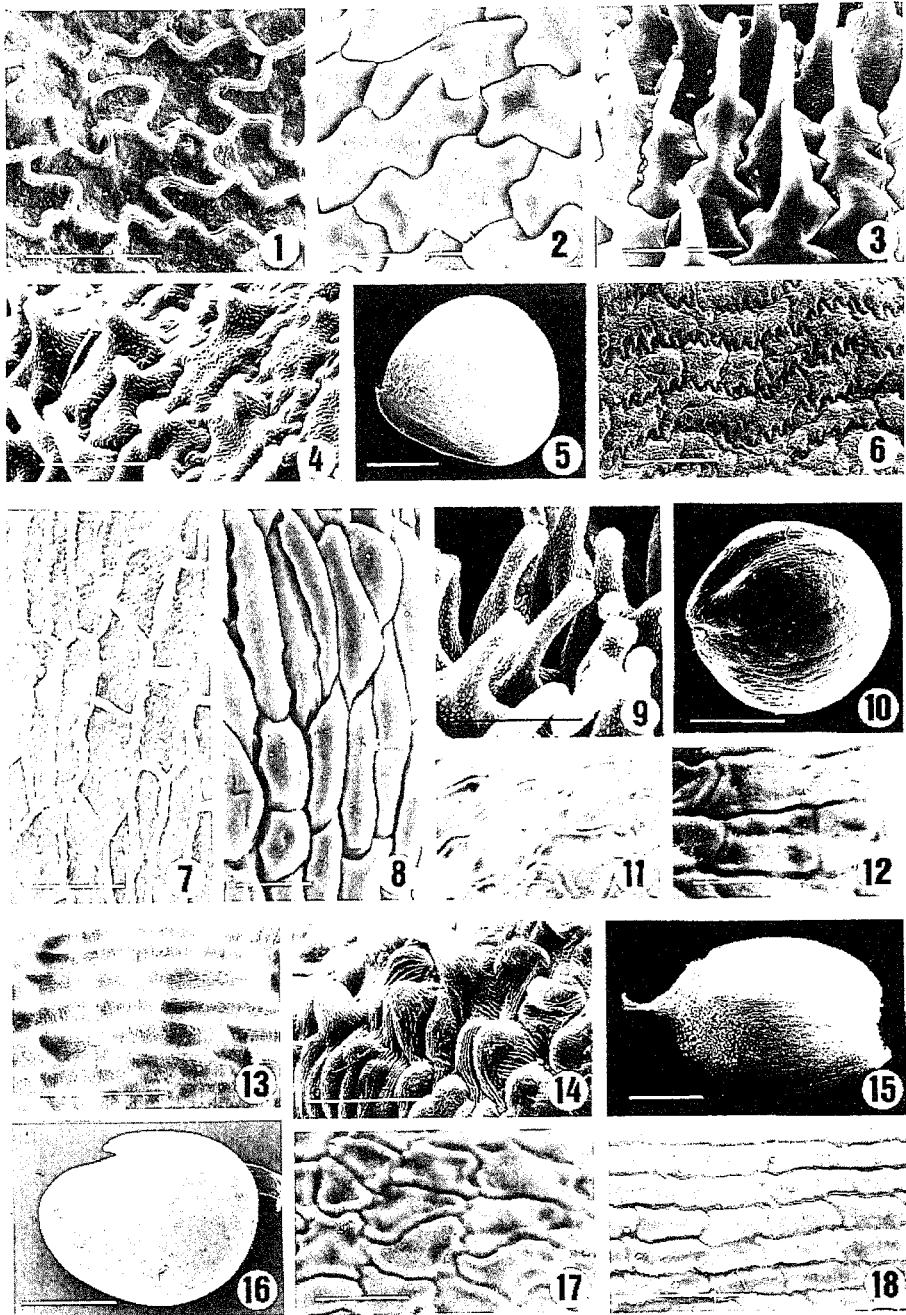
### *Paronychia argentea* Lam.

*Utricles* from 1 - 1.6 x 0.9 - 1.5 mm (length x width), membranous, disposed in glomerulous. They are obovoid or subglobose, slightly narrowed towards the base, with apiculum and radiosymmetric. The style is persistent, from 0.3 to 0.5 mm, bifid and fragile. Surface formed by irregular cells of sinuous contour and smooth cuticle; without stomas (Fig. 2). When the surface has not been treated, it presents cells with regularly swollen superficial radial walls and with membranous external tangential wall that is deposited on the intern which is granular (Fig. 1). Papillae are granular, slightly granular or smooth, disposed in the upper half, unicellular, from 8 to 88  $\mu$ m (Figs. 3, 4). Irregular dehiscence at the base.

*Seeds* from 0.8 - 1.1 x 0.8 - 1.2 mm (length x width), they are suborbicular, slightly compressed and with swollen margins. Basal placentation. Terminal insertion. Colour brown clear to dark. The seed coat is more or less smooth and brilliant formed by elongate, irregular cells, with sinuous contour and rugulate and convex tangential walls (Figs. 5, 6).

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Figs. 1 - 6, *Paronychia argentea*; Figs. 7 - 12, *P. echinulata*; Figs. 13, 14, 16, 17, *P. capitata* var. *libyca*; Figs. 15, 18, *P. capitata* var. *capitata*. 1, 7, 13, surface of utricule; 2, 8, surface of utricule treated with critical point; 3, 4, 9, 14, papillae; 15, general aspect of utricule; 5, 10, 16,



general aspect of seed; 6, 11, 17, surface of seed coat in the central zone; 12, 18, surface of seed coat in the marginal zone. Scale bars: 50  $\mu\text{m}$  (1 - 4, 6 - 9, 11 - 14, 17 - 18); 200  $\mu\text{m}$  (10); 500  $\mu\text{m}$  (5, 15, 16).

**Paronychia echinulata** A. O. Charter

*Utricles* from 0.6 - 1 x 0.6 - 0.9 mm (length x width), membranous, disposed in glomerulous. They are more or less globose, slightly apiculate and radiosymmetric. The style is persistent, from 0.3 to 0.5 mm, bifid. Surface formed by polygonal, elongate, convex cells with smooth cuticle; without stomas (Fig. 8). When the surface has not been treated presents cells with regularly swollen superficial radial walls and with membranous external tangential wall, which is deposited on the intern that it is granular (Fig. 7). Densely papillate in the upper half. Papillae are granular or smooth, unicellular, of 16 to 104  $\mu\text{m}$ , and generally with swollen apex (Fig. 9). Irregular dehiscence at the base.

*Seeds* from 0.5 - 0.8 x (0.4) 0.5 - 0.8 mm (length x width), they are orbicular, subglobose. Basal placentation. Apical insertion. Colour dark brown. The seed coat is smooth, brilliant and formed by irregular cells, with slightly sinuous contour, which are polygonal in the marginal zone and with smooth tangential walls (Figs. 10 - 12).

**Paronychia capitata** (L.) Lam

*Utricles* from 1.2 - 1.9 (2.2) x 0.6 - 1.2 mm (length x width), membranous, disposed in glomerulous. They are elipsoid, having a ring-like mark near the top, with apiculatum and radiosymmetric (Fig. 15). The style is persistent, from 0.2 to 0.5 mm, bifid. In treated and not treated cells, the surface is formed by polygonal, elongate and slightly concave cells with smooth cuticle; without stomas (Fig. 13). Smooth or with some papillae located in the ring-like mark near the top. Smooth or striate papillae, unicellular, from 6 to 32  $\mu\text{m}$  (Fig. 14). Longitudinal dehiscence at the base.

*Seeds* from (0.9) 1 - 1.5 x 0.6 - 1.1 (1.2) mm (length x width), elliptical, slightly compressed with swollen margins. Basal placentation. Subterminal insertion. Colour dark brown. The seed coat is smooth and brilliant formed by irregular and slightly sinuous cells in the central zone and polygonal and elongate in the marginal zone, with smooth tangential walls (Figs. 16 - 18).

**a var. capitata**

*Utricles* from (1.2) 1.3 - 1.7 x (0.6) 0.7 - 1.1 mm (length x width). Style from c. 0.2 mm. Papillae from 12 to 32  $\mu\text{m}$ .

*Seeds* from (1) 1.1 - 1.4 x 0.8 - 1 (1.1) mm (length x width).

**b var. libyca** Bozzi & Mattai

*Utricles* romf 1.2 - 1.8 (2.2) x 0.8 - 1.2 mm (length x width). Styles from 0.3 to 0.5 mm. With or without papillae from 6 to 22  $\mu\text{m}$ .

*Seeds* from (0.9) 1 - 1.5 x 0.6 - 1.1 (1.2) mm (length x width).

## KEY OF FRUITS

1. Surface formed by irregular cells with sinuous contour ..... *P. argentea*
1. Surface formed by polygonal and elongate cells ..... 2
2. Utricle densely papillate in the upper zone. Papillae from  
16 to 104  $\mu\text{m}$  ..... *P. echinulata*
2. Utricle smooth or with papillae only in the ring-like mark near the  
top. Papillae from 6 to 32  $\mu\text{m}$  ..... *P. capitata*

## KEY OF SEEDS

1. Seed coat formed by cells with surface rugulate, elongate and with  
sinuous contour ..... *P. argentea*
1. Seed coat formed by cells with smooth surface, irregular, with  
slightly sinuous contour in the central zone and polygonal, elongate  
in the marginal zone ..... 2
2. Seeds from 0.5 - 0.8 x (0.4) 0.5 - 0.8 mm, orbicular, subglobose ..... *P. echinulata*
2. Seeds from (0.9) 1 - 1.5 x 0.6 - 1.2 mm, elliptical slightly  
compressed ..... *P. capitata*

## Discussion

Attending to the morphology of the fruits, is observed some differences in the shape of the utricles, since in *P. argentea* and *P. echinulata* tend be subglobose, even though, they are slightly apiculate and smaller size in the last taxon, while in *P. capitata* are ellipsoid and with a ring-like mark near the top. The epidermal characters also have resulted of usefulness to differentiate the different taxa. So *P. argentea* and *P. echinulata* present papillae lesser to greater density respectively, while *P. capitata* lacks papillae or only has some. However this variation is not so marked neither constant as indicated CHAUDHRI (1968) who regarded that the subgenus *Anoplonychia*, where is *P. capitata*, does not present papillae in the pericarp. The papillae are located always in the upper half of the fruits. In this zone the papillate cells can be smooth or granular as in *P. argentea* and *P. echinulata*, being furthermore abundant, in the last taxon, the papillae with the swollen apex; while in *P. capitata* presents smooth or striate papillate cells.. In the lower half, the pericarp is formed always by smooth elongate cells which can be with sinuous contour in *P. argentea* and polygonal cells in *P. capitata* and *P. echinulata*. The fruits, which have not been treated with critical point, present variations in the surface of the pericarp due to the fact that the external tangential wall which is membranous, is deposited on the intern. These differences are very evident in *P. argentea* and *P. echinulata*.

Concerning the seeds, the seed coat is always smooth, with rugulate tangential wall in the case of *P. argentea*, even though, in *P. capitata* the cells are elongate, more or less polygonal, while in the others two species are sinuous cells. Also the insertion,

subterminal in *P. capitata* and *P. echinulata*, separates these taxa of *P. argentea* which presents terminal insertion. The smallest seeds are present in *P. echinulata*, just like the fruits.

In the three taxa the seeds are brilliant due probably to epicuticular waxes, that they increase the water repellency. The ecological advantages of this repulsion can be related to the protection of the seed of pathogens or particles that they could alter it or contaminate it (BARTHLOTT, 1981).

The *Caryophyllaceae* do not seem to have a specialized dispersion mechanism (THOMPSON & RABINOWITZ, 1989), and PIJL (1982) indicates that many of its species are anemoballists. According to CHAUDHRI (1968) the taxa of the subtribe *Paronychiinae* uses normally the wind as dispersion system. However the genus *Paronychia*, due to its habit and the permanency of the utricles in the plant until this begins to be disintegrated, it might be though that it is behaved as barocora plant.

The results seems to indicate that *P. capitata* shows the greatest differences, supporting the fact to be included in the subgenus *Anoplonychia* in contrast to the other two species.

## Appendix

### Plant material studied

*Paronychia argentea* Lam. CÁDIZ: Algodonales, 23.IV.1995, *Ocaña & Rojas* (SEV 139403). Between Vejer de la Frontera and Tahivilla, Laguna de la Janda, 20.V.1996, *Moreno Socías & Ocaña* (SEV 139406). CÓRDOBA: Zuheros, 15.V.1996, *Martín Mosquero & Ocaña* (SEV 139405). Rute, Castle, 25.VI.1996, *Martín Mosquero & Ocaña* (SEV 139408) HUELVA: Cortegana to Las Veredas, 27.V.1996, *Martín Mosquero & Ocaña* (SEV 139407). SEVILLA: La Puebla del Río, Venta del Cruce, 14.V.1996, *Fernández & Ocaña* (SEV 139404).

*Paronychia echinulata* Chater. CÁDIZ: Chiclana, between Nuevo Sancti-Petri and Urbanización Cabo Roche, 31.V.1995, *Martín Mosquero & Ocaña* (SEV 189410). Alcalá de los Gazules, El Picacho, 19.VI.1996, *Ocaña & Rojas* (SEV 139413). HUELVA: Between El Portil and El Rompido, 28.V.1995, *Ocaña & Rojas* (SEV 139409). La Granada de Río Tinto, 17.VI.1996, *Martín Mosquero & Ocaña* (SEV 139412). Between Ayamonte and Villablanca, river Pedraza, 3.VII.1996, *Martín Mosquero & Ocaña* (SEV 139414). SEVILLA: Pilas, 27.V.1996, *Ocaña* (SEV 139411).

*Paronychia capitata* (L.) Lam. var. *capitata*. CÁDIZ: Grazalema, Puerto de las Palomas, 5.VI.1995, *Ocaña & Rojas* (SEV 139415).

*Paronychia capitata* (L.) Lam. var. *libyca* Bozzi & Mattai. CÁDIZ: Algodonales, Sierra de Líjar, 23.IV.1995, *Ocaña & Rojas* (SEV 139417). CÓRDOBA: Rute, Pico de las Cruces, 15.V.1996, *Martín Mosquero & Ocaña* (SEV 139418). Cabra, Ermita de Nuestra Señora de la Sierra, 26.VI.1996, *Martín Mosquero & Ocaña* (SEV 139419). SEVILLA: Gilena, Sierra Acebuchosa, 7.VI.1995, *Ocaña & Pastor* (SEV 139416).

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