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Original scientific paper

LEAF ANATOMY OF THE *IRIS CROATICA* I. ET M. HORVAT
(*IRIDACEAE*)

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The leaf anatomy of the stenoendemic Croatian species *I. croatica* I. et M. Horvat is described. Two separate populations were analyzed and stability of investigated leaf anatomical characteristics (especially of taxonomically interesting features – shape and constitution of leaf margin and form of schlerenchymatous cap at phloem pole) was established. In comparison with related species *I. germanica* L., these features show significant differences.

I n t r o d u c t i o n

A hundred years ago some authors determined the importance of leaf anatomy for the family *Iridaceae* L. (Chodat et Balicka-Iwanowska 1892, Balicka-Iwanowska 1893, Arber 1921). Recently, leaf anatomy of the family *Iridaceae* and of the genus *Iris* has been intensively investigated, and it has been established that some anatomical structures of leaves, have important taxonomical and phylogenetical significance (Imamura et Hida 1956, Rudall 1983, 1986, 1990, 1991, 1993; Goldblatt et al. 1984, Wu et Cutler 1985, Rudall et Burns 1989, Mitić 1990, Rudall et Mathew 1990, Rudall et Goldblatt 1991, Rudall et Mathew 1993, Mitić et Pavletić 1995).

I. croatica I. et M. Horvat, as the stenoendemic species of the Croatian flora grows on the limestones and dolomites of the north-western part of

Croatia (Fig. 1). It was described by Horvat et Horvat (1961/62), who gave its detailed morphological and ecological description. The leaf anatomy of this species, not examined until now, will be presented in this paper. Taxonomically interesting anatomical characteristics (shape and constitution of the leaf margin and the form of sclerenchymatous cap at phloem pole) will be compared with *I. germanica* L., a wide spread European species. It should be mentioned that some authors did not recognize *I. croatica* as a separate species and mentioned it as a synonym for related *I. germanica* (Webb et Chater 1989, Mathew 1981), but others have treated it as an independent species within the genus *Iris* (Horvat et Horvat 1961/62, Ehrendorfer 1973, Köhlein 1981, Schulze 1988, Domac 1994, Regula-Bevilacqua 1994).

Material and methods

The material of *I. croatica* was collected from two localities – Oštrc in Samoborsko gorje and Strahinjščica in Hrvatsko Zagornje (Fig. 1), during the flowering time, in May 1994. The material of *I. germanica* was taken, at the same time, from the horticulture (Samobor). Leaves were fixed in FAA – mixture (Johansen 1940). The material was cross sectioned using a razor blade, in the central part of the leaves, and analyzed as by Wallis (1965) and Wu et Cutler (1985). Leaf surface preparations were made by scraping method (Cutler 1978). Photographs were taken using an Opton light photomicroscope.

The parameters analyzed and observed on the blade surfaces and in cross sections – a) in *I. croatica*: epidermis (including stomata and papillae), mesophyll, styloids, shape of leaf margin and form of marginal sclerenchyma and form of sclerenchymatous cap at phloem pole of veins; b) in *I. germanica*: shape of leaf margin and form of marginal sclerenchyma and form of sclerenchymatous cap at phloem pole of veins.

Results

1) *Iris croatica*

The leaf anatomical characteristics investigated of two different populations of this species are very similar, and the following descriptions are valid for both of them.

Blade surface

As with most species of the genus *Iris*, the leaves of *I. croatica* are unifacial or non-dorsiventral, with similar appearance and structure in the two epidermal surfaces. The epidermal cells are axially elongated, usually 5-6 times longer than their width. Among them, in longitudinal rows, are anomocytic

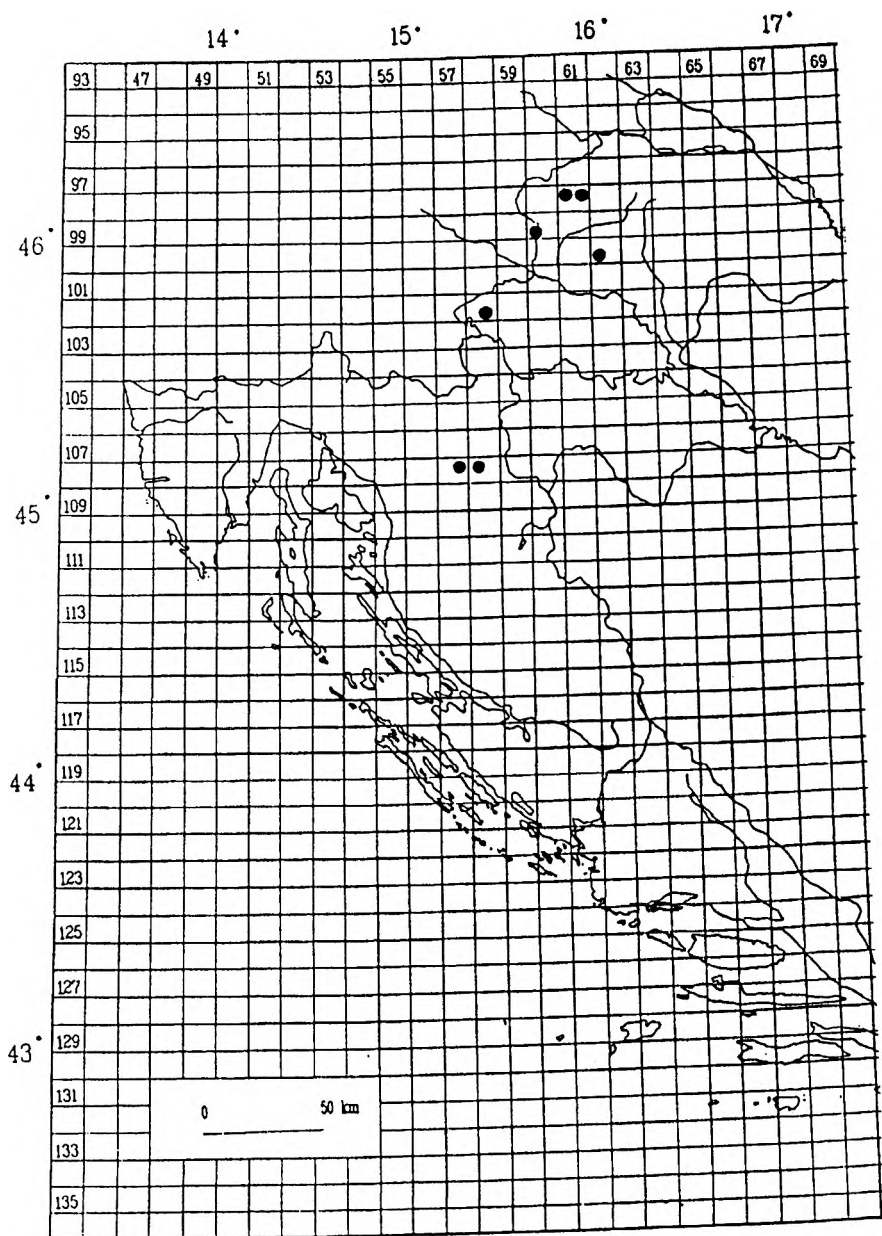


Fig. 1. Distribution of the species *Iris croatica* I. et M. Horvat
 Sl. 1. Rasprostranjenost vrste *Iris croatica* I. et M. Horvat

stomata (Fig. 2a). Crystals occur in special elongated thin-walled cells (idioblasts) of calcium oxalate – styloids (Fig. 2b). Styloids are elongated, prism-

shaped and arranged in longitudinal files lying parallel to the long axis of the leaf. They are present in the mesophyll layer and very often are visible through the epidermis.

Blade structure in cross section

Leaves are narrowly strap-shaped with two flat surfaces.

The epidermal cells are roundish, covered with cuticle, and within them is a large number of anomocytic sunken stomata (Fig. 3a).

The mesophyll consists of 3-4 layers of palisade parenchyma on both sides, and 3-5 layers of spongy parenchyma among them (Fig. 3b). Short papillae are frequently present, as protuberances, on the outer periclinal wall of epidermal cells. One epidermal cell can have only one papilla (Fig. 3c).

In cross sections, we can also see the styloids – more or less as glittering rectangles (Fig. 4a).

The leaf margin is broadly triangular with a broadly roundish apex, and marginal sclerenchyma shanks are longer than the undivided part of sclerenchyma (Fig. 4b).

Vascular bundles are collateral, arranged typically of unifacial leaves with phloem towards the leaf surface. The veins contain sclerenchymatic sheaths (sclerenchymatous cap), expressed especially above the phloem pole, and in *I. croatica* this cap is kidney shaped. (Fig. 4c).

2) *Iris germanica*

The leaf margin of *I. germanica* is triangular with a roundish apex, and marginal sclerenchyma shanks are of the same length as, or shorter than, the undivided part (Fig. 5a). Sclerenchymatous cap at the phloem pole of veins is crescent shaped (Fig. 5b).

Discussion and Conclusion

The results point out that two different populations of the species. *I. croatica* show very similar (almost identical) anatomical characteristics of leaves, which confirms earlier conclusions about the taxonomical importance of anatomic structures for the genus *Iris* (Chodat et Balicka-Iwanowska 1892, Balicka-Iwanowska 1893, Goldblatt et al. 1984, Wu et Cutler 1985, Mitić 1990, Rudall et Mathew 1933, Mitić et Pavletić 1995).

Some of the anatomical characteristics of the leaf shown in our results are well known and typical of the majority of taxa of the genus *Iris*. They include the shape and constitution of epidermal cells and mesophyll, sunken anomocytic stomata, the presence of the papillae on the epidermis and the presence of styloids in idioblasts (Esau 1965, Goldblatt et al. 1984, Wu et Cutler 1985, Mitić 1990, Rudall 1990, Rudall et Goldblatt 1993, Rudall et Mathew 1993, Mitić et Pavletić 1995). The shape and size of papillae and shape and size of styloids can be useful for taxonomical purposes on the

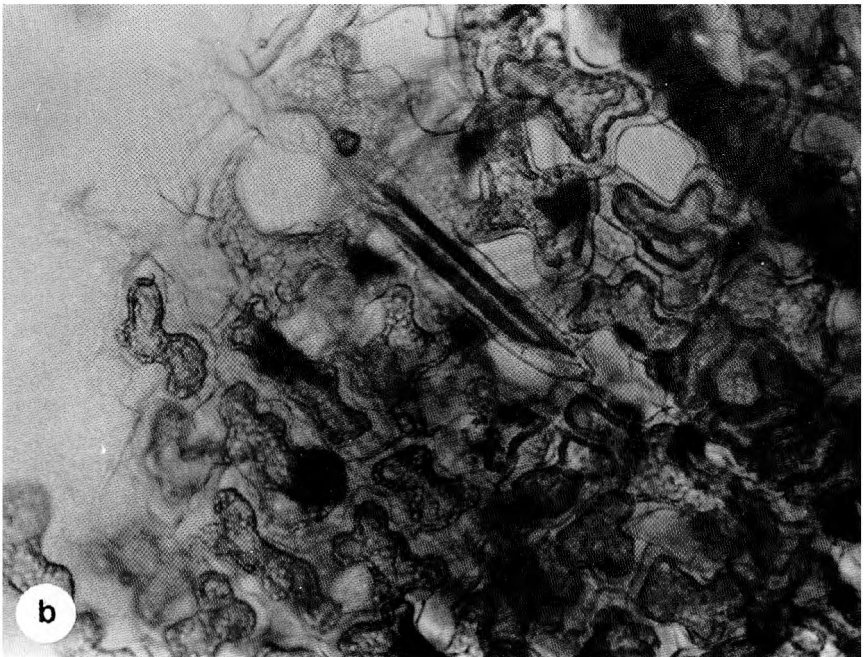
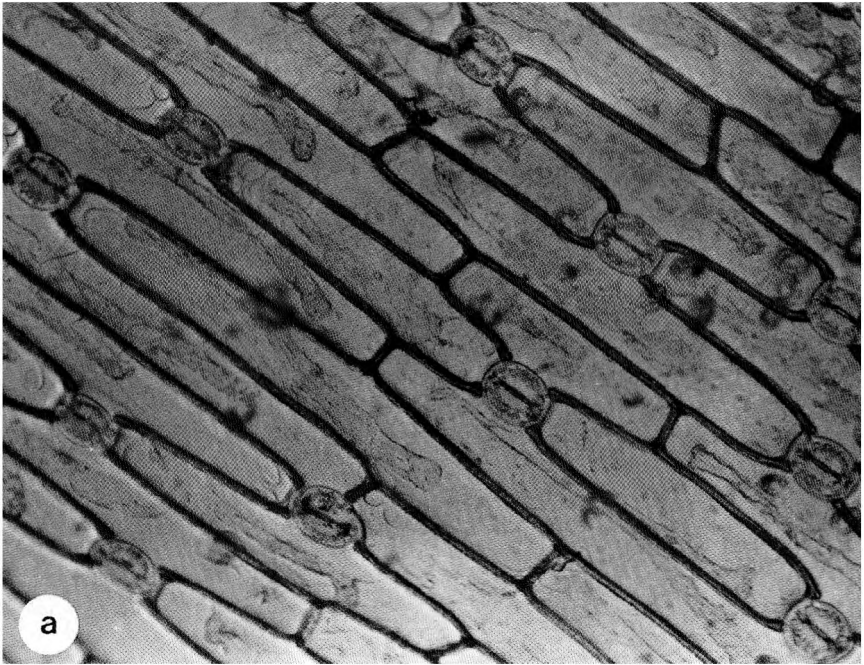


Fig. 2. *I. croatica* – leaf surface and cell below epidermis: a) epidermal cells with anomocytic stomata (40x); idioblast with styloid (64x)
 Sl. 2. *I. croatica* – površina lista i subepidermalno staničje: a) epidermalne stanice s anomocitnim pučima (40x); b) idioblast sa stiloidom (64x)

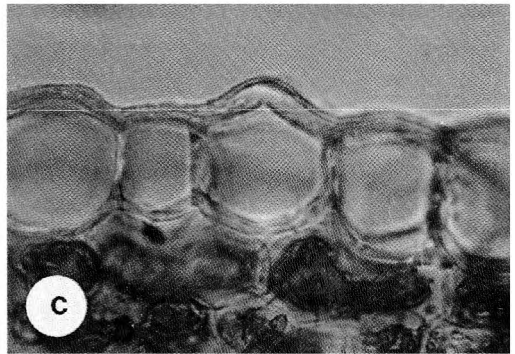
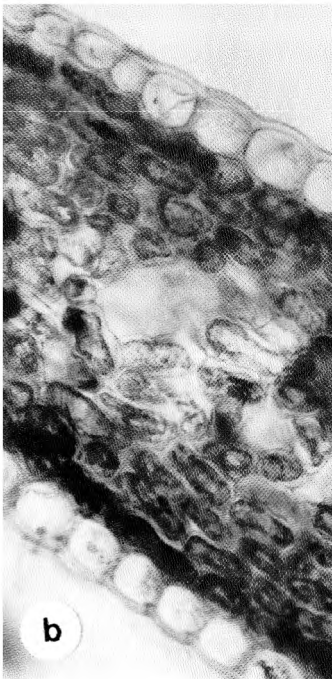
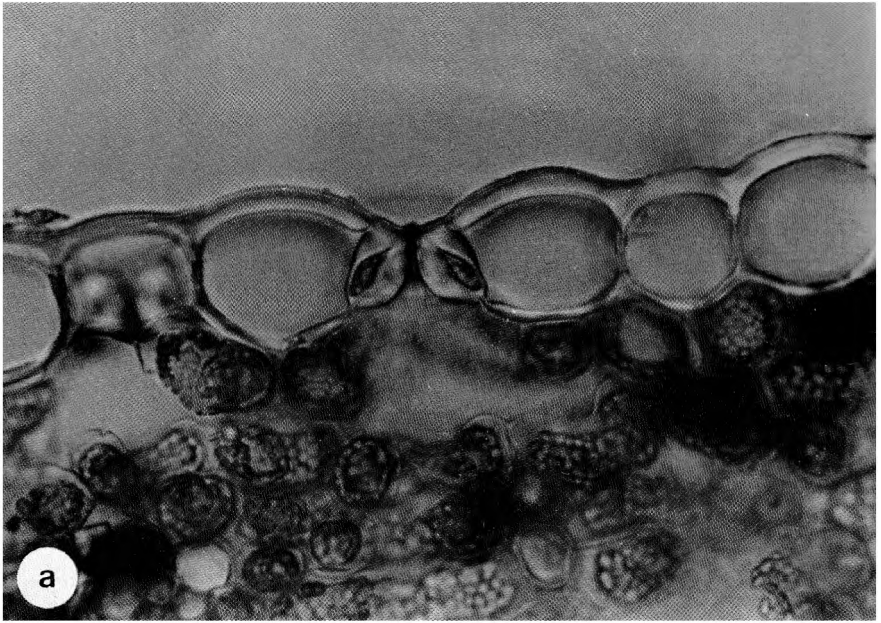


Fig. 3. *I. croatica* – cross section of the leaf: a) epidermal cells with cuticle and anomocytic stoma (102,4x); b) mesophyll (51,2x); c) epidermal papilla (102,4x)
 Sl. 3. *I. croatica* – poprečni prerez lista: a) epidermalne stanice s kutikulom i anomocitnom pući (102,4x); b) mezofil (51,2x); c) epidermalna papila (102,4x)

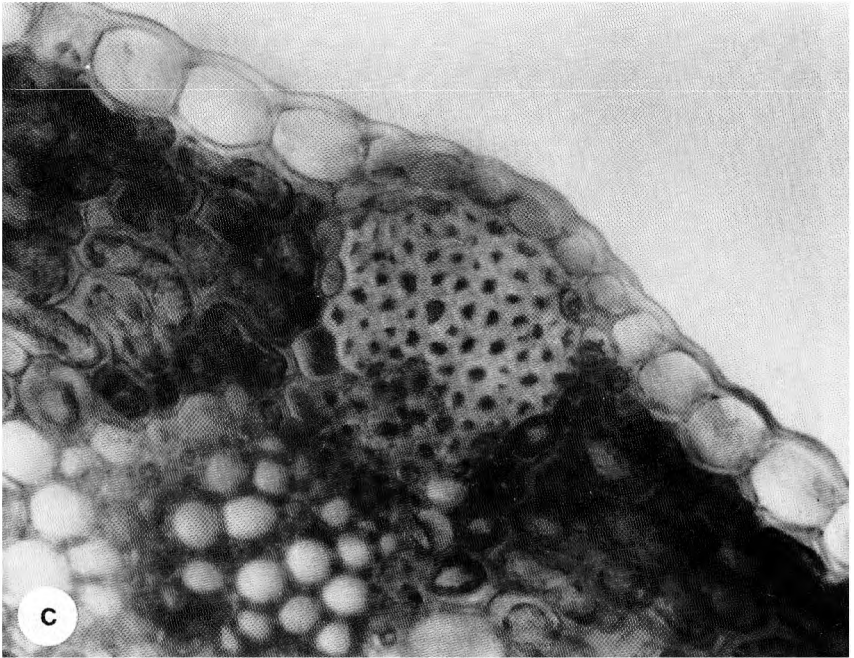
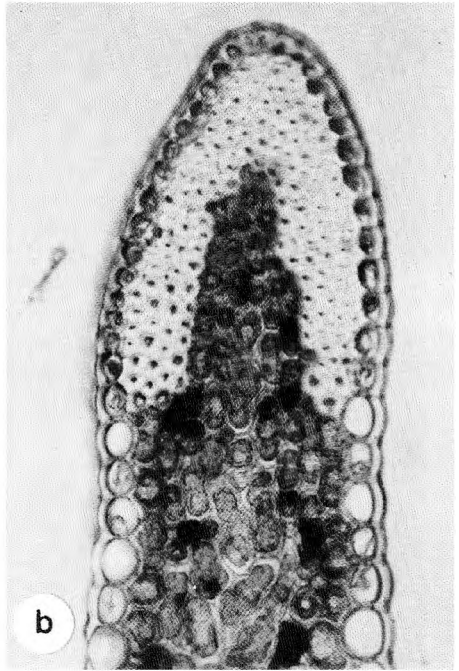
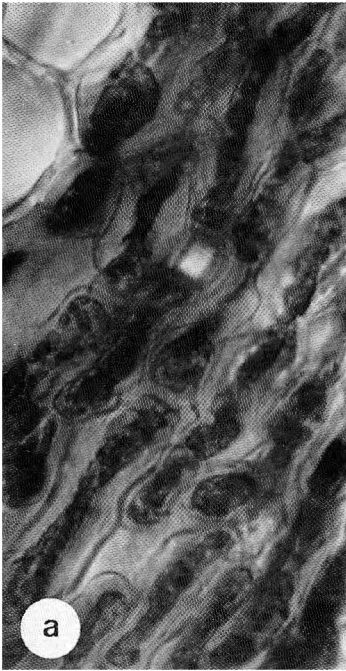


Fig. 4. *I. croatica* – cross section of the leaf: a) glittering styloid (102,4x); b) leaf margin (40x); c) vein with sclerenchymatous cap (64x)
 Sl. 4. *I. croatica* – poprečni prerez lista: a) svjetlucajući stiloid (102,4x); b) rub lista (40x); c) žila sa sklerenijskom kapom (64x)

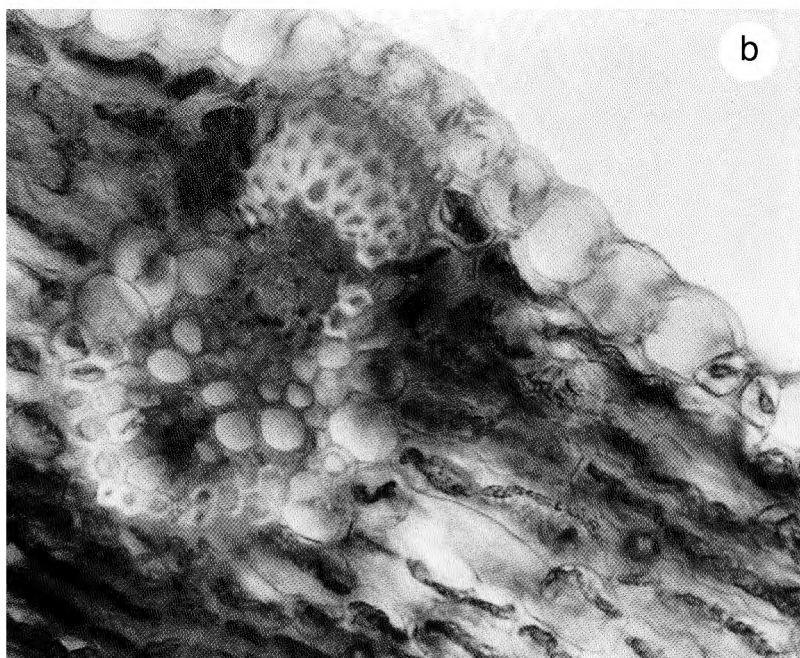
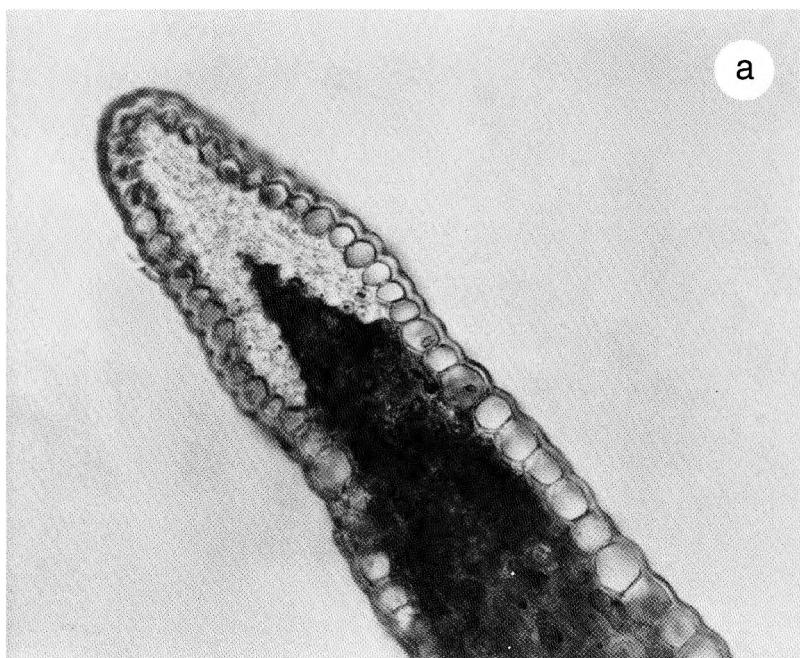


Fig. 5. *Iris germanica* – cross section of the leaf: a) leaf margin (40x); b) vein with sclerenchymatous cap (64x)

Sl. 5. *Iris germanica* – poprečni prerez lista: a) rub lista (40x); b) žila sa sklerenhimskom kapom (64x)

level of larger groups within the genus *Iris* (Goldblatt et al. 1984, Wu et Cutler 1985).

The most interesting anatomical characteristics of the leaf for the taxonomy of the species *Iris* are the shape and constitution of leaf margins, form of marginal sclerenchyma (marginal fibre strand) and the form of sclerenchymatous cap at phloem pole of veins. Those parameters could be useful for distinguishing close related species of the genus *Iris* (Wu et Cutler 1985, Mitić 1990, Rudall et Mathew 1993, Mitić et Pavletić 1995). According to our results those parameters may also be useful in distinguishing and determination (in non flowering time) of the related species *I. croatica* and *I. germanica*. *I. croatica* has a broadly triangular leaf margin with a broadly roundish apex, and marginal sclerenchyma shanks are longer than the undivided part of sclerenchyma (Fig. 4b). *I. germanica* has a triangular leaf margin with a roundish apex, and marginal sclerenchyma shanks are of the same length as, or shorter than, the undivided part (Fig. 5a). Sclerenchymatous cap at the phloem pole of the veins in *I. croatica* is kidney shaped (Fig. 4c) and in *I. germanica* it has the shape of a crescent (Fig. 5b).

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S A Ž E T A K

ANATOMIJA LISTA VRSTE *IRIS CROATICA* I. ET M. HORVAT (*IRIDACEAE*)

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U radu je provedena anatomsko-morfološka analiza lista hrvatske steno-endemične perunike *Iris croatica* I. et. M. Horvat, kojoj neki autori osporavaju status vrste. Istraživane su dvije odvojene populacije i ustanovljeno je da obje pokazuju istovjetne anatomske osobine lista. Neke od tih osobina značajne su za cijeli rod *Iris* – izgled i građa epiderme i mezofila, udubljene anomocitne puči, prisutnost papila i stiloida. Međutim, posebno taksonomsko značenje za pojedine vrste imaju oblik i građa lisnog ruba, oblik rubnog sklerenhima i oblik sklerenhimske »kape« iznad floemskog pola žila, što je potvrđeno i za vrstu *I. croatica*. Naime, ovim je radom ustanovljeno da se hrvatska perunika *I. croatica* i srodna vrsta *I. germanica*, u pogledu navedenih parametara znatno razlikuju.

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