

# A CONTRIBUTION TO THE KNOWLEDGE OF THE NEOPHYTIC FLORA OF THE COUNTY OF ŠIBENIK AND KNIN (DALMATIA, CROATIA)

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**Milović, M.: A contribution to the knowledge of the neophytic flora of the County of Šibenik and Knin (Dalmatia, Croatia). Nat. Croat., Vol. 10, No. 4., 277–292, 2001, Zagreb.**

New localities for 13 neophytes in the area of the County of Šibenik and Knin are given in this paper. The neophytes – *Amaranthus crispus* (Lesp. & Thev.) N. Terracc., *Euphorbia nutans* Lag., *Tagetes minuta* L., *Eleusine indica* (L.) Gaertner and *Panicum dichotomiflorum* Michaux are mentioned for the first time for the researched area. Data are given for new findings of neophytes previously recorded in the area investigated – *Chenopodium ambrosioides* L., *Euphorbia maculata* L., *Ambrosia artemisifolia* L., *Artemisia verlotiorum* Lamotte, *Aster squamatus* (Sprengel) Hieron., *Galinsoga parviflora* Cav., *Solanum elaeagnifolium* Cav. and *Paspalum paspalodes* (Michx.) Scribner.

**Key words:** neophytic flora, new localities, County of Šibenik and Knin, Croatia

**Milović, M.: Prilog neofitskoj flori Županije Šibensko-kninske (Dalmacija, Hrvatska). Nat. Croat., Vol. 10, No. 4., 277–292, 2001, Zagreb.**

U radu se navode nova nalazišta za 13 neofita na području Županije Šibensko-kninske. Neofiti, *Amaranthus crispus* (Lesp. & Thev.) N. Terracc., *Euphorbia nutans* Lag., *Tagetes minuta* L., *Eleusine indica* (L.) Gaertner i *Panicum dichotomiflorum* Michaux, se prvi put navode za istraživano područje. Za prethodno zabilježene neofite, *Chenopodium ambrosioides* L., *Euphorbia maculata* L., *Ambrosia artemisifolia* L., *Artemisia verlotiorum* Lamotte, *Aster squamatus* (Sprengel) Hieron., *Galinsoga parviflora* Cav., *Solanum elaeagnifolium* Cav. i *Paspalum paspalodes* (Michx.) Scribner, na istraživanom području navode se nova nalazišta.

**Ključne riječi:** neofitska flora, nova nalazišta, Šibensko-kninska županija, Hrvatska

## INTRODUCTION

The town of Šibenik and its surroundings constitute an important tourist area with developed road, railway and marine transportation which is favourable for the entry of adventitious plants from other, geographically distant regions. The remarkable participation of adventitious species in the flora of the County of Šibenik

and Knin has been confirmed by numerous findings of neophytic species in this area (TRINAJSTIĆ, 1975, 1993; PAVLETIĆ, 1987; ILIJANIĆ, 1990; MARKOVIĆ *et al.*, 1990, 1993; PANDŽA, 1998, 1998a, 1998b; SMITAL *et al.*, 1998; PANDŽA & STANČIĆ, 1999 and



Fig. 1. The researched area of the County of Šibenik and Knin

others). In the period from 1996 to 2000, as part of the preparation for my master's thesis, I did research into the flora of Šibenik and the wider surroundings, with special reference to neophytes. Later on I expanded this research to practically the whole area of the County of Šibenik and Knin (Fig. 1). This area belongs to the central coastal mezoregion of the Mediterranean macroregion of Croatia (NIKOLIĆ *et al.*, 1998:29, Fig. 6), in the UTM net, quadrant WJ (100x100km).

The results of the research into 13 neophyte species were singled out for this paper, because it seemed that they would supplement knowledge to date of their spread in the coastal region of Croatia. New localities are stated here for neophytes that have arrived in the area of Croatia recently and have not previously been recorded for the County of Šibenik and Knin: *Amaranthus crispus* (Lesp. & Thev.) N. Terracc., *Tagetes minuta* L., *Euphorbia nutans* Lag., *Eleusine indica* (L.) Gaertner and *Panicum dichotomiflorum* Michaux) and for those that were formerly recorded but just at a few localities: *Chenopodium ambrosioides* L., *Ambrosia artemisiifolia* L., *Artemisia verlotiorum* Lamotte, *Aster squamatus* (Sprengel) Hieron., *Galinsoga parviflora* Cav., *Solanum elaeagnifolium* Cav. and *Papalum paspalodes* (Michx.) Scribner.

## NEW LOCALITIES OF THE SPECIES RESEARCHED INTO

### *Amaranthus crispus* (Lesp. & Thev.) N. Terracc. (*Amaranthaceae*)

This neophyte originating from Argentina (AKERROYD, 1993: 132) was first noted in Croatia at several localities in Slavonia (MARKOVIĆ-GOSPODARIĆ, 1963; LOVAŠEN-EBERHARDT, 1980) and much later it was found in Dalmatia, in the Makarska region (TRINAJSTIĆ *et al.* 1993).

In July 1997 I observed and collected several specimens of this species in Šibenik (Fig. 2), in the area of the city park at the time it was remodelled. Since then I have not found this neophyte either in Šibenik or in the surroundings.

### *Chenopodium ambrosioides* L. (*Chenopodiaceae*)

The species originating from the tropical parts of America (AKERROYD, 1993:112) has been present in Croatia for a longer period (VISIANI, 1842:239; SCHLOSSER & FARKAŠ-VUKOTINOVIĆ, 1869:970). For the area of Šibenik the only finding is from Skradin (MARKOVIĆ *et al.*, 1993).

I found this neophyte in ruderal habitats in Perković (July 1998), Solaris (August 1998), Šibenik (July 2000), Kistanje and Knin (November 2000) (Fig. 2).

### *Euphorbia maculata* L. (*Euphorbiaceae*)

This neophyte originating from North America (SMITH & TUTIN, 1968:216) was originally stated for Croatia (Šibenik) by VISIANI (1826:35). After that it was registered in the region of Rijeka (THELLUNG, 1917; JAVORKA, 1925; ILIJANIĆ, 1957) and on more localities in the lowlands of Croatia between Karlovac and Okučani (ILIJANIĆ,

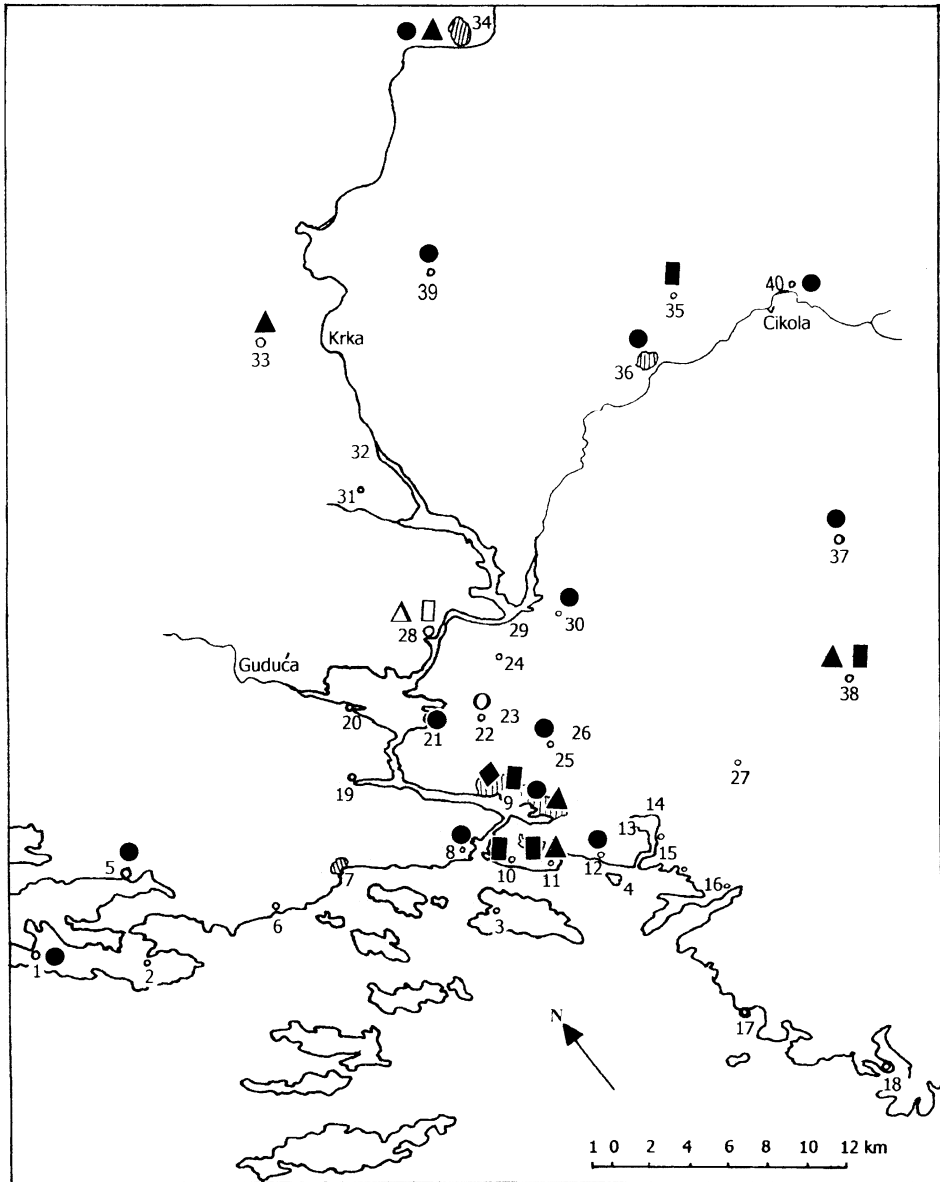
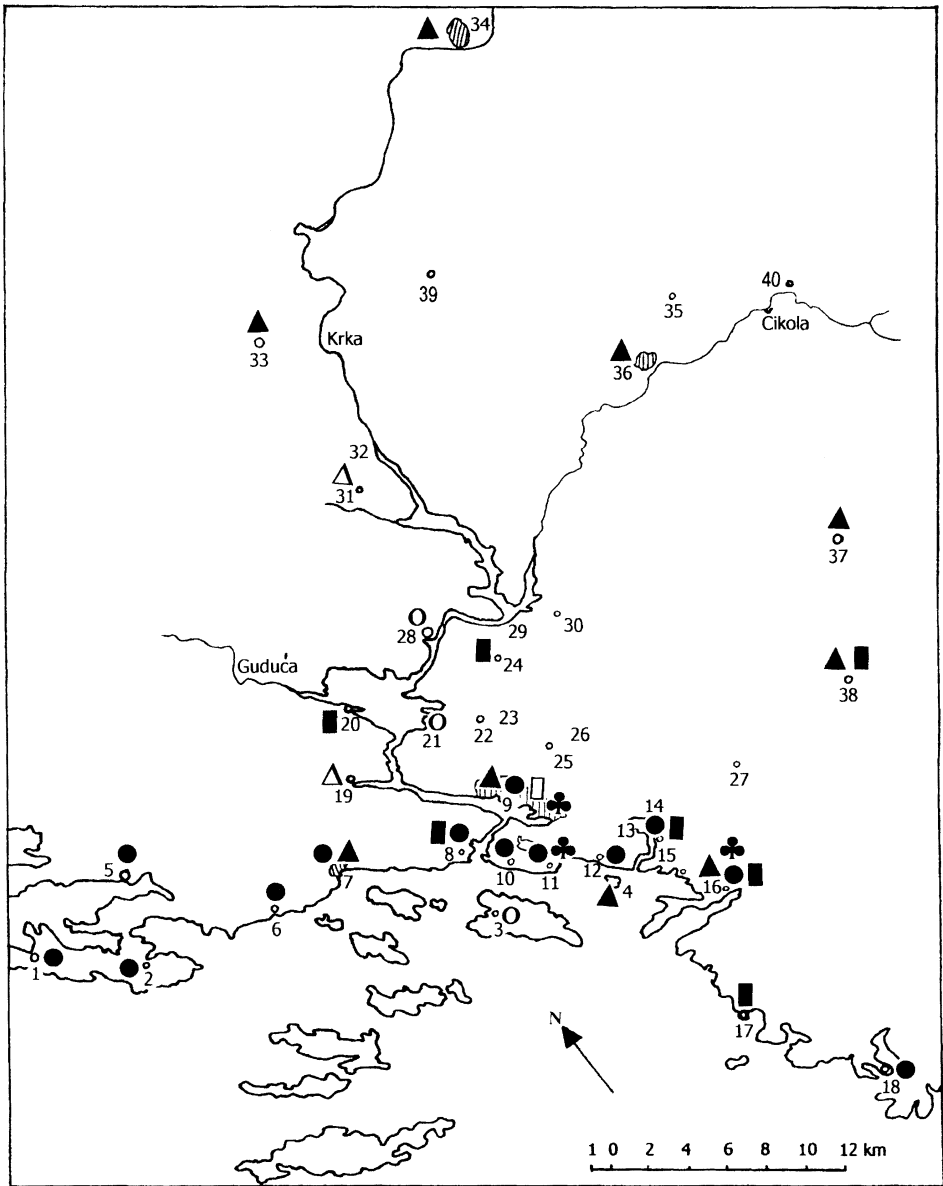


Fig. 2. The currently known localities of the neophytes researched into in the County of Šibenik and Knin

- new locality of *Amaranthus crispus* (Lesp. & Thev.) N. Terracc. (◆)
- registered (△) and new localities (▲) of *Chenopodium ambrosioides* L.
- registered (□) and new localities (■) of *Ambrosia artemisifolia* L.
- registered (○) and new localities (●) of *Artemisia verlotiorum* Lamotte



**Fig. 3.** The currently known localities of the neophytes researched into in the County of Šibenik and Knin

- new localities of *Tagetes minuta* L. (♣)
- registered (○) and new localities (●) of *Aster squamatus* (Sprengel) Hieron.
- registered (△) and new localities (▲) of *Galinsoga parviflora* Cav.
- registered (□) and new localities (■) of *Euphorbia maculata* L.

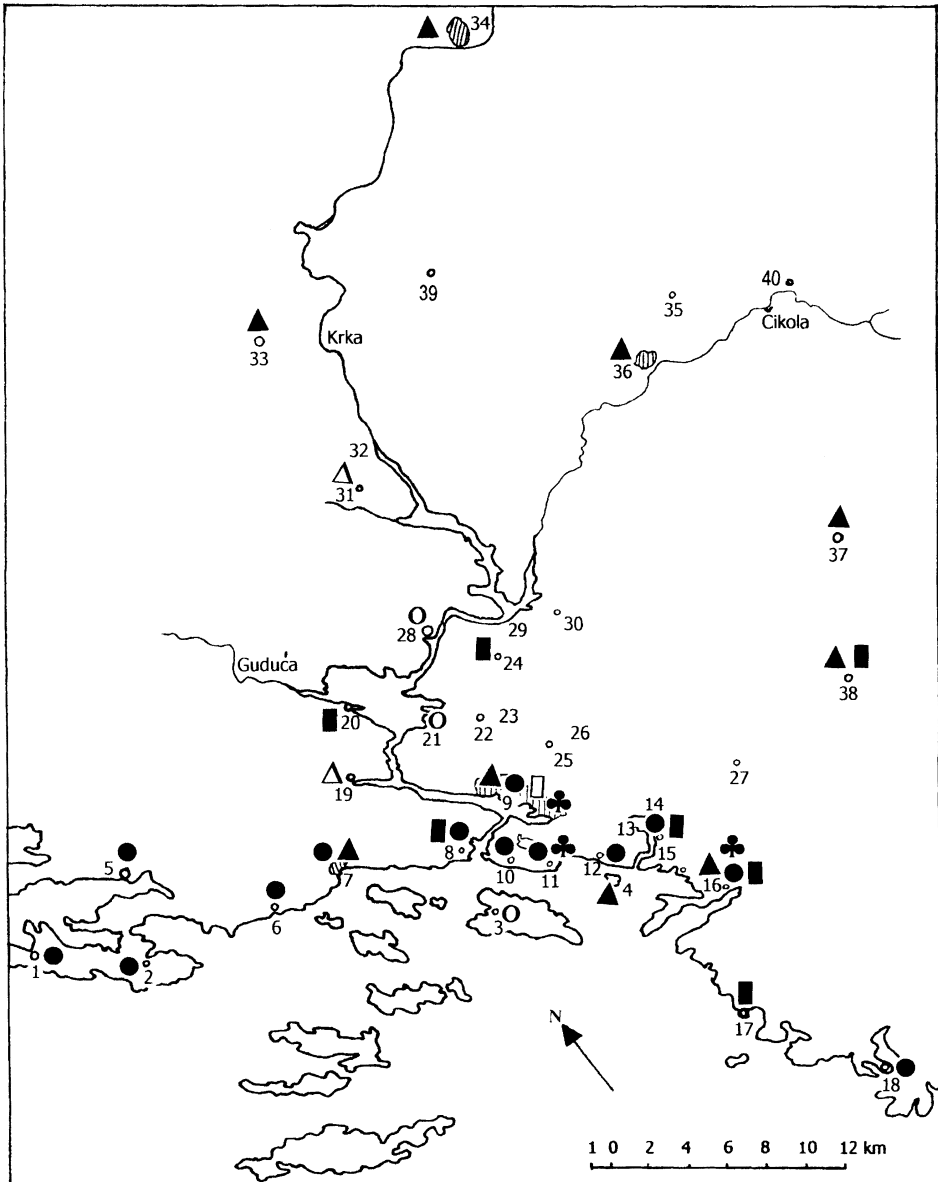


Fig. 4. The currently known localities of the neophytes researched into in the County of Šibenik and Knin

- new localities of *Euphorbia nutans* Lag. (◆), *Eleusine indica* (L.) Gaertner (●) and *Panicum dichotomiflorum* Michaux (♣)
- registered (◻) and new localities (◼) of *Solanum elaeagnifolium* Cav.
- registered (Δ) and new localities (▲) of *Paspalum paspalodes* (Michx.) Scribner

### Caption for figures 2–4

The list of localities (UTM grid, 10x10 km, in brackets):

1 – Murter (WJ 45), 2 – Jezera (WJ 54), 3 – Zlarin (WJ 63), 4 – Krapanj (WJ 73), 5 – Pirovac (WJ 55), 6 – Tribunj (WJ 64), 7 – Vodice (WJ 64), 8 – Jadrija (WJ 64), 9 – Šibenik (WJ 74), 10 – Zblaće (WJ 64), 11 – Solaris (WJ 73), 12 – Brodarica (WJ 73), 13 – Mučići (WJ 73), 14 – D. polje (WJ 73), 15 – Jadrtovac (WJ 73), 16 – Grebaštica (WJ 73), 17 – Primošten (WJ 72), 18 – Rogoznica (WJ 72), 19 – Zaton (WJ 64), 20 – Raslina (WJ 64), 21 – Mikulandre and Vrulje (WJ 74), 22 – Bilice (WJ 74), 23 – Krnići and Jurasi (WJ 74), 24 – Lozovac (WJ 74), 25 – Dubrava (WJ 74), 26 – Rupići (WJ 74), 27 – Vrpolje (WJ 73), 28 – Skradin (WJ 75), 29 – S. buk (WJ 75), 30 – Konjevrate (WJ 84), 31 – Rupe (WJ 76), 32 – Roški slap (WJ 76), 33 – Kistanje (WJ 77), 34 – Knin (WJ 97), 35 – Siverić (WJ 95), 36 – Drniš (WJ 95), 37 – Unešić (WJ 94), 38 – Perković (WJ 83), 39 – Oklaj (WJ 86), 40 – Otavice (XJ 05)

1957) and recently in Makarska (TRINAJSTIĆ *et al.*, 1993) and several localities in Istria and the Bay of Kvarner (ČARNI, 1996; ČARNI & JOGAN, 1998).

Within summer and autumn 1997–2000 I found this neophyte at several localities in Šibenik itself and in surrounding settlements: Raslina, Jadrija, Lozovac, Jadrtovac, Perković, Grebaštica and Primošten (Fig. 3). It appears in trampled habitats by the roads and ways, in the fissures of the wall bases, as a weed in flower gardens, and very frequently by the railways (Šibenik, Perković).

### *Euphorbia nutans* Lag. (Euphorbiaceae)

This neophytic spurge originating from North America (SMITH & TUTIN, 1968:215) was noted for Croatia by ILIJANIĆ (1957). Since then there have been no more findings.

I found a great number of specimens in Šibenik in the suburb of Mandalina, in the cracks by the edge of the road, between the Barracks of the Bribirian Dukes and the fence wall of *Remont* (September 1999). Aproximately at the same time I also found several specimens of *E. nutans* by the edge of the way in the village Grebaštica (Fig. 4).

### *Ambrosia artemisifolia* L. (Asteraceae)

This is a North American species that has sporadically spread in the region of South and Central Europe (HANSEN, 1976:142). It most commonly appears as a weed on cultivated land and on different types of ruderal habitats in settlements. It was first noted for Croatia in the 1950s (KOVAČEVIĆ, 1944; HORVATIĆ, 1947.). Since then it has spread in the lowlands of Croatia mainly as a weed on cultivated land, while it rarely appears in the coastal region (ŠILIĆ & ŠOLIĆ, 1999).

It was noted for the first time in the area of Šibenik in Skradin (MARKOVIĆ *et al.*, 1993). In September 1998 I observed this neophyte in Njivice, a suburb of Šibenik, and in Solaris and Zblaće. I also found it in Perković on November 2000 (near the railway station) and Siverić (Fig. 2). It mostly appears as a part of ruderal vegetation by the roads and ways at all the localities given.

### *Artemisia verlotiorum* Lamotte (Asteraceae)

This neophytic species originating from South-West China (TUTIN, 1976:180) is spreading in many parts of West, Central and South Europe. It was firstly noted for Croatia in Poreč, Istria (MELZER, 1969) and in the surroundings of Zagreb (MARKOVIĆ & HULINA, 1970). Since then this species has spread considerably in Croatia (SMITAL *et al.*, 1998): in the central part (Zagreb and environs by the banks of the Sava), in Istria and in the northern coastal region and the central coastal region (Split, Makarska and Ploče). The first finding in the central coastal region comes from Split (ILIJANIĆ *et al.*, 1991). The only reported finding so far for the area of Šibenik comes from Bilice not far from Šibenik (SMITAL *et al.*, 1998).

In the autumn of 1997 and 1998 I observed this neophyte in ruderal habitats by the roads and ways in the whole area of Šibenik (Crnica, Njivice, Šubičevac and Vidici) and in the surrounding settlements: Murter, Pirovac, Jadrija, Mikulandre, Bilice (Novo naselje, Slavice), Dubrava (Rakovo Selo), Brodarica and Konjevrate and later, in November 2000, in the area of Unešić, Oklaj, Drniš, Otavice and Knin (Fig. 2). The data given indicate that this neophyte has been spreading in the region of central Dalmatia not only in the coastal region but in the hinterland as well (the area of Drniš and Knin).

### *Aster squamatus* (Sprengel) Hieron. (Asteraceae)

This is an interesting neophyte (Fig. 5) originating from Central and South America (YEO, 1976:115) that has come to Croatia recently. It was first found in 1970 in the valley of the Neretva near Ploče, and then in 1971 by Melzer in Gradac (TRINAJSTIĆ *et al.*, 1993). It has recently been recorded in Makarska (TRINAJSTIĆ *et al.*, 1993). This neophyte has been recorded in the area of Šibenik in the most recent times: in the area of Bilice (Mikulandre i Vrulje) and Skradin (MARKOVIĆ *et al.*, 1993) and on the island of Zlarin (PANDŽA, 1998a).

In summer and autumn of 1996–2000 I found this neophyte in the area of the town of Šibenik and in the surrounding settlements in the coastal region: Pirovac, Murter, Jezera, Tribunj, Vodice, Jadrija, Zablaće, Solaris, Brodarica, Jadrtovac, Grebaštica and Rogoznica (Fig. 3). The plant spreads fast in different anthropogenic types of habitats: the edges of roads and ways in settlements and it is particularly widespread in habitats by the sea and brackish water. It is interesting that it was observed only on the island of Zlarin but not on any other inhabited island of the Šibenik archipelago (Krapanj, Prvić, Obonjan, Žirje and Kaprije).

### *Galinsoga parviflora* Cav. (Asteraceae)

This neophyte originating from South America (TUTIN, 1976:144) is spreading as a dangerous weed in the continental lowland part of Croatia (TRINAJSTIĆ *et al.*, 1993). It occurs rather rarely in the coastal part, but has been noted in Makarska (TRINAJSTIĆ *et al.*, 1993) and in the surroundings of Šibenik, the area of Rupe and Zaton (MARKOVIĆ *et al.*, 1993).



In the summer and autumn of 1999 and 2000 I found this species on more new localities in the County of Knin and Šibenik: on the island of Krapanj, in Vodice, Šibenik, Grebaštica, Perković, Kistanje, Unešić, Drniš and Knin (Fig. 3). It grows as a weed in the vegetable and flower gardens and vineyards. These findings indicate that *G. parviflora* spreads relatively fast in the area of Šibenik and Knin so that it could soon become a widespread and dangerous weed in the coastal region as it is in the continental part of Croatia.

### *Tagetes minuta* L. (Asteraceae)

This neophytic species originated from South America (HANSEN, 1976:144). It was first noted for Croatia 70 years ago (HAYEK, 1928–1931:618 as *T. glandulifera* Schrk.) but without any statement of a precise locality. In the last 30 years this neophyte has been found on numerous localities along the Croatian coastal region from Rijeka to Dubrovnik (ŠILIĆ, 1973; TRINAJSTIĆ, 1974; ILIJANIĆ *et al.*, 1991; ŠILIĆ & ŠOLIĆ, 1999).

*T. minuta* has not previously been noted in the area of Šibenik. In November 1997 I found it in Šibenik (Crnica and Njivice), Solaris and Grebaštica (Fig. 3), where it appears by the roads and ways and in neglected gardens.

### *Solanum elaeagnifolium* Cav. (Solanaceae)

This adventitious plant (Fig. 6) originating from South America has been spreading in the South Europe region only recently (HAWKES & EDMONDS, 1972:199; PIGNATTI, 1982:515). It has been noted so far in Croatia on the island of Plavnik in the Bay of Kvarner (GAŽI-BASKOVA & ŠEGULJA, 1978a,b), the village of Podšpilje on the island of Vis (PAVLETIĆ *et al.*, 1978) and in the area of Šibenik in the town port and in Donje Polje in the immediate surroundings (PANDŽA & STANČIĆ, 1999).

I found *S. elaeagnifolium* on several new localities in the Šibenik area: in September 1997 in the Bilice area (by the road through the village Krnići and on uncultivated land below Jurasi, a village by the road to Dubrava), in the summer of 1998 in Dubrava (weed on arable surface by the road through the settlement of Gojanovići) and in the village of Rupići (in the yard in front of a deserted house) (Fig. 4). The new localities, each with a great number of specimens, indicate that this species is spreading very fast and becoming more and more a dangerous weed in the area of Šibenik.

### *Eleusine indica* (L.) Gaertner (Poaceae)

This adventitious species (Fig. 7) originating from southwest Asia has spread all over the world mainly in warm and moderately warm areas (VREŠ, 1996). The first finding for Croatia comes from Umag (HODAK, 1960), and it has been noted in quite a number of localities in the continental region (Zagreb and surroundings, Lipik, Vukovar, Baranja) and in the coastal region of Croatia (Umag, Poreč, Rijeka, Split, Makarska, in the Neretva delta and Dubrovnik) (MARKOVIĆ & HULINA, 1970; TOPIĆ & ŠEGULJA, 1978; TOPIĆ & KUSULJA, 1989; IVKOVIĆ, 1982, ILIJANIĆ, 1989; LOV-



Fig. 5. *Aster squamatus* (Sprengel) Hieron.



Fig. 6. *Solanum elaeagnifolium* Cav.



Fig. 7. *Eleusine indica* (L.) Gaertner



Fig. 8. *Paspalum paspalodes* (Michx.) Scribner

RIĆ & RAC, 1987; DUBRAVEC *et al.*, 1989; ILIJANIĆ *et al.*, 1991; VREŠ, 1996; ČARNI & JOGAN, 1998; ŠILIĆ & ŠOLIĆ, 1999).

*E. indica* has not been recorded so far for the area of Šibenik. In summer 1996–2000 I found it in several localities in the town of Šibenik (Grad, Centar, Obala, Gorica, Dolac, Crnica) and in the suburban area called Bilice (Novo Naselje) (Fig. 4). It occurs on the lawns, in trampled habitats by the roads and in the fissures of the stone streets and stairs.

### ***Panicum dichotomiflorum* Michx. (Poaceae)**

By origin from North America (CLAYTON, 1980:261) it was first noted for Croatia in 1985 on several localities: Črnc polje, Banija (HULINA, 1985), in Turopolje (not far from Selce) and in the surroundings of Karlovac (Ozalj) (ILIJANIĆ & MARKOVIĆ, 1986). On these localities it mostly appears as a weed in the corn fields and by the field paths (ILIJANIĆ & MARKOVIĆ, 1986). Recently this neophyte has been noted in the area of Vukomeričke gorice (ŠEGULJA, 1996).

On 20 August 1999 I found a few specimens of this neophyte in Vodice in the grassy areas near the town market and many more specimens in Knin (Fig. 4) on the railway station (November 2000). These are the first findings of *P. dichotomiflorum* for the coastal region of Croatia.

### ***Paspalum paspalodes* (Michx.) Scribner (Poaceae)**

The first finding of this tropical grass (Fig. 8) for Croatia was in the Neretva valley around Metković and Opuzen (HORVATIĆ, 1949). It has been found to date in several localities in the coastal region of Croatia in damp and swampy habitats (MIJUŠKOVIĆ, 1986; ILIJANIĆ, 1990; ILIJANIĆ *et al.*, 1991; MARKOVIĆ *et al.*, 1993.).

In the area of the County of Šibenik and Knin, the neophyte *P. paspalodes* has been recorded only in the area of the Krka National Park, around Roški slap and Skradinski buk, and in the area below the village of Rupe (MARKOVIĆ *et al.*, 1993).

I found this species in two new localities in the Šibenik area (Fig. 4), near the village of Mučići near the Bay of Morinje (3 July, 1997) and in the central part of the village of Vrpolje (August, 1999). The marginal parts of the swamps in both localities are thickly overgrown with this weed.

The neophyte specimens collected in this research have been stored in the Herbarium of the Department of Botany, Faculty of Science, University of Zagreb (Hb Za).

## **CONCLUSION**

In the total of 13 neophyte species that were the object of this research, five of them were stated for the first time for the County of Šibenik and Knin (*Amaranthus crispus*, *Tagetes minuta*, *Euphorbia nutans*, *Eleusine indica* and *Panicum dichotomiflorum*). For eight species recorded previously, numerous new localities in the research area have been given (*Chenopodium ambrosioides*, *Ambrosia artemisifolia*, *Artemisia verlotiorum*, *Aster squamatus*, *Galinsoga parviflora*, *Solanum elaeagnifolium*, *Panicum dictio-*

*tomiflorum* and *Paspalum paspalodes*) which indicates that these species are expanding over the research area and in Croatia. The findings from the area of Knin and Drniš are of special interest because the available data about neophytic flora for these towns are really rare.

The numerous new localities of the neophytic species covered by this research in the County of Šibenik and Knin contribute to the better knowledge of their present distribution as well as of the dynamics of their expansion in Croatia.

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## S A Ž E T A K

Prilog neofitskoj flori Županije Šibensko-kninske  
(Dalmacija, Hrvatska)

M. Milović

U razdoblju od 1996. do 2000. godine, u sklopu širih florističkih istraživanja na području Županije šibensko-kninske, posebna je pažnja posvećena istraživanju neofita. Za ovaj rad su izdvojeni podaci za 13 vrsta neofita: 5 neofita (*Amaranthus crispus* (Lesp. & Thev.) N. Terracc., *Tagetes minuta* L., *Euphorbia nutans* Lag., *Eleusine indica* (L.) Gaertner i *Panicum dichotomiflorum* Michaux) se prvi put navode za istraživano područje, a za 8 neofita (*Chenopodium ambrosioides* L., *Ambrosia artemisifolia* L., *Artemisia verlotiorum* Lamotte, *Aster squamatus* (Sprengel) Hieron, *Galinsoga parviflora* Cav., *Solanum elaeagnifolium* Cav. i *Paspalum paspalodes* (Michx.) Scribner), koji su prethodno zabilježeni, navode se brojna nova nalazišta. Dosad objavljeni nalazi neofita i rezultati ovog istraživanja ukazuju na veliko bogatstvo neofitske flore Županije šibensko-kninske, naročito njenog priobalnog dijela.