Wild Marigold - *Tagetes minuta* L., New Weed on the Island of Hvar, and New Contribution to the Knowledge of its Distribution in Dalmatia (Croatia)

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Summary

Wild marigold (*Tagetes minuta* L., syn. *T. glandulifera*, familia *Asteraceae*) is native to South America and naturalized in Europe, Africa, Asia and Australia. Its presence as an adventive plant on Balkan Peninsula was noted by Hayek (1931), Šilić (1973), Trinajstić (1974) and others. During the last 6-10 years wild marigold had appeared as weed in vineyards on the island of Hvar and become an agricultural and medical problem. However, it has also very interesting agrochemical and pharmacological properties. Disadvantages and advantages of wild marigold are considered. Weed control measures are discussed.

Key words

wild marigold, *Tagetes minuta* L., weed, vineyards, distribution, island of Hvar, Dalmatia, Croatia, essential oils, insecticid, nematocid, agricultural problem, medical problem

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Introduction

During the last 6-10 years in vineyards of the island of Hvar (around Ivan Dolac) a robust on an average of 1 m tall weed in large and dense populations appeared. Now, it is on the south-facing side of the island (localities: Ivan Dolac, Sveta Nedilja and Zavala) widely spread and physically fills out interstices in vineyards. It has very unpleasant odour. It causes nausea, headache and contact dermatitis. In fact, this weed becomes very dangerous agricultural and medicinal problem. In this context it was important to identify this weed because the name is the key for information about its properties and the first step for further activities and weed control (Hulina, 1998). Early recognition of new weed offers the best opportunity for timely and cost-effective intervention.

The submitted data in this paper is actually of floristic and practical interest.

Area of investigation

In accordance with the geographic location, the island of Hvar belongs to the group of Central Dalmatian islands. It has a typical Mediterranean climate and it is known as the sunniest Adriatic island (Friganović, 1974; Mihovilović, 1995).

By its altitude (Sv. Nikola 626 m above sea level) the island of Hvar is one of our highest islands. It is 68 km long and on an average 4.5 km wide. With its surface of 312.5 sq km it is one of the largest islands of the Croatian littoral. The structure of areas is approximately: vineyards about 13%, olive-groves 3.5%, gardens and fields 1.5 %, grasslands 33% and maquis with forests 54%. High quality wine production and organic farming has significant influence on the economy of the island of Hvar.

In the landscape of this island are expressive forests of the Aleppo pine (*Pinus halepensis)* and the holmoak (*Quercus ilex)* and dalmatian pine forests (*Pinus nigra ssp. dalmatica).* There is also garrique of *Rosmarinus officinalis (*Trinajstić, 1977; 1995). Trinajstić (1993) listed 1038 taxa for the flora of the island of Hvar, but the species *T. minuta* is not on this list.

Materials and methods

In January 2007 Mrs. Ivana Krstulović Carić, B.Sc. agr. collected for the determination fruiting specimens of an unknown weed in vineyards on locations around Ivan Dolac.

In the laboratory of Department of Botany of Faculty of Agriculture, University of Zagreb, an experiment on the germination behaviour was carried out and the growth of seedlings was observed.

Determination was made by using the usual floristic literature (Hegi, 1925-1968; Hansen, 1976; Pignatti, 1983; Javorka, 1925; Hayek, 1931). The nomenclature of plant species follows Ehrendorfer (1973).

Data on taxon distribution and informationon field observations (for the island of Hvar) were collected from literature and on terrain from local residents.

Results and discussion

On the basis of determination of collected specimens and seedlings, an unknown weed from the vineyards on island of Hvar was recognized as *Tagetes minuta* L, synonim *T. glandulifera* Schrank, familia *Asteraceae*. The specific epithet "minuta" is from the Latin word *minutus* meaning small and refers to the small size of the capitula, and "glandulifera" from *glandula* and *fere* and refers to glands on backside of leaves and on leaves of involucrum. Common or vernacular names are: wild marigold, stinking Roger, Mexican marigold, stink weed, tall khaki weed and ambrozijana (on the island of Hvar).

Morphological description

Wild marigold - *Tagetes minuta* L. is an annual, strongly aromatic herb. Stem is erect, on average of 1 m tall, branched and furrowed. Some plants may reach a height of 2 m. Leaves are opposite (sometimes alternate on smaller branches). They are up to 5-15 cm long, divided into one terminal and several (3-7) lateral leaflets. Leaflets are elliptic, serrated up to 2-8 cm long. Flowers heads are up to 2 mm wide and 10 mm long. They are suited on short stalks, in erect dense corymbs at ends of branches (Fig.1 a). Flowers are creamy yellow and appear in late summer. The plant blooms from September to December. Fruits are achenes, spindle shaped, flattened, 5-8 mm long and 0.6 mm wide, black, covered with short hairs and on apex of achenes are four pointed scales, one longer than the others.

Wild marigold reproduces by seed. It is a prolific seed producer (>29,000 seeds per plant).

In the laboratory, at temperature between 20-25 °C, seeds germinate within two weeks and emergence is 90%. Seedlings (Fig. 1 b) resemble garden marigold (*Tagetes erecta)* seedlings. They have red hypocotyls, and long branchy hairs above axils.

All plant parts are extremely rich with essential oils and the plant has distinctive unpleasant scent.

Habitats

Wild marigold is ruderal and segetal weed. It grows on wast ground, roadsides, gardens, orchards and vineyards. It is a drought tolerant plant and it easily survives in poor soils.

(a)

(b)

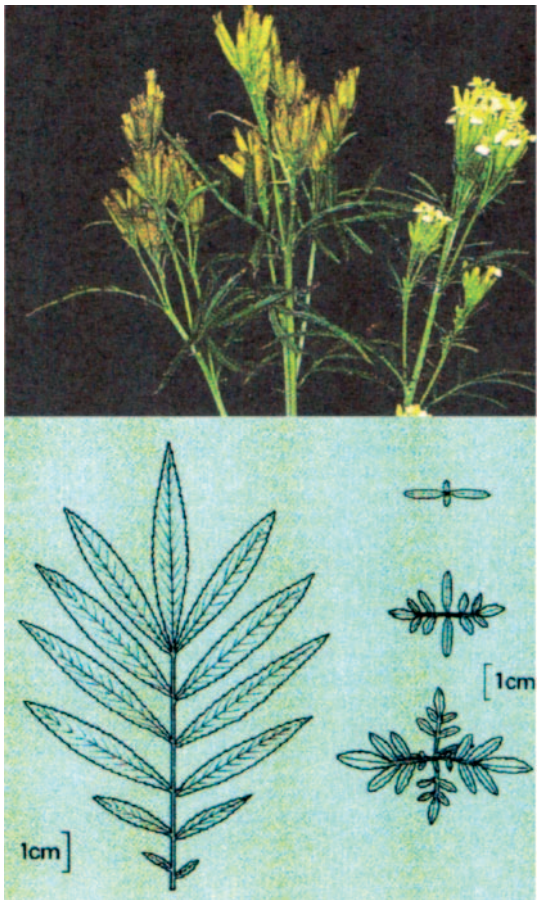

Figure 1. Wild marigold - *Tagetes minuta* L.
(a) erect dense corymbs, (b) seedling

In conjunction with the observations of local residents wild marigold was a primary coloniser of different ruderal sites and a secondary invaded the vineyards. Herbicidal treatment or other land-clearing operations often produce open spaces ready to be colonised by wild marigold.

Distribution

Wild marigold is native to South America. But it was listed as a part flora of Europe (Ehrendorfer, 1973; Hegi, 1925-1968; Hansen, 1976; Pignatti, 1983). Wild marigold is widely naturalised in many parts of Mediterranean region and also in Africa, Asia and Australia.

The earliest published information on the presence of *Tagetes minuta* in the flora of Balkan Peninsula comes from Hayek (1931) and notes only Dalmatia as the area of distribution. Šilić (1973) published a number localities of *Tagetes minuta* (Makarska, Herzegovina, Montenegro and southern part of Macedonia). Trinajstić (1974) documented the first record of its spread in area of former Yugoslavia. Continued spread of this species in Dalmatia were published by Hećimović (1982), Trinajstić (1985), Hećimović M. and S. (1987), Pavletić (1987), Ilijanić (1991), Trinajstić et al. (1993), Šilić and Šolić (1999), Šolić and Lukač (1997) and Milović (2001). Localities of *Tagetes minuta* in the territory of Slovenian Istria were published by Kaligarić and Jogan (1990).

Based on data it can be concluded that *Tagetes minuta* is widely distributed in Dalmatia, but on the island of Hvar until now was not noted. Now, it is widely distributed in the vineyards on the southern side of island (localities: Ivan Dolac, Sveta Nedilja and Zavala). On the northern side of island (e.g. locality Svirće) it is not present yet.

Use

In South America dried leaves of wild marigold were traditionally used for decades as a seasoning herb and insect repellent. In Brazil and other countries it is commercially grown for the oil, which is used in perfumes and for flavouring numerous food products. Essential oil has been used in aromatherapy and for medical purposes (for skin complaints, varicose veins, hemorrhoids).

Wild marigold has been widely cultivated around the world due to its agrochemical and pharmacological properties. It is very effective biopesticid. Root secretion kills subsurface and surface soil pathogens and it is the best treatment for nematodes in the soil. Floral, foliar and root extracts have insecticidal activity against adult *Coleoptera* and mosquito larvae and adults.

Its root extracts can reduce populations of weed species *Agropyron repens* and *Convolvulus arvensis*.

In Africa it is usually grown by organic gardeners for its insecticide and nematocide activities between lettuce, cabbage and tomatoes. In Africa it is gathered and used as a condiment and herbal tea.

Dangers

Wild marigold has become a major agricultural weed in 35 countries. It was reported as weed by Šilić (1973), Kovačević (1976), Kaligarić and Jogan (1990), Jauzein (1995), Pignatti (1983), Terry and Michieka (1987) and others.

Wild marigold is a problematic weed of pastures and numerous crops in East and South Africa, South America and Australia. The seed has unpleasant odour and can reduce the value of grain harvests when it is a contaminant.

Root extracts are allepathic to many vegetables, corn and sunflower. In the literature there is no answer on question how wild marigold affects the root of grape vine.

Wild marigold is resistant to natural enemies. Due to robust habitus it is a fierce competitor for space and light. Once established and uncontrolled it creates dense monotypic stands and displaces other plants. So it has negative effects on biological diversity.

Wild marigold has become a medical problem on the island of Hvar, because the stay in vineyard can cause nausea, headache and contact dermatitis.

Control activities

Regarding above mentioned reasons it is important to co-ordinate mechanical eradication of wild marigold in every vineyard on the island and to prevent new infestations by manual removal and destruction of plants before flowers mature.

Conclusion

The following conclusions may be drawn:

1. The South American species *Tagetes minuta* is in the last 30 years in a stage of intensive expansion in the region of Dalmatia and Adriatic islands, but until now it was not noted in the flora of the island of Hvar.
2. Really, it has been already present for about ten years on island of Hvar. It grows on ruderal places and is much expanded weed in vineyards on southern site of the island around localities Ivan Dolac, Sveta Nedilja and Zavala. It has become naturalised and invasive weed with consequent potential for causing economic (on grapes production) and environmental (loss of biodiversity) harms and harmful effects on human health (nausea, headache and contact dermatitis).
3. For that reason it is important to co-ordinate mechanical eradication of wild marigold in every vineyard on the island and to prevent new infestations by manual removal and destruction of plants before flowers mature.
4. If eradication or other control measures will not be conducted, it is reasonable to expect the further spread of wild marigold.

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