Comparaison of the flower scents of two *Impatiens* species

Christelle Marlet [1,*], Anne-Laure Jacquemart[2], Arnaud Vervoort[2], Georges Lognay[1]

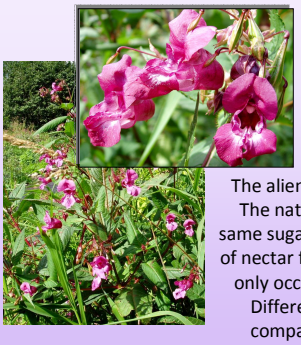
[1] *Department of Analytical Chemistry, Gembloux Agro-Bio Tech, University of Liège, Passage des Déportés 2, 5030 Gembloux (Belgium)*
E-mail: Christelle.Marlet@ulg.ac.be

[2] *Research group "Genetics, reproduction, populations", Earth and Life Institute, Catholic university of Louvain, Croix du Sud 2 box 14, 1348 Louvain-la-Neuve (Belgium)*

Université de Liège — gembloux agro bio tech — Department of Analytical Chemistry

UCL Université catholique de Louvain

Introduction



The Giant balsam, *Impatiens glandulifera* (Royle) (Balsaminaceae) was introduced in Europe from the Himalayas as a garden ornamental plant in 1839. Due to its great success from nursery gardeners (1), it is now considered as one of the 100 worst invasive species in Europe. On the contrary, the native *I. noli-tangere L.* is considered to be in decline. Both species are annuals that absolutely need reproductive output to maintain or extend their populations. High fecundity has frequently been associated with invasiveness. However, traits controlling the reproductive success like pollinator attractiveness have not yet been assessed.

The alien species is profusely visited by bumblebees which constituted the main visitors and efficient pollinators (2-3). The native also presents traits linked to insect attractiveness. Flowers produced similar quantities of nectar with the same sugar concentration and composition than the exotic. Therefore, the native could be considered as valuable source of nectar for pollinators. Despite the fact that nectar reward is likely to influence pollinator attractiveness, *I. noli-tangere* only occasionally received visits. Indeed, a flower of the native is 40 times less visited than a *I. glandulifera* flower (3). Differences in visitation rates may be explained by several factors, as floral scents, UV patterns or floral display. A comparative study of floral scents between these two species was performed by thermal desorption (TD)-GC-MS.

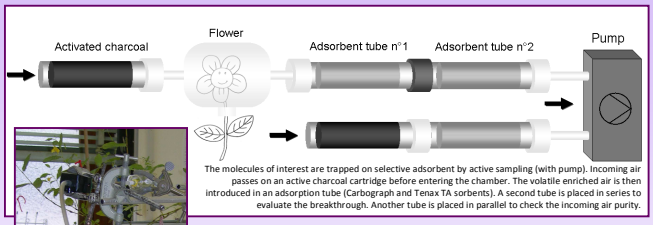
***Impatiens glandulifera* (Royle) (Balsaminaceae)**

***Impatiens noli-tangere L.* (Balsaminaceae)**

Experimental

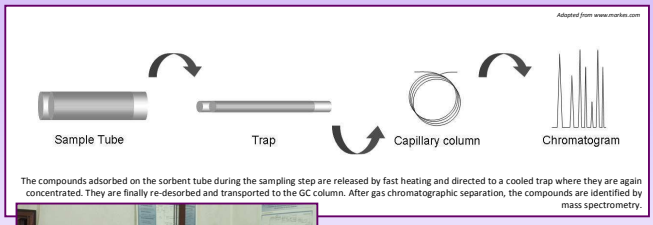
Material and method

Sampling



The molecules of interest are trapped on selective adsorbent by active sampling (with pump). Incoming air passes on an active charcoal cartridge before entering the chamber. The volatile enriched air is then introduced in an adsorption tube (Carbograph and Tenax TA sorbents). A second tube is placed in series to evaluate the breakthrough. Another tube is placed in parallel to check the incoming air purity.

TD-GC/MS



The compounds adsorbed on the sorbent tube during the sampling step are released by fast heating and directed to a cooled trap where they are again concentrated. They are finally re-desorbed and transported to the GC column. After gas chromatographic separation, the compounds are identified by mass spectrometry.

Results

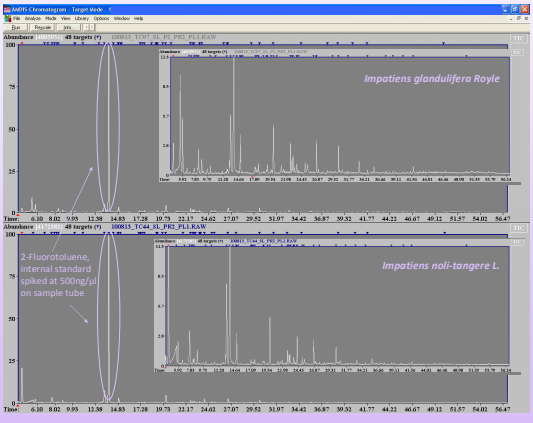


Fig.1 TD-GC-MS chromatogram in full scan for two flowers scents (obtained by A.M.D.I.S.)

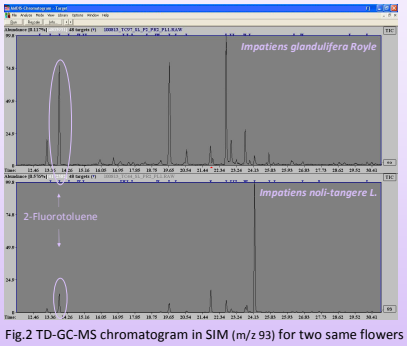


Fig.2 TD-GC-MS chromatogram in SIM (m/z 93) for two same flowers

References
(1) Beerling DJ and Perrins JM 1993 Biological flora of the British Isles : Impatiens glandulifera Royle (Impatiens roylei Walp.). Journal of Ecology 81:367-382.
(2) Chittka I and Schürkens S 2001 Successful invasion of a floral market. Nature 411:63.
(3) Vervoort A, Cawoy V and Jacquemart A-L. submitted. Comparative reproductive biology in co-occurring invasive and native Impatiens species. International Journal of Plant Sciences, submitted July 2010.

Table 1 Main monoterpenes detected in the two species

Name	IUPAC Name	Retention time (min)		Area (%)	
		I. glandulifera	*I. noli-tangere L.*	*I. glandulifera*	*I. noli-tangere*
α-Pinene	BICYCLO[3.1.1]HEPT-2-ENE, 2,6,6-TRIMETHYL-	19.78 ± 0.16 [3]	20.52 ± 0.18 [3]	1.10 ± 0.58 [3]	0.97 ± 0.48 [3]
Camphene	BICYCLO[2.2.1]HEPTANE, 2,2-DIMETHYL-3-METHYLENE-	20.74 ± 0.22 [2]	20.75 ± 0.19 [2]	0.15 ± 0.13 [2]	0.09 ± 0.10 [2]
β-Phellandrene	CYCLOHEXENE, 3-METHYLENE-6-(1-METHYLETHYL)-	21.86 [1]	*n.d.*	0.05 ± 0.09 [1]	*n.d.*
β-Pinene	BICYCLO[3.1.1]HEPTANE, 6,6-DIMETHYL-2-METHYLENE-, (1S)-	22.02 ± 0.20 [2]	22.02 ± 0.20 [2]	0.14 ± 0.16 [2]	0.31 ± 0.28 [2]
1,4-Cineole	7-OXABICYCLO[2.2.1]HEPTANE, 1-ISOPROPYL-4-METHYL-	23.66 [1]	23.65 [1]	1.47 ± 2.55 [1]	1.71 ± 2.95 [1]
d-Limonene	CYCLOHEXENE, 1-METHYL-4-(1-METHYLETHENYL)-, (R)-	23.83 ± 0.20 [3]	23.81 ± 0.18 [3]	0.59 ± 0.15 [3]	1.89 ± 2.20 [3]
(Z)-Ocimene	1,3,6-OCTATRIENE, 3,7-DIMETHYL-	*n.d.*	24.17 ± 0.36 [3]	*n.d.*	0.73 ± 0.61 [3]
1,8-Cineole (Eucalyptol)	2-OXABICYCLO[2.2.2]OCTANE, 1,3,3-TRIMETHYL-	24.41 ± 0.22 [2]	24.56 [1]	0.55 ± 0.84 [2]	1.09 ± 1.89 [1]
α-Terpinolene	CYCLOHEXENE, 1-METHYL-4-(1-METHYLETHYLIDENE)-	26.59 ± 0.14 [2]	26.49 [1]	0.80 ± 1.34 [2]	1.04 ± 1.81 [1]
Fenchol	BICYCLO[2.2.1]HEPTAN-2-OL, 1,3,3-TRIMETHYL-	*n.d.*	27.99 [1]	*n.d.*	0.11 ± 0.20 [1]
1-Terpineol	3-CYCLOHEXEN-1-OL, 1-METHYL-4-(1-METHYLETHYL)-	28.52 [1]	28.53 [1]	0.43 ± 0.74 [1]	0.96 ± 1.66 [1]
β-Terpineol	CYCLOHEXANOL, 1-METHYL-4-(1-METHYLETHENYL)-	29.02 [1]	29.01 [1]	1.45 ± 2.51 [1]	2.13 ± 3.70 [1]
α-Terpineol	3-CYCLOHEXENE-1-METHANOL,α,4-TRIMETHYL-	30.75 [1]	30.76 [1]	1.06 ± 1.83 [1]	2.34 ± 4.05 [1]
Geraniol	2,6-OCTADIEN-1-OL, 3,7-DIMETHYL-, (Z)-	*n.d.*	32.37 [1]	*n.d.*	0.15 ± 0.27 [1]

Three flowers have been studied for each species. The monoterpenes proportion presented in the table 1 is defined on basis of area of all compounds identified by A.M.D.I.S (I. glandulifera R. : 69 ± 9 compounds, I. noli-tangere L. : 65 ± 11 compounds). The number of flowers presenting the molecule is indicated in bracket. The mention "n.d." is indicated if compound is not detected by the method.

Conclusions

The specific sampling chamber allows to study floral scents in realistic conditions; the flower must not be cut. The first assay shows a difference of monoterpenes profiles for the two species. Terpenes (*α*-pinene, camphene, *β*-pinene, *1,4*-cineole, *d*-limonene, *1,8*-cineole, *α*-terpinolene, *1*-terpineol, *α* and *β*-terpineol) were emitted by the flowers of both species but (Z)-ocimene, fenchol and geraniol were absent in the flower scent of the alien *I.* glandulifera. However, the two species presented a high alcanes (>25%), aldehydes (>17%) and alcohols (>6%) proportion. Ongoing studies are undertaken in order to determine the attractiveness of *impatiens* scents to bumblebees.

Phytochemical Society of Europe (PSE) International Symposium on "Terpenes- Application, Activity and Analysis", 26-29.10.2010, Istanbul, TURKEY.