



THE DISTRIBUTION OF *HERACLEUM MANTEGAZZIANUM* SOMMIER & LEVIER
AND *H. SOSNOWSKYI* MANDEN. IN THE PŁASKOWYŻ JĘDRZEJOWSKI
PLATEAU (WYŻYNA MAŁOPOLSKA UPLAND)

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ABSTRACT. *Heracleum mantegazzianum* Sommier & Levier and *H. sosnowskyi* Manden. are alien species native to the Caucasus. They are highly invasive throughout Europe and displace the native flora. Both taxa served as fodder plants due to high biomass and were imported to state-owned farms in former communist countries in the 1970s. They entered the Płaskowyż Jędrzejowski plateau (Niecka Nidziańska basin) via this pathway. Fifteen stands of *H. mantegazzianum* and two localities of *H. sosnowskyi* have been recorded in the Płaskowyż Jędrzejowski plateau. The localities are situated along traffic routes (roads, railway tracks) along which the species migrate. Control and eradication measures such as mowing and herbicide treatment applied at the sites have to date been ineffective.

KEY WORDS: *Heracleum mantegazzianum*, *H. sosnowskyi*, invasive species, Płaskowyż Jędrzejowski plateau, Wyżyna Małopolska upland

INTRODUCTION

One of the most important aims of nature protection and conservation in Poland is to protect the native flora from alien species. They can spread quickly and displace native species of plants and animals. Two species of the genus *Heracleum*: *Heracleum mantegazzianum* Sommier & Levier and *Heracleum sosnowskyi* Manden., are dangerous invasive plants. *Heracleum mantegazzianum* Sommier & Levier (giant hogweed) is native to the Caucasian mountains. First data on the species date from 1817 when it was included on the seed list at Kew Botanic Gardens, London (UK). It was acquired as an ornamental plant. The first natural locality of *H. mantegazzianum* was recorded in Cambridgeshire (UK) in 1828 (KLINGENSTEIN 2007). The species has since colonized 19 countries in Europe and is still spreading to new areas. It entered Poland at the turn of the 19th and 20th centuries (THE GIANT HOGWEED... 2005). *Heracleum sosnowskyi* Manden. (Sosnowsky's hogweed) is similar to *H. mantegazzianum*. The species was separated from *H. mantegazzianum* from Georgia (former USSR) and described by Mandenova in 1944 (KOSTECKA-MĄDALSKA 1962, KABUCE 2006). It became an interest of studies as potential fodder in the former USSR in the early 1960s (WRÓBEL 2008) as the plant has a very high yield of green fodder which was used to feed cattle (BOCHNIARZ and BOCHNIARZ 1986). It very quickly became a fodder plant and was cultivated in state-owned farms (SF) in former communist countries. *Heracleum sosnowskyi* was brought to Poland through

this route in the 1970s and became the main fodder in state-owned farms (WOJTKOWIAK et AL. 2008). This was quickly abandoned as it turned out that the species can cause burns and damage the skin.

Both species are very similar. Characters distinguishing the two are subtle, which makes the identification of the taxa very difficult. Unlike *H. mantegazzianum*, *H. sosnowskyi* is slightly smaller (shorter in height, smaller size of leaves and umbels) and has obtuse leaf blades (THE GIANT HOGWEED... 2005, RUTKOWSKI 2006, JAHODOVÁ et AL. 2007) (Fig. 1).

Localities of both species in Poland are scattered (ATLAS... 2001). Many of them are in the Carpathian Mts (BIAŁECKA 1982, KOTOŃSKA 1991, MIREK 1986-1987, MIREK and PIĘKOŚ-MIRKOWA 1987, WRÓBEL 2008) and in Pomerania (BALCERKIEWICZ 1972, SOBISZ 2007, SOBISZ and TRUCHAN 2008). *Heracleum mantegazzianum* has been reported from the Niecka Nidziańska basin (SZELĄG 1997, TOWPASZ 2006) and the Przedgórze Hłeczkie foothills (NOBIS 2007, PIWOWARCZYK 2010) in the Wyżyna Małopolska upland. These studies are mostly regional floristic papers that report only localities of the two species but do not characterize them in detail. Only a few publications in Poland (SOBISZ 2007, SOBISZ and TRUCHAN 2008) deal with the chorology of both more broadly, as is the case with other plants considered to be invasive.

The objective of this study is to describe the localities of *H. mantegazzianum* and *H. sosnowskyi* in the Płaskowyż Jędrzejowski plateau (Niecka Nidziańska basin). Special attention will be paid to former state-owned

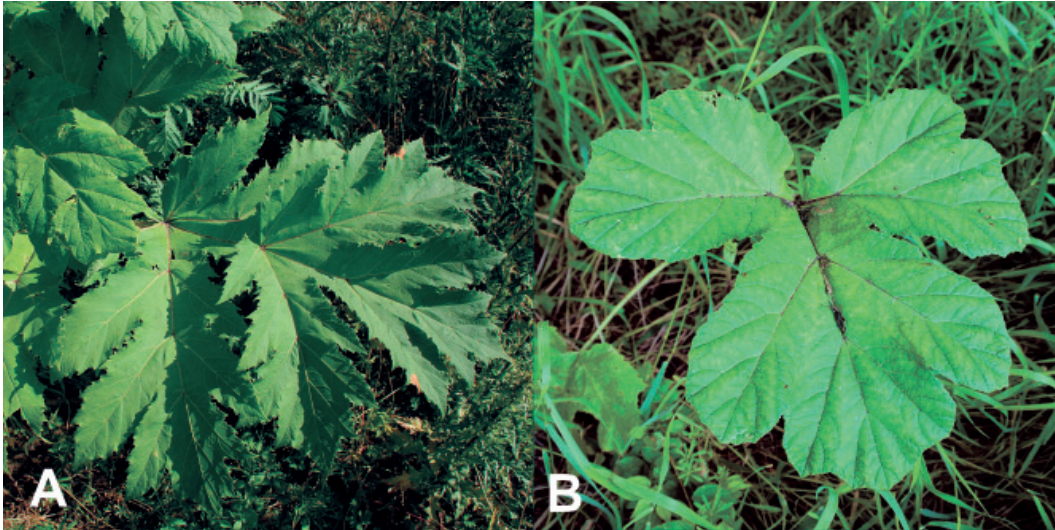


FIG. 1. Leaves of *Heracleum mantegazzianum* Sommier & Levier (A) and *H. sosnowskyi* Manden. (B)
Photo B. Piwowarski

farms. A brief note has been published on the subject (PIWOWARSKI and MACIEJCZAK 2010) but it needs further elaboration. Neither species has been reported from the Płaskowyż Jędrzejowski plateau and the data reported in this study are new.

STUDY AREA

The Płaskowyż Jędrzejowski upland is located in the macroregion of the Niecka Nidziańska basin (KONDRACKI 2002), formed on calcareous rocks mostly dating from the Cretaceous period. The geological substrate determines soil type. Heavy rendzina soils, considered to be very fertile (FLIS 1956), predominate. Agricultural peoples who interfered with the local landscape have settled here since the early neolith profiting from climatic and soil conditions (ZWOLSKI 1971). Fertile deciduous forest have been cleared for arable fields, mostly cereal crops, less frequently root and bulb plants. The current landscape of the Płaskowyż Jędrzejowski plateau is predominantly agricultural. As many as eleven state-owned farms, including their local branches such as cooperative agricultural associations, were set up in the area in the 1970s. *Heracleum mantegazzianum* and *H. sosnowskyi* were imported to the farms.

METHODS

Floristic field studies were conducted in the Płaskowyż Jędrzejowski plateau in 2006 using the ATPOL method (2.5 km flowering) (ZAJĄC 1978). The location of the new discovered sites of *H. mantegazzianum* and *H. sosnowskyi* was mapped schematically, individuals were counted, including flowering and sterile plants, and their location in relation to the nearest former state-owned farms was determined. The definition of former communist state-owned farms also includes warehouses, garages and cooperative agricultural associations. Topographic maps in the scale of 1:25 000 were used.

The distribution of *H. mantegazzianum* and *H. sosnowskyi* was mapped digitally and the accurate straight-line distance from the sites to the nearest former state-owned farm was measured using ArcMap 9.2. The distance is given at the end of the descriptions on the list of localities (e.g. PGR 850 m); the acronym of the Polish term for state-owned farms, PGR, is used on the list and in the figures.

RESULTS

A total of 17 localities of both species were recorded in the Płaskowyż Jędrzejowski plateau: 15 sites of *H. mantegazzianum* and two sites of *H. sosnowskyi*. The localities are clearly grouped in the western part of the study area (Fig. 2). A list of the localities and their full description are given below.

1. Localities of *Heracleum mantegazzianum*

1. **EE 9012** E of the Chycza border village, not far from the road leading to ponds; 8 individuals (2 flowering); PGR 3200 m.
2. **EF 0010** Roźnica, by the road to Sieńsko within the ruins of an old palace complex which used to be a cooperative agricultural association; on a small hill on the western side of the palace; 92 individuals (49 flowering); PGR < 100 m.
3. **EF 0011** halfway between Roźnica and Sieńsko; 17 individuals (3 flowering); PGR 850 m.
4. **EF 0013** SE Trzciniac in a loose built-up area, by a house, at the junction of two dirt roads; 1 sterile individual; PGR 1200 m.
5. **EF 0020** SW border of Nowa Wieś, on the margin of a pine grove on *Tilio-Carpinetum* habitat, by a metalled road to Bugaj village; 34 individuals (8 flowering); PGR 2700 m.
6. **EF 0032** Sędziszów: abundant locality, thousands of individuals, scattered throughout the town. The largest aggregation is by a sports and leisure centre (a swimming pool, football pitches), by the road

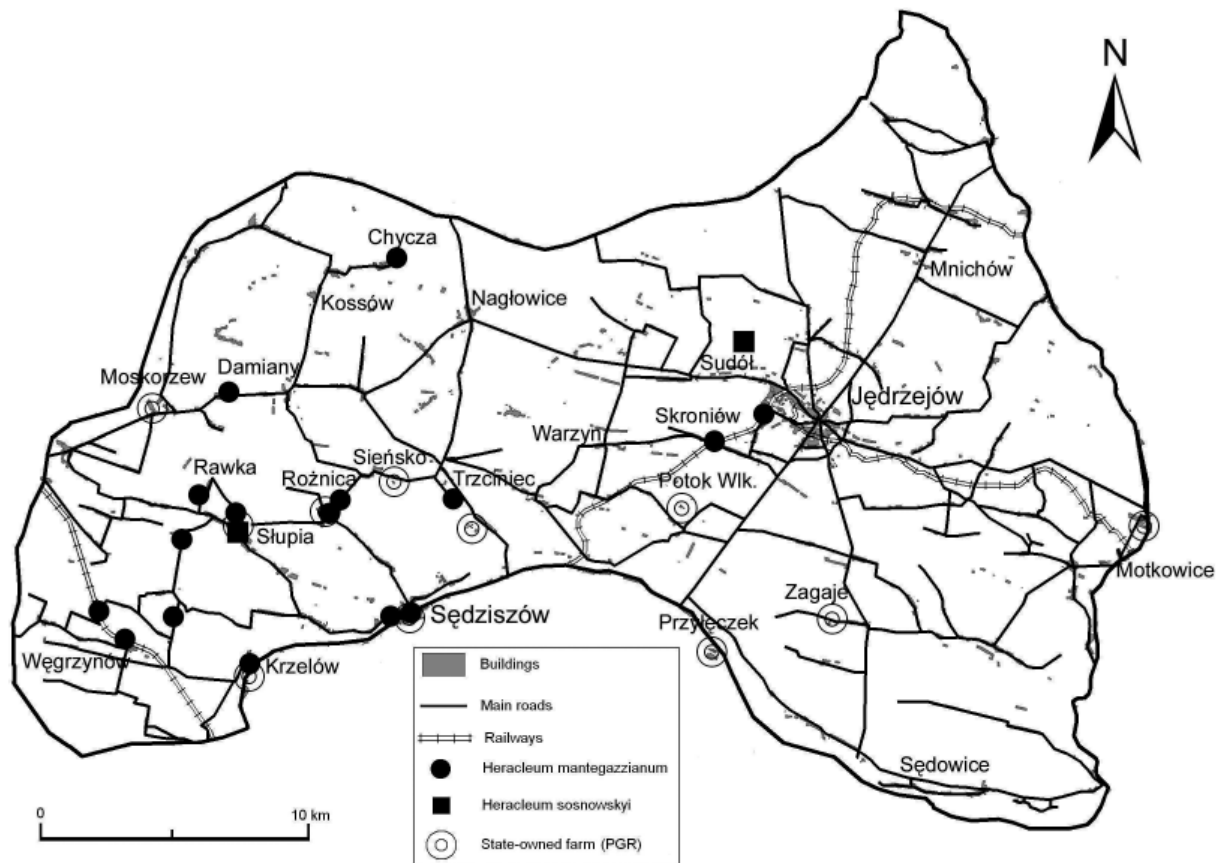


FIG. 2. The distribution of *Heracleum mantegazzianum* Sommier & Levier and *H. sosnowskyi* Manden. in the Płaskowyż Jędrzejewski plateau, including the location of former state-owned farms

- to Tarnawa and in a former state-owned farm converted into a welfare centre; ca. 2500 individuals (the majority of flowering); PGR < 100 m.
7. **EF 0103** Skroniów, by railway tracks, near a level crossing; 15 individuals (3 flowering); PGR 2900 m.
 8. **EF 0200** Jędrzejów, industrial part of the town (W), by railway tracks; 8 individuals (6 flowering); PGR 4800 m.
 9. **DF 0912** behind a residential house in Rawka village, near a junction; 10 individuals (7 flowering); PGR 1900 m.
 10. **DF 0913** N border areas of Słupia, along the road from a former state-owned farm to Rawka. Approximately 1 000 individuals (the majority of flowering) are distributed along the same road and enter a pine grove on *Tilio-Carpinetum* habitat; PGR < 100 m.
 11. **DF 0922** S border of Wielkopole village, in ditches by the road to Raszków; 135 individuals (26 flowering); PGR 2400 m.
 12. **DF 0931** by a level crossing between Węgrzynów Stary and Węgrzynów Nowy (on an old rubble heap between a dirt road and the railway tracks) and on the N borders of Węgrzynów Nowy, by a dirt road; 25 individuals (4 flowering); PGR 6700 m.
 13. **DF 0932** 1 km S of Raszków, in an old excavation pit (a fly-tipping site) by the road to Węgrzynów Nowy; 45 individuals (21 flowering); PGR 4300 m.
 14. **DF 1903** Krzelów, by the road between a pond dyke towards Bugaj; 1 sterile individual; PGR 200 m.

15. **DF 9933** Damiany, by a metalled road leading N of individual houses; 4 individuals (sterile); PGR 2300 m.

II. Stanowiska *Heracleum sosnowskyi*

1. **EE 9133** by the Gaj forester's lodge on the SW border of the "Ostoja Gaj" PLH 260027 Nature 2000 ecological site; 23 individuals (sterile); PGR 7200 m.
2. **DF 0923** Słupia, in a small yard behind the village social centre by the market place (park); 84 individuals (4 flowering); PGR 800 m.

The majority of the localities (14) are grouped in the western part of the study area. They do not occur in the western part at all although the habitat and the landscape are the same. Both *H. mantegazzianum* and *H. sosnowskyi* occupy here accidental habitats. They are mostly recorded on synanthropic habitats (roadsides, baulks, nitrophilous habitats) or in their immediate vicinity, e.g. in a meadow by a road or on the forest margin.

The most abundant localities of *H. mantegazzianum* are in Sędziszów (EF 0032) and Słupia (its N border, by a former state-owned farm) (DF 0913) and in their vicinity where the majority of the localities (10) are grouped (Fig. 2). The largest state-owned farms in the Płaskowyż Jędrzejewski plateau operated here and it is very likely that the taxon was cultivated at this site. The same situation is observed in Różnica (EF 0010). As the abundance of individuals at the localities near Sieńsko, Trzcinięc, Łowinia or Moskorzew is low, the stands most probably

also derive from these populations although cooperative agricultural associations and lower territorial units of state-owned farms were active in the area.

Only three localities (Gaj forester's lodge, Skroniów and Jędrzejów) are distributed in Jędrzejów (Fig. 2). The occurrence of the species here may be caused by the presence of a large urban agglomeration with a well-developed infrastructure nearby (E-7 national road and local roads; ordinary, wide-gauge and narrow-gauge railway tracks). Węgrzynów (DF 0931) is similarly crossed by railway route 64 (Kraków-Koniecpol) (Fig. 2). The location of these sites (immediately by the railway tracks) and a relatively long distance from the nearest state-owned farms show that diaspores probably involuntarily entered these localities by rail.

The distribution of flowering individuals of *H. mantegazzianum* at individual localities should be discussed separately (Fig. 3). Flowering individuals exceed 50% for five sites, which may indicate a high population potential. These sites may function as dispersion sources at the basic expansion potential, that is the generative reproduction potential (PERGLOVÁ ET AL. 2007). On the other hand, sterile and juvenile individuals predominate at the majority of the localities which may indicate the development and spread of the populations.

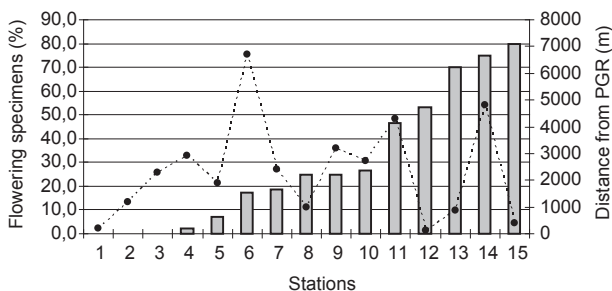


FIG. 3. The relationship between flowering specimens of *Heracleum mantegazzianum* and the distance from state-owned farms (PGR) at various localities in the Płaskowyż Jędrzejowski plateau (1 – Krzelów, 2 – Trzciniec, 3 – Damiany, 4 – Skroniów, 5 – Rawka, 6 – Węgrzynów Stary, 7 – Wielkopole, 8 – between Roźnica and Sieńsko, 9 – Chyca, 10 – Nowa Wieś, 11 – Raszków, 12 – Roźnica, 13 – Sędziszów, 14 – Jędrzejów, 15 – Słupia)

The distance between the localities and the nearest former state-owned farms plays a similar role. Sites located less than 1 km are very abundant, although such a relationship can be observed only for the stands in Sędziszów and Słupia. A high range of distances from state-owned farms is observed for other localities and it is difficult to determine unequivocally specific correlations between them. The generative reproduction potential of individual populations and the distance from the source sites proposed are not correlated (Fig. 3). The same is observed for the localities of *H. sosnowskyi* although a detailed analysis is not viable due to the small number of sites (2).

DISCUSSION

The two localities of *H. sosnowskyi* with single individuals, mainly sterile and juvenile, seem to be accidental in the study area. It was *H. sosnowskyi* that was a fodder taxon, not *H. mantegazzianum*. The two species may not have been fully distinguished by the farm staff in the 1970s and *H. mantegazzianum* was imported to the Płaskowyż Jędrzejowski plateau instead of *H. sosnowskyi*.

The distribution and the detailed location of the occurrence of *H. mantegazzianum* and *H. sosnowskyi* indicate that the two species are strongly attached to synanthropic habitats and traffic routes which they use to spread (PIWOWARSKI and MACIEJCZAK 2010) as is the case in Pomerania (SOBISZ 2007, SOBISZ and TRUCHAN 2008).

Although the two plants are strongly invasive, they are sometimes thought to be ephemerophytes (RUTKOWSKI 2006) or epocophytes (NOBIS 2007). However, it is more probable that *H. mantegazzianum* and *H. sosnowskyi* are agriophytes (ZAJĄC ET AL. 1998) in the rank of hemiagriophytes (TOWPASZ 2006, PIWOWARCZYK 2010). The localities in the Płaskowyż Jędrzejowski plateau should be classified as such. The slow penetration of *H. mantegazzianum* into secondary forest communities (a pine tree stand on the *Tilio-Carpinetum* habitat) in Słupia and Nowa Wieś raises concerns. Both species may soon pose an even greater threat to the native flora, fauna and people.

Control methods to eradicate *H. mantegazzianum* and *H. sosnowskyi* have been introduced at nearly all larger sites of both species in the Płaskowyż Jędrzejowski plateau. The two plants pose a health risk to people and animals, and threaten the native plant cover. However, observations show that the control methods have failed so far. Plants re-grow after mowing or spraying with Roundup (herbicide). Nielsen et al. (THE GIANT HOGWEED... 2005, NIELSEN ET AL. 2007) recommend cutting the root 10 cm below soil level and applying herbicides containing glyphosate or triclopyr in spring when the plants are not mature (up to 50 cm in height). This treatment should be successive and the sites must be systematically and frequently monitored during the vegetative season. The most efficient control is obtained when the above methods are applied simultaneously.

CONCLUSIONS

1. Fifteen localities of *Heracleum mantegazzianum* and two localities of *H. sosnowskyi* occur at the Płaskowyż Jędrzejowski plateau.

2. A vast majority of the localities is grouped in the western part of the study area.

3. The most abundant populations of *H. mantegazzianum* are in Sędziszów and Słupia, where the largest state-owned farms in the Płaskowyż Jędrzejowski plateau operated.

4. Only Sędziszów and Słupia can be classified as dispersion sources of the species. Only the localities in their most immediate vicinity may be derived from

there. The genesis of other sites cannot be unequivocally determined.

5. Five localities of the two species are not related to the operation of state-owned farms but is instead associated with a large urban agglomeration and well-developed infrastructure.

6. The two localities of *H. sosnowskyi* in the Płaskowyż Jędrzejowski plateau seem to be accidental. The abundance is low and the majority of the plants are sterile and juvenile.

7. Only *H. mantegazzianum*, considered to be a decorative species, was cultivated in state-owned farms in Sędziszów and Słupia, and not *H. sosnowskyi*, which was reported as a fodder plant in the literature. This shows that the two taxa were not fully distinguished by the farm staff.

8. Both invasive species in the study area should be treated as hemiagrophytes that spread along traffic routes (roads, railways).

9. Individuals of *H. mantegazzianum* have penetrated forest communities (a pine stand on the *Tilio-Carpinetum* habitat) at two localities, Nowa Wieś and Słupia. This may be very dangerous for the native plant cover in the future.

10. *Heracleum mantegazzianum* is mown and treated with Roundup (herbicide) at the majority of the localities. The treatment is ineffective. The eradication of hogweed species should be successive and complex (a range of simultaneous treatment measures).

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