

## New locations of Persian walnut (*Juglans regia* L.) in valleys of selected right-bank tributaries of the Warta River in Poznan, part 3

Krzysztof Janku, Mostefa Mana, Ewa Arczyńska-Chudy

*Institute of Agricultural and Forest Environment, Polish Academy of Sciences, Poznań, email – krzysztof.janku@isrl.poznan.pln*

**Received:** March 29, 2018 **Accepted:** June 15, 2018 **Published:** July 19, 2018

**Abstract:** Studies on the occurrence of Persian walnut (*Juglans regia* L.) in the valleys of the analysed watercourses confirmed that this species grows along all of the tributaries of the Warta River within the Poznan city limits. The specimens were most commonly found in lines of trees (267 pcs) and in forests. Total number of observed trees reached 348 pieces. Authors suppose that it is significant that no specimens of *Juglans regia* were found next to the Czapnica watercourse bed, but 17 pcs were recorded on the slopes and along the shoreline of Czapnica Lake. The distribution pattern of the species could be associated with the presence of gardens in the vicinity of the lake. Entering forest associations by this species (74 pcs) is new and very different from previous studies in this area. The recorded diameters at the breast height (DBH) of trees growing next to Główna and Cybina watercourses indicate the ongoing expansion of walnut in the valleys of these watercourses.

**Key words:** Persian walnut, river valleys, urban area

### INTRODUCTION

In Poland, Persian walnut (*Juglans regia*) is gradually becoming an element of phytocoenoses that are particularly susceptible to expansion of anthropophytes such as forests and thickets in river valleys (Towpasz 2006, Sikora, Sobieraj 2015). However, several authors noticed that walnuts occur widely in forest patches in southern Poland and in other forests in the Alps (Loacker et al. 2007). The process of entering walnut into forest complexes adjacent directly to human settlements is limited to the forest edge zone only (Lenda et al. 2017). Walnut trees grow well and often bear fruit among fallows (Lenda et al. 2012). However, it is believed that in the forests, its expansion may be inhibited by competition from indigenous tree species resistant to alien species invasions (Essl, Milasowszky et al., 2011, Kowarik, 1995).

The research presented in the article is a continuation as well as completion of the sequel of papers on Persian walnut (*Juglans regia* L.) trees in the valleys of the Warta River tributaries in the area of the city of Poznań. The reason for conducting this study was to supplement the data obtained from other areas and the fact that watercourses are strongly diversified in terms of the period of occurrence of water in riverbeds, the volume of flow, the degree of transformation of the course and channels, and the share of land use forms in the catchment.

The aim of the study was to find new walnut locations in the valleys of three remaining right tributaries of the Warta River in the Poznan city limits: Główna, Cybina and

Czapnica. Two of these tributaries are the biggest of all analysed watercourses that flow through the diverse areas of urban landscape.

### DESCRIPTION OF THE AREA AND METHODS

Field studies were carried out during the growing season of 2017 and beginning of 2018. Inventory of Persian walnut locations was conducted in the valleys of the following watercourses: Główna, Cybina, and Czapnica (Fig. 1). All of analysed rivers are located in the district of Nowe Miasto (western part of Poznan) and characterised by a latitudinal (east to west) flow. Główna and Cybina flow closer to the north and Czapnica to the south limits of the city. The total length of the analysed watercourses is approx. 16 km. Główna in the mid-course (taking under consideration only length of the river in the city) goes through old industrial and residential areas block of apartments housing. Almost 3 km (out of 5.6 km) are still little converted for human needs. Cybina (only 2 km to south from Główna) is an example of a watercourse strongly transformed for recreational needs of population. Despite the fact that approx. 6 km of its course (of ~9 km in the city limits) are passing through forests, they are surrounded by numerous house estates (from the north) and apartment blocks (from the south). Czapnica is the shortest analysed watercourse with the most transformed river bed shape (similar to drainage ditch) and partially separated from Czapnica Lake where it formerly began. The highest share of land next to the course of the river belongs to fields.

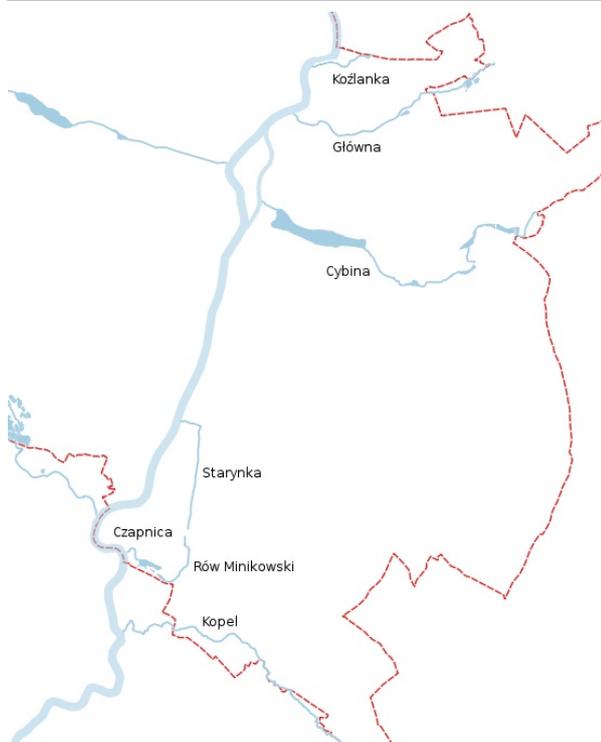


Fig.1 East tributaries of the Warta River (blue – watercourses and lakes, red – city limits)

Locations of walnut trees have been recorded using Garmin Traveller GPS receiver in the Global Positioning System - GPS NAVSTAR. The distribution of the trees was mapped using the QGIS software. Trunk diameter at 1.30 m (DBH) and the height (H) of individual trees were also measured during the field studies. The processing of GIS data included determining the number of locations, share of tree lines, municipal forests and unwooded sections (gaps) in the landscape of the studied valleys. Aerial photos, made in 2016 and obtained from Google Earth PRO, were used to determine the share of different forms of land use in the area directly adjacent to watercourses. These analyses did not include the sections of watercourses in pipelines. The following categories of land use were identified: wastelands, house and estate garden, parks and forests, fields, built-up areas and roads along watercourses. Forms of land use of the area in which the trees were found were given for each location.

## RESULTS

A total of 96 locations of Persian walnut was observed (Figs. 2-4). The specimens are most commonly found in tree lines. Forty-three were found alongside Główna (Tab. 1), 45 along Cybina (Tab. 2) and eight next to Czapnica Lake (Tab. 3). The largest cluster of trees was observed along Cybina and it was composed of 33 specimens. The total number of walnut trees reached 348 pieces.

Description of locations:

### I. Główna:

1. Gassy green belt located by the car park next to Hłonda

Street.

2. Tree line with dominant *Alnus glutinosa* growing on the slope.
3. Grassland next to Tadeusz Kirschke Park.
- 4-10. Continuation of the tree line mentioned in point 2, growing next to the old gasworks buildings (dominant *Acer* sp.), adjacent to apartment blocks in the south. Situated on the abandoned and neglected garden plots. Walnuts occurring here spread up to Gdyńska Street.
- 11-15. Tree line situated next to the private park, garden and construction area (from the north), apartment blocks and estates gardens (from the south).
- 12-21. Same tree line but separated from the previous section by the railway embankment. In the north, locations are adjacent to the wasteland covered with natural bushes. In the south, estate gardens are present on the entire length.
22. Tree line with dominant *Alnus glutinosa* and multi-species mixture of shrubs.
23. Edge of municipal forest located between Bałtycka and Gnieźnińska Streets.
24. Continuation of the forest mentioned in point 23, located next to a fork of the roads where watercourse is flowing to a water reservoir.
25. Forest behind the fork of the roads mentioned in point 24, located on the side of the reservoir.
26. Growing within a forest (with dominant *Fraxinus excelsior* and *Alnus* sp.) on the south side of the reservoir.
- 27-30. Continuation of the forest mentioned in point 23.
31. Specimen in a stand adjacent to Bałtycka Street from the south.
32. Tree located in a stand (*Alnus* sp.), adjacent from the north to Bałtycka Street.
- 33-38. Continuation of the stand mentioned in point 32, located by a pipeline.
- 39-40. Continuation of a stand mentioned in point 32, located on the edge of a forest adjacent to a field, north side of the watercourse, outside the Poznan city limits.
41. Line of trees located by a pipeline, outside city limits, close to the point 40.
42. Located on an island, among lines of trees.
43. Located in a line of trees, between a reservoir and a railway embankment.

### II. Cybina:

- 1-2. Single trees growing on a meadow.
3. In the line of trees, located by the conduit at Jana Pawła II street.
4. Walnut trees form a line from the north side of the watercourse between Jana Pawła II Street and Cybiński weir, in the south – part of trees is located in an

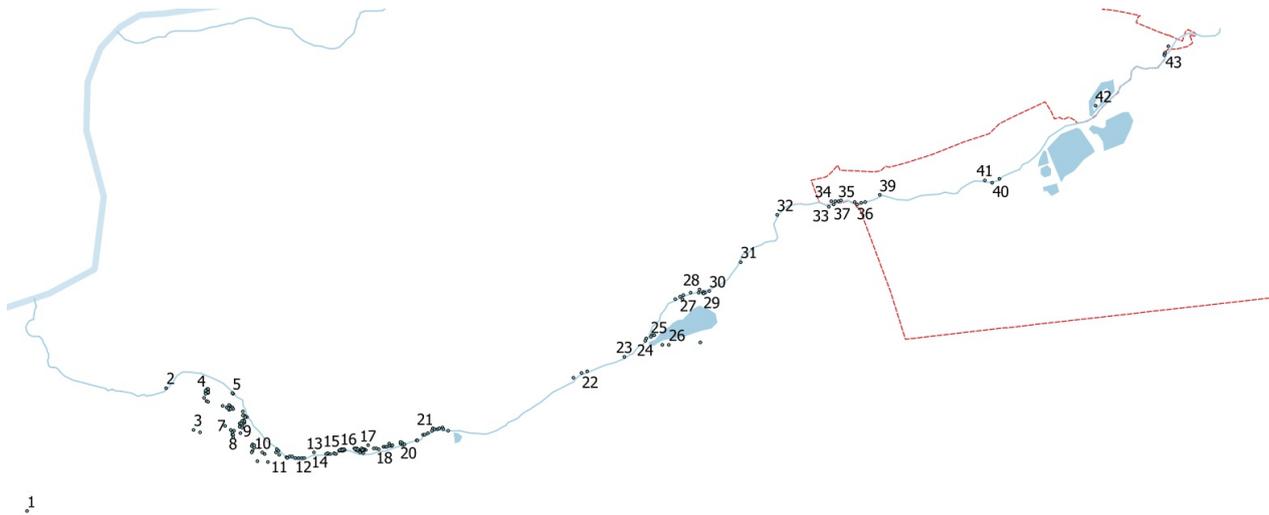


Fig.2. Locations of Persian walnut next to Główna.

Table 1. List of locations and DBH and height ranges and number of Persian walnut trees for Główna valley

Watercourse name	Form of occurrence	No. of locations	DBH range [cm]	H [m]	No. of trees [pcs]
Główna	single	2	6.5-12.7	1.9-7	3
	line of trees	24	0.3-46.8	0.2-16	145
	municipal forest	17	0.5-16.6	0.8-12	34
<b>SUMMARY</b>		43	0.3-46.8	0.2-16	182

abandoned park.

- 5-6. Behind Lake Malta in a line of trees, located on both sides of the watercourse.
- 7. Single tree by the car park, in the stand adjacent to the watercourse from the south side, in the vicinity of Browarna Street.
- 8-17. Located in a line of trees directly by the shoreline (11, 13, 14, 15-17), on the south side of Browarny pond.
- 18. Two trees in a shelterbelt, located in the vicinity of

Sępia Street.

- 19. Single tree on the edge of a pine stand.
- 20-23. Line of trees spreading from Browarny Staw to Młyński Staw, on the east side of the watercourse.
- 24. Shelterbelt adjacent to allotment gardens „Nowy Młyn” on the west side of the watercourse.
- 25. Single walnut tree on the edge of the stand described in point 20-23.
- 26-31. Located in a stand (dominant *Pinus silvestris*, species composition is more diverse by the reservoir’s shore - *Acer* sp., *Betula pendula*, *Fraxinus excelsior*, *Salix* sp.) on the north side of Browarny Staw.
- 32-33. Located in the stand mentioned in point 24, by the southern shore of Młyński Staw.
- 34. Line of trees at Radziwoja Street.
- 35. Continuation of tree line at Radziwoja Street, by the dyke separating Młyński and Antoninek ponds.
- 36. Line of trees at Radziwoja Street by the northern shore of Antoninek pond.
- 37-41. Stand located between northern shore line of Młyński Staw and Browarna Street.

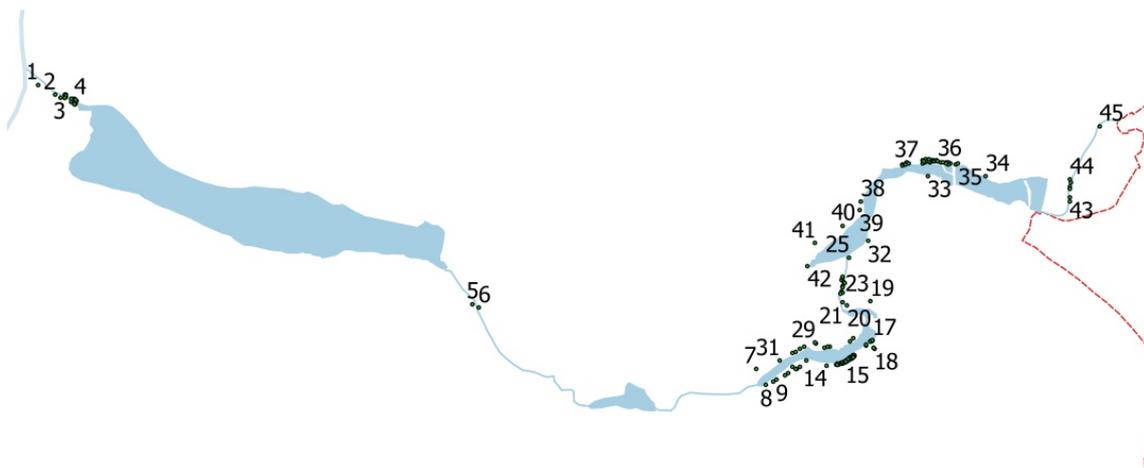


Fig. 3. Locations of Persian walnut next to Cybina

- 42. Single tree in a roadside shelterbelt at Browarna Street.
- 43-44. Tree line located along estate gardens to Warszawska Street.
- 45. Tree line located between Sarnia Street and Swarzędzkie Lake.

Table 2. List of locations and DBH and height ranges and number of Persian walnut trees for Cybina valley

Watercourse name	Form of occurrence	No. of locations	DBH range [cm]	H [m]	No. of trees [pcs]
Cybina	single	2	0.8-19.1	1.6-9	3
	line of trees	22	0.5-29.9	0.4-17	109
	municipal forest	21	0.4-17.5	0.3-15	37
<b>SUMMARY</b>		45	0.4-29.9	0.3-17	149

III. Czapnica:

- 1. Line of trees with dominant *Robinia pseudacacia* growing on the slope next to the unnamed street, adjacent to the western bank of a lake.
- 2. Single tree close to location mentioned in point 1.
- 3. Line of trees next to the southern lake shore.
- 4. Line of trees with dominant *Acer* sp. growing on the north steep slope of the lake. From the north, adjacent

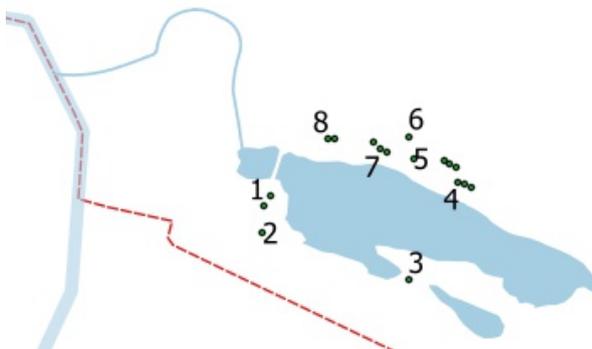


Fig. 4. Locations of Persian walnut next to the Czapnica Lake

Table 3. List of locations and DBH and height ranges and number of Persian walnut trees for Czapnica valley

Watercourse name	Form of occurrence	No. of locations	DBH range [cm]	H [m]	No. of trees [pcs]
Czapnica	single	1	5	3.5	1
	line of trees	5	3-12	3.5-9	13
	municipal forest	2	8-20	6.5-13	6
<b>SUMMARY</b>		8	3-20	3.5-13	17

- to gardens and to the recreational road from the south.
- 5. Line of trees located next to the recreational road.
- 6. Municipal forest composed of mixed deciduous species.
- 7. Continuation of the line of trees mentioned in point 5.

- 8. Municipal forest mentioned in point 6.

SUMMARY AND CONCLUSIONS

The share of tree lines along the riverbanks of the studied watercourses is substantial. The tree lines cover 20 to 62% of riverbanks (Fig. 5). Walnut trees were recorded in the various forms of the landscape and land use of the valleys such as wasteland and fields, but primarily in tree lines 77% and forests 21% (Tab. 4). Entering forest

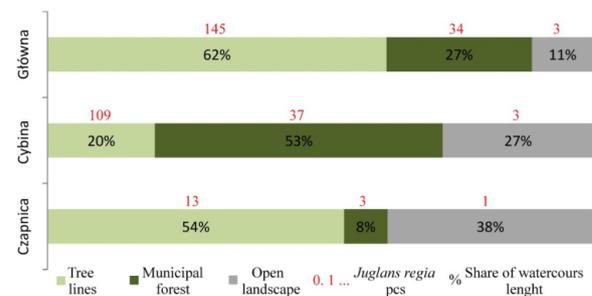


Fig. 5. Dependence of Persian walnut presence on type of afforestation in landscape

associations by this species is new and very different from previous researches in this area (Janku et al. 2017a, 2017b). It is significant that even if the share of line trees had the lowest value along the river, the number of observed specimens was the highest for that form of landscape.

Land use of Cybina and Główna is characterized by a high share of forests (Fig. 6). Czapnica, on the other hand, is characterized by a large share of fields adjacent to watercourses. Authors suspect that it is significant that no

Table 4. List of locations and DBH and height ranges and number of Persian walnut trees for all valleys depending form of occurrence

Form of occurrence	No. of locations	DBH range [cm]	H [m]	No. of trees [pcs]
single	5	0.8-19	1.6-9	7
line of trees	51	0.3-46.8	0.2-17	267
municipal forest	40	0.4-20	0.3-15	74
<b>SUMMARY</b>	96	0.3-46.8	0.2-17	348

specimens of *Juglans regia* were found next to the Czapnica watercourse bed, but 17 pcs were recorded on the slopes and along the shoreline of Czapnica Lake. It could be associated with the presence of family estate gardens present only in the vicinity of the lake – 13 of 17 trees were found there. Most of the trees of the examined species were observed along Główna watercourse, which is probably associated with an abandoned garden houses

located in the lower section of the river, where the biggest specimens were found (locations 7-10, Tab. 1).

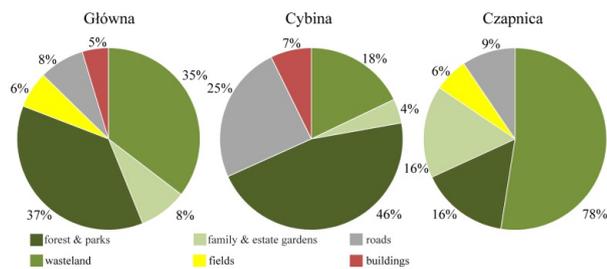


Fig. 6. Share of land form categories adjacent to watercourses

Nevertheless, Główna shows the highest number of Persian walnut trees of all Warta tributaries in city limits; Cybina takes the second place – trees of the analyzed species are located mostly next to the man-made lakes. Observed walnut trees, just like in the case of previous studies, are most often located in the vicinity of urbanized areas.

1. Most of the recorded trees grew in shelterbelts and forests.

2. The walnut trees in forests are located in two watercourses.

3. The recorded breast height diameters of trees growing next to Główna and Cybina watercourses indicate the expansion of walnut in the valleys of these watercourses.

4. No walnut trees were observed next to Czapnica watercourse, except for shoreline and slopes of Czapnica Lake.

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