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## Woody species of Araliaceae at the Rogów Arboretum

Drzewa i krzewy z rodziny Araliaceae w Arboretum w Rogowie

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**ABSTRACT.** The collection of the Araliaceae in Rogów Arboretum consists of the specimens of four genera (the number of species and lower taxonomical ranks in parenthesis): *Aralia* (8), *Eleutherococcus* (14), *Kalopanax* (2), and *Oplopanax* (2). Most of them, except *Kalopanax*, are medium to large shrubs or small trees. The present paper refers almost exclusively to botanical taxa and species and cultivars of the genus *Hedera* grown in the Arboretum are excluded from this study. The observations refer primarily to leaf sprouting, flowering, fruiting, and morphological variability of the plants. Special attention has been paid to the frost resistance of the listed species as many of them are considered frost tender. *Kalopanax septemlobus* f. *maximowiczii* (Van Houtte) H. Ohashi, in literature treated as juvenile form, has been proved to be persistent with its typical characters present in mature trees.

**Key words:** Rogów Arboretum, results of cultivation, *Aralia*, *Eleutherococcus*, *Kalopanax*, *Oplopanax*

### Introduction

Rogów Arboretum, similarly to many other botanic gardens, specializes in several plant groups. In Rogów it includes the national collection of the Aceraceae (Tumiłowicz 1993), woody species from the Chinese flora (Tumiłowicz 1996), genus *Stewartia* L. (Tumiłowicz 2001) and numerous experimental forest plantations with non-native tree species described in many publications. For many years the Arboretum has been also developing collections of trees and shrubs of the family Araliaceae, with the exception of the genus *Hedera* L., the national collection of which is held in Wrocław University Botanic Garden (Nowak 1999). Among 50 genera and 1412 species of Araliaceae, mostly tropical and subtropical plants (Frodin, Govaerts 2003), only species of the genera *Aralia* L., *Eleutherococcus* Maxim., *Kalopanax* Miq. and *Oplopanax* (Torr. et A. Gray) Miq. can be

cultivated in the climatic conditions of Central Poland. Except monotypic *Kalopanax septemlobus*, which is a tree of considerable size, all of them are small trees, shrubs and herbs mostly with trunks and shoots covered with prickles, less frequently also with prickly leaves. The seed set is infrequent because most of the species of these genera flower relatively late in the season, from July till October.

They are very interesting, distinctively shaped plants with flat or spherical umbellate or paniculate inflorescences, frequently visited by bees. Most of species have great medicinal value and young shoots of some plants are edible.

Apart of earlier studies and biometric data used in the present paper, detailed observations of leaf sprouting, flowering, fruiting, and frost resistance were carried in summer and autumn of 2005, and in spring and summer of 2006.

## Genera and species review

### *Aralia* Vent.

Genus *Aralia* comprises of approximately 70 mostly tropical and subtropical species from Eastern Asia, and North, Central and South Americas. At least 17 species are herbaceous, the rest being small trees and shrubs, except *Aralia gigantea* J. Wen growing in SE Asia which reaches 20 m in height (Frodin, Govaerts 2003).

An important morphological character helpful in identification of *Aralia* species is the presence and shape of the stipules. It is noteworthy that fundamental handbooks of dendrology, as those of Krüssmann (1984) and Rehder (1960), not only treat them as unimportant but also contain information of their absence. Meanwhile, among taxa growing in Rogów Arboretum, they are present in *Aralia stipulata* Franch., *A. spinosa* L. and also in herbaceous *A. cordata* Thunb. In the identification key to *Aralia* species (Xiang, Lowry 2006) the authors state that stipules are present in most of the species and they discuss them by species descriptions.

The species most frequently grown in Poland (almost exclusively in botanic gardens) is *A. elata* Seem., while other are very rare and usually misidentified.

### *Aralia chinensis* L.

It is a small tree up to 8 m in height, with a very broad geographical range in Central and South China. It extends from Hebei and Shanxi provinces in the north (USDA climatic zone 6-7) to the island of Hainan and Northern Vietnam in the south (zone 9-10), with var. *longibracteata* J. Wen growing also in Borneo. Its altitudinal range extends from the sea level to the altitude 2700 m (Frodin, Govaerts 2003, Xiang, Lowry 2006). The species is often mismatched with *Aralia elata*, and identification of many specimens grown in botanic gardens needs to be verified (Krüssmann 1984, Seneta 1991).

The first introduction of *Aralia chinensis* in Rogów took place in 1957 from seeds obtained from Kyoto, Japan (as *A. elata*). The resulted several trees grew weakly and were often damaged by frosts during severe winters. After winter

of 1986/87 only two of them survived, one of them produced numerous root suckers. These specimens developed paniculate inflorescences in October and scarcely flowered due to early frosts. Similar growth habit was observed in case of young 10-year-old specimens cultivated from seeds collected in Hunan province, in Heng mountain (USDA zone 9) at altitude 500 m: out of five planted specimens only one survived, in winter 2005/06 it was damaged by frost to the ground and now produces side shoots.

One of the arborescent specimens grown from seeds collected in Qin Ling mountain in Sanxi Province (zone 7) at altitude 1600 m grows well: it flowers and sets fruit. At the age of 21 it is 6 m in height. Older, 32-year-old multi-stemmed plant grown from seeds from the Botanic Garden in Essen (Germany) has bushy shape. It flowers and sets fruit, and reached 3 meters in height. No signs of frost damage on either of the specimens were observed after winter of 2005/06.

Plants of *A. chinensis* begin to flower at least two weeks later than *A. elata*, and the main axis of the conical inflorescence is up to 40 cm in length, their leaves also sprout later in spring and the stems are less prickly.

#### ***Aralia elata* (Miq.) Seem.**

*Aralia elata* is characterized by very wide geographic range: it grows in Japan, Korea, Russia and China. The taxon includes four varieties: var. *elata*, var. *inermis* (Yamagita) J. Wen, var. *mandshurica* (Rupr. et Maxim.) J. Wen, and var. *ryukyuensis* J. Wen, the latter includes the form f. *subinermis* (Ohwi) Jotani (Frodin, Govaerts 2003).

*Aralia elata* is the species most frequently encountered in Poland, it grows in most botanic gardens (Nowak 1999), rarely in parks and private collections. The oldest specimens of var. *elata* in Rogów Arboretum come from seeds from the botanic garden in Pyong-Yang in North Korea, and at the age of 36 they reach 8.5 m in height, and 13 cm dbh. They are completely frost resistant even during severe winters. They are frequently multi-stemmed plants with shoots growing diagonally, which at certain age may break at the ground level due to the weight of the crown. This species produces numerous root suckers emerging at the distance up to 10 m from the maternal tree, which makes it problematic in cultivation. *A. elata* flowers from the third decade of August onwards. Its wide umbels are very ornamental, and the fruits ripe in the end of September. In Rogów Arboretum individuals from self-dispersed seeds are frequently encountered.

#### ***Aralia elata* var. *mandshurica* (Rupr. et Maxim.) J. Wen**

According to Poletiko (1960) geographic range of var. *mandshurica* includes eastern provinces of Russia, Korea and NE China, while typical var. *elata* grows in Japan, in Kuril Islands and southern Sakhalin. This author concludes that the two varieties often hybridize.

Several specimens from seeds from the botanic garden in Vladivostok and neighboring wild localities, obtained as *Aralia mandshurica* Rupr. et Maxim., grow quite well in Rogów. At the age of 35 they reach up to 6 m in height and 12 cm dbh. Some old specimens die out (causes other than frost) but numerous root suckers take over. The differences in leaf and inflorescence morphology between the species and the variety are minute and difficult to trace (Seneta 1991).

### ***Aralia spinosa* L.**

In Rogów there are two specimens grown from seeds collected in nature in Anne Arundel County in Maryland (USA). At the age of 20 they reach 20 m in height, and their growth and viability is quite poor. During severe winter of 2005/06 the young shoot tips were frost damaged. There are two root suckers growing in the vicinity of maternal plants. The shoots are densely covered with prickles, small prickles being also present on leaf petioles.

The leaves of this species are the last to sprout in spring. Two 1-1.5 cm stipules present at the broad base of the leaf petiole are narrow, filiform and dividing at the end. In August plants produce paniculate inflorescences up to 70 cm in length terminating with umbellets, with short side branches. The flowering period begins in the end of September, and in the end of October on the terminal umbellets green fruits were observed. These however did not ripe.

### ***Aralia stipulata* Franch.**

Seeds of this species were collected in natural sites in the Emei mountain (Sichuan, China), at altitude 2800 m. They were obtained as seeds of *Aralia atropurpurea* Franch., and after several years this description clearly proved to be a misidentification because *A. atropurpurea* is herbaceous (Frodin, Govaerts 2003). At the age of 11 three single- to four-stemmed trees reached 6 m in height and 5 cm dbh each. They regularly flower and set fruit, after the winter 2005/06 no frost damage was observed. All of them produce root suckers.

The correct identification of these specimens was problematic, as the description of the species is absent from classic dendrology textbooks. They resemble *Aralia chinensis* (paniculate inflorescences) but other features did not match the description of this species. Young compound bipinnate leaves and shoots are tinted red, later in the season they turn green. The plants produce yellowish flowers in the beginning of August, and black fruits on red pedicles maturing in September/October. Trunks of these small trees are prickly in their lower part. Leaflets, entire at the base, are distantly dentate with red petioles. In leaves from the upper branches 2 cm-long stipules are present by the sheathing petioles, the stipules are fused, lanceolate and acuminate at the end (Fig. 1).

The description of these specimens along with color plates were sent in 2006 to the expert in taxonomy of the genus *Aralia*, Dr. Jun Wen from Natural History Museum in Washington, who identified it as *A. stipulata*, rather frequently encountered species in the Emei mountain, at altitude 2800 m.



Fig.1. Characteristic long and narrow stipules at the base of *Aralia stipulata* Franch. leaves  
(phot. by P. Banaszczak)

Ryc.1. Charakterystyczne długie i wąskie przylistki u nasady liści *Aralia stipulata* Franch.  
(fot. P. Banaszczak)

At present plants of this species obtained from the same seed portion grow in Rogów, Glinna, Wrocław, Wojsławice and Von Gimborn Arboretum.

### *Aralia nudicaulis* L.

It has been in cultivation in Rogów since 1972 from seeds collected in Canadian provinces Quebec and Alberta. It spreads widely from subterranean stems, covering approx. 8 m<sup>2</sup>. The life form of this species is rather controversial. According to Frodin and Govaerts (2003) it is herbaceous (*hemicryptophyta*), but specimens from Rogów should rather be treated as small shrubs (*chameaphyta*). Vertical or diagonal suffrutescent stems grow from rhizomatous rootstock, the shoots are 3-5 mm in thickness and up to 20 cm in length, they terminate with a single bud. Inflorescences and some leaves are produced by older and longer above-ground shoots, while numerous leaves develop also from rhizomes with no visible above-ground parts. Both Krüssman (1984) and Seneta (1991), the latter discussed the species based on specimens from Rogów, also treated *A. nudicaulis* as low subshrubs.

Leaves and inflorescence buds appear as early as in April/May, and flowers open in mid May, however they fall off in June not setting fruit.

*Aralia nudicaulis* is a rarity in our botanic gardens, it grows in Rogów and Glinna, being typically a species of specialist collections with no great ornamental value. According to Frodin and Govaerts (2003) rhizomes and roots are used for root beer.

Two other species of herbaceous *Aralia* have been grown in Rogów for many years: North American *Aralia racemosa* L. and *Aralia cordata* Thunb. from East Asia. Specimens of both species reach up to 2 m in height, flower and set viable fruit, new plants being recruited via self-seeding. The flowers are visited by bees and young shoots and leaves are edible.

***Eleutherococcus Maxim.***

(*Acanthopanax* (Decne. et Planch.) Witte)

The genus comprises 38 species growing in Eastern Asia, from the Himalayas to Vietnam, and from NE Russia to North Philippines (Frodin, Govaerts 2003), 18 of them being a part of the Chinese flora (Xiang, Lowry 2006). In most cases they are shrubs with divided leaves consisting of 3-5 leaflets, and spherical, usually terminal umbels. These shrubs are of poor ornamental value, however they are important medicinal plants. Their flowers are visited by bees.

In Poland they are in cultivation almost exclusively in botanic gardens. The most frequently encountered species are *Eleutherococcus senticosus* Maxim., *E. henryi* Oliv. and *E. sessiliflorus* (Rupr. et Maxim.) S. Y. Hu.

The flowering periods described below refer to terminal umbels, while axillary, if present, flower later in season, sometimes too late for seeds to ripen.

**Section *Eleutherococcus* (Maxim.) Harms**

***Eleutherococcus henryi* Oliv.**

In Rogów this species, represented by several specimens of various age from seeds from either natural sites (mountains in Hunan and Sichuan provinces) or two botanic gardens, has been in cultivation since 1960. Older plants flower and set fruit, and reach up to 3 m in height. They are frost resistant. Some shrubs planted in strongly shaded conditions grow poor. The plants flower in August/September, and fruits ripen in October. The oldest specimens produce suckers.

In 1927 two dwarf specimens were obtained in Kórník from seeds, in 1957 (Browicz, Bugała 1957/58) they were described by Browicz and Bugała as form *nana*, however only one of them remained, which reverted and grows normally (Dolatowski 1989).

***Eleutherococcus leucorrhizus* Oliv.**

The species geographic range includes large part of China, from provinces Gansu and Shaanxi in the north (zone 6-8) to Guandong and Yunnan in the south, and Sichuan in the west (6-9 zone). Four geographic varieties have been described: var. *axillari-tomentosus* (G. Hoo) Ohashi from Sichuan, var. *brevipedunculatus* Y. R. Ling from Guandong, var. *fulvescens* (Harms et Rehder) Nakai and var. *scaberulus* (Harms et Rehder) Nakai from Central and Southern China (Frodin, Govaerts 2003).

At present there are twelve 10-25-year-old specimens growing in the Arbore-

tum, from two natural locations in provinces Anhui and Sichuan. They are shrubby with rather loose growth habit, reaching up to 3 m in height. They flower and set fruit, their annual growth or shoot tips may be frost damaged during severe winters. Leaves consist of 5(3-4) leaflets, the petioles are up to 15 cm in length, rarely with *setae* on the central vein and prickles by the leaf base. Flowers are produced in August/September, they are clustered in spherical terminal umbels 3-4 cm in diameter or smaller axillary umbels set on 15 cm long peduncles. Fruits mature in the beginning of October and the pendent infrutescence is 7 cm in diameter.

In 1988 a seed sample collected in the Emei mountain (Sichuan) described as *Acanthopanax evodiifolius* Franch. had been obtained, resulting in 4 seedlings which, after flowering, were identified as *E. leucorrhizus*. There were three types present among these four specimens: two belonged to the typical variety and the remaining two represented two other varieties mentioned above.

***Eleutherococcus leucorrhizus* var. *axillaritomentosus* (G. Hoo) Ohashi**

This is shrubby specimen with weakly branched shoots, 3 m in height. The leaves consisting of 3-5 leaflets are serrate, glabrous and shiny on both surfaces, with visible patches of pale hairs along the leaf veins, the patches are elongated by the leaf base and continuously smaller and waning towards the leaf tip (Fig. 2). This specimen flowers and sets fruit.



Fig. 2. Lower leaf surfaces of *Eleutherococcus leucorrhizus* var. *axillaritomentosus* (G. Hoo) Ohashi (phot. by P. Banaszczak)

Ryc. 2. Liście *Eleutherococcus leucorrhizus* var. *axillaritomentosus* (G. Hoo) Ohashi od spodu (fot. B. Banaszczak)

***Eleutherococcus leucorrhizus* var. *fulvescens* (Harms et Rehder) Nakai**

This is also weakly branched four-stemmed shrub, 2.5 m in height. The leaves consist of 3-5 leaflets, narrower and longer than those of the type variety, they are less shiny, with short hairs on the upper side of the blade, and densely pale pubescent on veins on the lower side. Leaf petioles are tinted purple. This plant also flowers and sets fruit.

In 2002 numerous seedlings, mostly resembling the typical variety, were obtained out of seeds collected in 2001 from all four specimens. One of the specimens however had unusually narrow, lanceolate leaflets. At the age of five it reached 1 m in height. Its leaves consisting of 5 leaflets are set on 18 cm long petioles, with long *setae* by the leaf and leaflets' bases, and shorter on the midrib. The leaflets are densely and sharply serrate, glabrous and shiny on both surfaces (Fig. 3). No description relevant to such form was found in the available literature. The varieties and the form described above account in favor of large variability of the species.



Fig. 3. Leaves of *Eleutherococcus leucorrhizus* Oliv. narrow-leaved form (phot. by P. Banaszczyk)  
Ryc. 3. Liście wąskolistnej formy *Eleutherococcus leucorrhizus* Oliv. (fot. P. Banaszczyk)

***Eleutherococcus setchuensis* (Harms) Nakai**

(*Acanthopanax setchuensis* Harms)

This species grows in Central China, its range extending from the provinces Gansu and Shanxi in the north to Guizhou and Sichuan in the south and the west, in climatic zone 6-9, mainly in mountain regions at 1000-3200 m in altitude. In Rogów the species is represented by four specimens, two of them, aged 22,



were obtained from seeds collected in Shanxi province, in the Qin Ling mountains, at 1600 m in altitude (climatic zone 7).

These are multi-stemmed shrubs with erect shoots, 3-4 m in height, densely covered with prickles. The leaves are ternate, with entire or slightly serrate margins, glabrous and somewhat purplish on the lower side. The shrubs flower in mid August with fruits maturing in October. Root suckers are sometimes present. During severe winter of 2005/06 one-three year old shoots were frost damaged, however they regenerated well.

In 1997 seeds of *Acanthopanax stenophyllum* Harms collected in Gansu province, in the Maiji mountains, at altitude 1800 m (climatic zone 7) were obtained. Two specimens, at present up to 1 m in height, after flowering were identified as *E. setchuensis*.

### ***Eleutherococcus senticosus* (Rupr. et Maxim.) S. Y. Hu**

(*Acanthopanax senticosus* (Rupr. et Maxim.) Harms)

The species range includes E Russia, NE China (zone 3-7), Korea and Japan, the plants being the most frost resistant representatives of the genus. These are dense shrubs, reaching in Rogów up to 3 m in height, with shoots densely covered with pale *setae* pointing downwards. There are 9 specimens, aged 16-31, cultivated in the Arboretum grown from seeds from natural sites in Russia (Primorskij Kraj) and from the botanic garden in Moscow. The species is one of the earliest to flower within the genus, it begins to flower in the beginning of July, with fruits maturing in the end of September. Mature, pendant infrutescences produced on 20 cm long peduncles are up to 8 cm in diameter and up to 50 g in weight. Seed germination is good.

### **Section *Cephalopanax* Bill.**

### ***Eleutherococcus divaricatus* (Siebold et Zucc.) S. Y. Hu**

(*Acanthopanax divaricatus* (Siebold et Zucc.) Seem.)

There are 10 specimens, aged 12-33, grown in the Arboretum, obtained from seed from several sources, exclusively from botanic gardens. The oldest plants reach 3-4 m in height and 6 m in diameter. Leaves usually consist of (3-)5 leaflets. The shrubs flower late, in August/September, with two-seeded fruits maturing in October. Plants of this species are fully hardy.

The oldest 58-year-old specimen of *Eleutherococcus* from the Arboretum also belongs to this species, this shrub was obtained from seeds from Kórnik as *Acanthopanax sieboldianus* Makino. Although it grows in slightly shaded conditions, it flowers and sets fruit and reached 3.5 m in height and 5 m in diameter.

### ***Eleutherococcus divaricatus* var. *chiisanensis* (Nakai) C. H. Kim et B. Y. Sun**

There are 10 specimens of this variety growing in the Arboretum, all of them obtained from seeds collected in the botanic garden in Pyong-Yang in North Korea

as *Acanthopanax chiisanense* Nakai. The shrubs grown in mid shade reach 2.5 m in height, they flower and set fruit. The shoots are almost unarmed, leaves consist of 3-5 leaflets, and no frost damage was observed on them even during severe winters. The plants flower by the end of August with fruits maturing in October.

Single 12-year-old specimen from natural site in South Korea, obtained as the same variety, is 1.5 m in height and its shoots are covered with prickles, and all leaves consist of 5 leaflets. So far it has not produced flowers.

***Eleutherococcus lasiogyne* (Harms) S. Y. Hu**

(*Acanthopanax lasiogyne* Harms)

There is one, 22-year-old specimen growing in the Arboretum, 2 m in height, obtained from seeds from the botanic garden in Zurich. The shoots are pale, almost unarmed, with scattered prickles at their base, leaves ternate. Flowers in terminal umbel, 2 cm in width, on a very short peduncle, opened in the end of August but did not set fruit. After severe winters frost damage was observed on tips of young shoots.

***Eleutherococcus sessiliflorus* (Rupr. et Maxim.) S. Y. Hu**

(*Acanthopanax sessiliflorus* (Rupr. et Maxim.) Seem.)

There are 20 specimens, aged 33, grown in the Arboretum from seeds obtained from six botanic gardens. This species, resembling *E. divaricatus*, produces flowers and fruits almost in the same time, and it is fully hardy. The plants from Rogów reach 4 m in height, with characteristically wider crown, the leaves consisting of 3-5 leaflets are ternate on flowering shoots.

**Section *Euacanthopanax* Harms**

***Eleutherococcus giraldii* (Harms) Nakai**

(*Acanthopanax giraldii* Harms)

Geographic range of this species extends in Central and SW China, from provinces Gansu, Ningxia and Qinghai in the north (zone 5-7), to Sichuan and Yunnan in the south (zone 7-9). It grows in mountains, at altitude 1300-3500 m. There is one specimen grown in the Arboretum from seeds collected in the Emei mountain, Sichuan. At the age of 19 it reached 1.8 m in height. Young shoots are greenish and covered with almost black bristles pointing downwards, in older stems the bristles, similarly to the shoots, turn brown. The leaves are small, consisting of 5 leaflets, and in mid May sprout together with solitary umbels set on short peduncles, flower open early in the beginning of June, however no fruit set was observed so far. This is a botanical rarity, growing only in Rogów. No frost damage was observed on the plant.

***Eleutherococcus nodiflorus* (Dunn) S. Y. Hu**

(*Acanthopanax gracilistylus* W.W. Sm.)

This is a very variable species with wide geographic range, growing in China in 16 provinces, from Gansu and Shanxi in the north, to Yunnan and Guangdong in

the south (zone 6-10), it is also found in North Vietnam and in Taiwan.

There are 9 specimens, aged 18-23, growing in the Arboretum from seeds collected in the botanic garden in Hangzhou and from natural sites in the mountain regions of Shaanxi and Hunan provinces.

These are fast growing shrubs with compound leaves consisting of 5 leaflets, reaching in Rogów up to 4 m in height, with long, pendulous branches covered scarcely with sharp, hooked prickles. One-year-old shoot produced by a specimen cut to the height of 1 m was 3.5 m in length and penetrated the crown of the neighboring *Cladrastis lutea*, hooking on the branches like climbers. Unlike other species of *Eleutherococcus* described above, *E. nodiflorus* does not produce terminal inflorescences but numerous lateral umbels growing on short shoots along the main stems. The umbels are small up to 2 cm in diameter, solitary or in groupings of 2-3, set on peduncles 2-4 cm in length. Flowers open in the beginning of July, and fruits mature by the end of September. During severe winters some light frost damage of shoots is observed. This is also a botanical rarity grown in Rogów and lately also in Glinna.

#### ***Eleutherococcus sieboldianus* (Makino) Koidz.**

Specimens obtained earlier from seeds as *E. sieboldianus* were found to be misidentified and nowadays there is only a single, six-year-old shrub of the cultivar 'Variegatus'.

#### **Section *Zanthoxylopanax* (Siebold et Zucc.) Seem.**

#### ***Eleutherococcus wardii* (W. W. Sm.) S. Y. Hu**

(*Acanthopanax wardii* W.W.Sm., *A. ternatus* Rehder)

There are two specimens of this species grown in the Arboretum, obtained from seeds from two botanic gardens. The older plant, aged 32, from Geneva is 1 m in height, and produces small ternate leaves with several teeth and two prickles at their base. So far it has not produced flowers, probably because in the past it grew in shaded conditions. The second specimen, aged 23, from Brno is 2 m in height, it has larger leaves of unarmed leaflets with entire margin. Terminal umbel opens flowers in the beginning of September, two-seeded fruits with dichotomous persisting style mature in October. No frost damage was observed on the plants.

#### ***Kalopanax* Miq.**

#### ***Kalopanax septemlobus* (Thunb.) Koidz.**

(*Kalopanax pictus* (Thunb.) Nakai)

The largest and probably the oldest Polish specimen of this species grows in Rogów. At the age of 78 it reached 93 cm in trunk diameter at the height of 1 m. Approximately 1.5 m above the ground level the trunk divides dichotomously into two branches 58 cm in diameter each. The tree is 21 m in height. The second

tree with the Y-shaped trunk, at the same age, is 56 and 38 cm dbh, and produces branches low above the ground. Both plants grow at a distance from other plants and developed wide crowns. They come from Fukuoka, Japan, from seeds which germinated in 1926 (Tumiłowicz 2004). One of the trees produced flowers and set fruit for the first time in 1949, several seedlings were obtained from seeds sown in the next year (Kobendza 1953), one of them being planted in the Arboretum in 1954 – the tree is now 16 m in height and 38 cm dbh.

The species is now represented in the Arboretum (excluding the forest experimental plantation) by 23 trees, aged 23-81, from seeds originated from seven different botanic gardens including seeds from Rogów. The trees do not produce root suckers but abundantly reproduce by self-seeding within the area of the Arboretum, seeds being dispersed by birds. Some young trees are left in the Arboretum, and the other germinating in inappropriate places are removed or transplanted to the nursery.

The growth of the *Kalopanax* trees is rather good, good example being the grouping of 13 specimens that at the age of 41 reached from 17 to 35 cm dbh and an average height of 15.5 m (maximum 17.5 m) (Tumiłowicz 2004). The trees flower in August/September, the flowers being abundantly visited by bees, however long and warm autumn is necessary for fruits to mature. No frost damage was observed after severe winter of 2005/06 but after severe frosts in 1986/87 some young 1-3-year-old shoots were damaged – these regenerated well. Some young plants were damaged to the snow level and then produced offshoots.

In 1988 an experimental *Kalopanax* plantation was established (area 0.085 ha). In the open grounds 196 four-year-old seedlings from seeds from the old specimen of the type subspecies were planted in a 1.5 × 2 m spacing. Separately 42 seedlings from old specimen of the f. *maximowiczii* were planted. The maternal trees grow closely together, with interspersing crowns, therefore there is a possibility of cross-pollination between the two varieties. In years 1990-1996 numerous seedling died out mostly due to the root damage caused by mice and voles, empty spaces were filled with the plants from the nursery or self-seeded plants transplanted from the Arboretum. First pruning was done in 2003 and the next in 2006. At present there are 110 trees grown in the experimental plantation, among them 25 from seeds collected from the plant of f. *maximowiczii*. At the age of 23, the average dbh was 9 cm (4-18 cm), and the average height 8.5 m (maximum 12.5 m). The trees already produce flowers and set fruit.

***Kalopanax septemlobus* f. *maximowiczii* (Van Houtte) H. Ohashi**

(*K. pictus* var. *maximowiczii* (Van Houtte) Hand.-Mazz.)

There are two older specimens of this form growing in Rogów. The first one, grown from seeds obtained from Fukuoka (Japan) germinated in 1928, is 38 cm in dbh and 15 m in height. It was planted too close (4 m) to the largest *Kalopanax* tree of the typical variety, and due to the weaker growth habit it is overgrown by the neighbor. The trunk is dichotomous, curved, and the crown one-sided.

Palmatifid leaves with 5(-7) lobes are deeply cut to 3-4 cm from the base of the leaf (Fig. 4), the leaves of the neighboring tree are also 5-7 lobed but the division reaches approximately half way to the base of the leaf. The leaves of f. *maximowiczii* are more densely pubescent, especially on the leaf ribs.

The second specimen propagated via root cutting from the older tree is, at the age of 44, 20 cm in dbh and 11.5 m in height, it grows unrestrained in open space. Its leaves are (5-)-7-lobed, similarly to the maternal plant, with 7-lobed leaves prevailing. Both trees produce flowers and set fruit, they however grow weaker and slower when compared to the specimens of the typical variety.

It is interesting to observe the variability of leaf morphology of the specimens from the 23-year-old experimental plantation described above. Among specimens obtained from seeds from f. *maximowiczii* (25 trees) deeply lobed leaves are produced by 5 trees, and among 85 trees from seeds from the typical variety – by two specimens. The shape and the size of the leaf are very variable. There are numerous trees with the leaf division deeper than the half of the leaf blade, but not as deep as in case of the variety, yet many trees produce leaves cut to the 1/3 of the blade length. The leaf blade is 15-25 cm in width, however one of the specimens (not a sucker) in the upper part of the crown produces large leaves that reach 45 cm in width, 30 cm in length, with petioles up to 50 cm in length.



Fig. 4. The old specimen of *Kalopanax septemlobus* f. *maximowiczii* (Van Houtte) H. Ohashi in autumn colours (phot. by P. Banaszczak)

Ryc. 4. Stary okaz *Kalopanax septemlobus* f. *maximowiczii* (Van Houtte) H. Ohashi w jesiennych barwach (fot. P. Banaszczak)

Similarly large variability of leaf shape and size can be observed approximately 20–40 m from the oldest *Kalopanax* trees, in a thinned 48-year-old *Abies concolor* Lindl. stand where there are numerous self-seeded specimens of *K. septemlobus*. The leaves vary from shallowly to deeply lobed, including one approx. 20-year-old specimen, 5 cm in dbh and almost 8 m in height, with leaves typical for f. *maximowiczii*.

While discussing the variety *maximowiczii* (*Acanthopanax ricinifolius* var. *maximowiczii* C. K. Schneider) Harms (1918) notes that the specimens of this form produce numerous prickles and deeply lobed leaves, he adds however that sometimes in older plants some leaves happen to be shallowly cut, and such forms are mostly found in gardens. He also presents a photograph of a tree few meters in height with deeply lobed leaves up to the top of the crown.

In Hartig's opinion (1954) deeply incised leaves are juvenile form of foliage ("sterile Jugendform"), and after the tree matures they change the shape as in case of *Hedera helix* L.

Frodin and Govaerts (2003) also state that "the plants are phenologically heteroblastic (dimorfant), the foliage in young trees being much more deeply lobed than in fully adult examples. The young foliage state has been recognized as f. *maximowiczii* (Van Houtte) H. Ohashi". However observations conducted in Rogów are in contrast to these opinions, as mature and fruiting trees described above still produce leaves of such shape, moreover the same character persists in some of their offspring at maturity. Many observations show that from the beginning numerous *Kalopanax* seedlings produce leaves with shallow or medium lobes, and not necessarily deeply incised foliage. It is planned to collect and sow seeds from 44-year-old specimen planted at a distance from the type *Kalopanax* trees and to establish a derived plantation to check the ways this leaf shape variability is passed to the offspring. This taxon should not be regarded only as juvenile form, and its taxonomic rank may change.

### ***Oplopanax* (Torr. et A. Gray) Miq.**

This genus consists of three species: two in NE Asia (China, Japan, Russia and Korea) and one in USA and Canada.

### ***Oplopanax horridus* (Sm.) Miq.**

At present there are 9 shrubs, aged 34–35, grown in Rogów from seeds obtained from natural habitats in USA and Canada (three different sites) and from the botanic garden in Berlin-Dahlem. They reach 2 m in height, produce flowers and set fruit. Young foliage is often damaged by late frosts – the best indicator of the late frosts in the Arboretum! – but plants regenerate quite well. They are fully hardy in winter.

*Oplopanax* was the most important medicinal plant for native Americans from the west coast of USA and Canada, used for many maladies. Nowadays it is also

valued for its medicinal properties. Medicinal products are derived from roots and phloem (Pojar, MacKinnon 1994).

These are very striking shrubs with large leaves, with all above-ground parts and organs (except inflorescence) being prickly. The plants produce narrowly paniculate ornamental infrutescences, approx. 25 cm in length, with numerous two-seeded red drupes.

One three-year-old seedling of *Oplopanax japonicus* Nakai is grown in Rogów nursery. This is grown from seeds from Salaspils (Latvia), while the maternal Latvian plant comes from seeds obtained from Japan.

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