



## A New Species of *Lonicera* (Caprifoliaceae) from the Miocene of Primorye Region (the Russian Far East)

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### ABSTRACT

A new species of the genus *Lonicera*, *L. krassilovii* Pavlyutkin, is described on the basis of leaf remains from the Miocene of Mount Zametnaya locality in Primorye. This species has features in pattern of tertiary veins. Brief information on recent and fossil species of *Lonicera*, and the composition of the flora accompanied by this new species are also given.

**Key words:** *Lonicera krassilovii*, Miocene, plant fossil, leaf print

### РЕЗЮМЕ

Павлюткин Б.И. Новый вид *Lonicera* (Caprifoliaceae) из миоцена Приморского края (российский Дальний Восток). Приведены краткие сведения о современных и ископаемых видах *Lonicera*, приведен систематический список локальной миоценовой флоры Гора Заметная (Приморье), насчитывающей 41 вид из 30 родов и 20 семейств. Описан новый вид рода *Lonicera* (*Lonicera krassilovii* Pavlyutkin).

**Ключевые слова:** *Lonicera krassilovii*, миоцен, ископаемое растений, отпечаток листа

*Lonicera* is one of the most diverse genera in the family Caprifoliaceae. It includes 180 to 200 species, according to different estimates. The Plant List (2010) enumerated at least 108 species as credible. Only in China 57 species can be found (Qiner et al. 2011). In the northeastern Asia 41 native species including subspecies were identified (Nedoluzhko 1986). This genus is distributed in both hemispheres, in areas under almost sub-Arctic and tropical climates, but mainly under warm-temperate and subtropical ones. The species of *Lonicera* are small trees, mostly shrubs, twining vines, mostly deciduous in abscission habit, rarely evergreen. The leaves are simple, oppositely-arranged, with entire margin, from densely pubescent with simple hairs to pubescent only along veins, often with cilia along margin. Venation is pinnate camptodrome. Petiole is short; the transition from the midrib to the petiole is gradual without thickening.

The megafossil remains of *Lonicera* in the Paleogene deposits in the Russian Far East were not found. The genus is not mentioned in the monographs with the description of the Paleogene floras (Tanai 1970, Kodrul 1999, Budantsev 1997, 2006, Ablaev 2000). The remains of this genus occasionally occur in the Miocene sediments. Thus, in the Miocene floras of Japan *Lonicera protojaponica* Tanai et Onoe (Tanai & Onoe 1961, Huzioka & Uemura 1974, Uemura 1988) and *Lonicera* sp. (Tanai & Suzuki, 1965) were revealed. In the Russian Far East, the genus *Lonicera* takes part in a number of the Miocene floras (Akhmetiev 1973, Baranova et al. 1976, Sinelnikova et al. 1976, Chelebaeva 1978, Pavlyutkin 2005).

The Mount Zametnaya locality of the Miocene Ust-Suifun Formation (9155, Fig. 1), located 2 km to the southeast

from known Nezhino locality of fossil flora (9180), was discovered in the early 2010s in Southern Primorye (Fig. 1). I have found numerous remains of the leaves and rare fruits. Plant megafossils are from the layer of yellow-white tuffites, lying within gravel and sand beds (Fig. 1). Plant remains are impression without cuticles and other organic matters, showing a little different color from the surrounding rock. They are preserved isolately without overlapping on the plant-beddings. Until now, I recognized 41 species in 30 genera belonging to 20 families (Table 1). The flora is dominated by leaves of *Ulmus* (3 species), *Zelkova* (1 species), *Acer* (4 species), *Ampelopsis* (2 species). Well-preserved leaves were found, corresponding to the features of the genus *Lonicera*. They have no analogues among the known fossil plants of Primorye. Their description is given below as a new species of the genus *Lonicera*.

### CAPROFOLIACEAE A. L. DE JUSSIEU, 1789

#### *Lonicera* L., 1753

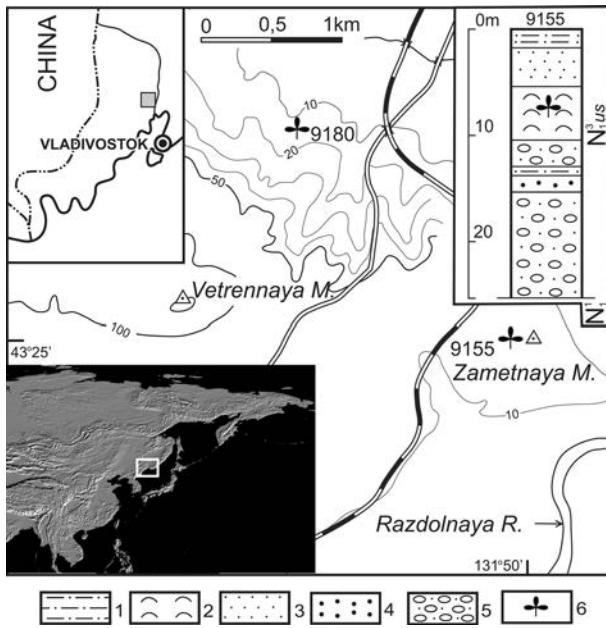
#### *Lonicera krassilovii* Pavlyutkin sp. nov.

#### Fig. 2a; Fig. 3: 1–11

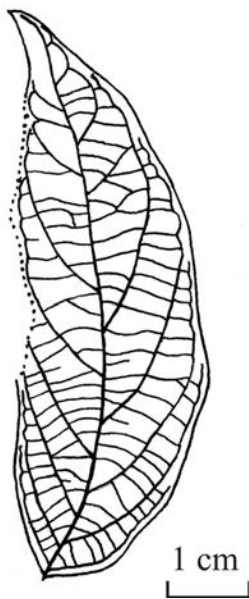
**Etymology.** Named in honour of the famous Russian paleobotanist Valentin Krassilov.

**Holotype.** Far East Geological Institute, 9155/59, imprint of leaf, Primorye, Nezhino Town; Ust-Suifun Formation, Late Miocene (Fig. 2; Fig. 3: 1, 2).

**Diagnosis.** Lamina oblong-ovate, length/width ratio 1.4–3.0, base rotundate, apex gradually contracted, tip short-attenuate, margin entire, venation pinnate camptodromous, midrib moderate thick, slightly curved, thinning toward apex, secondary veins (5–7 pairs) unevenly spaced, diverging at angle



**Figure 1.** Localities of the Miocene fossil flora (9155, 9180) and lithological column: 1 – siltstone, 2 – tuffite, 3 – sand, 4 – gravel, 5 – pebble, 6 – localities of plant remains



**Figure 2** *Lonicera krassilovii* sp. nov. Specimen 9155/59 (holotype)

45–55°, smoothly up-curved, intersecondary veins sporadic, tertiary veins subperpendicular to secondaries, percurrent to forking, straight to slightly curved, sparsely spaced (to 5 per 1 cm); venation of higher order reticulate.

**Description.** The leaves are single, symmetrical, sometimes slightly medially asymmetrical, usually curved in plan, small (3.9–6.7 cm long, 1.7–2.8 cm wide), oblong-ovate. The base is rounded; the apex acuminate, gradually narrowed, tip is short-attenuate, usually turns down sideways. The length/width ratio varies within 1.4–3.0. The petiole is partially preserved in one specimen

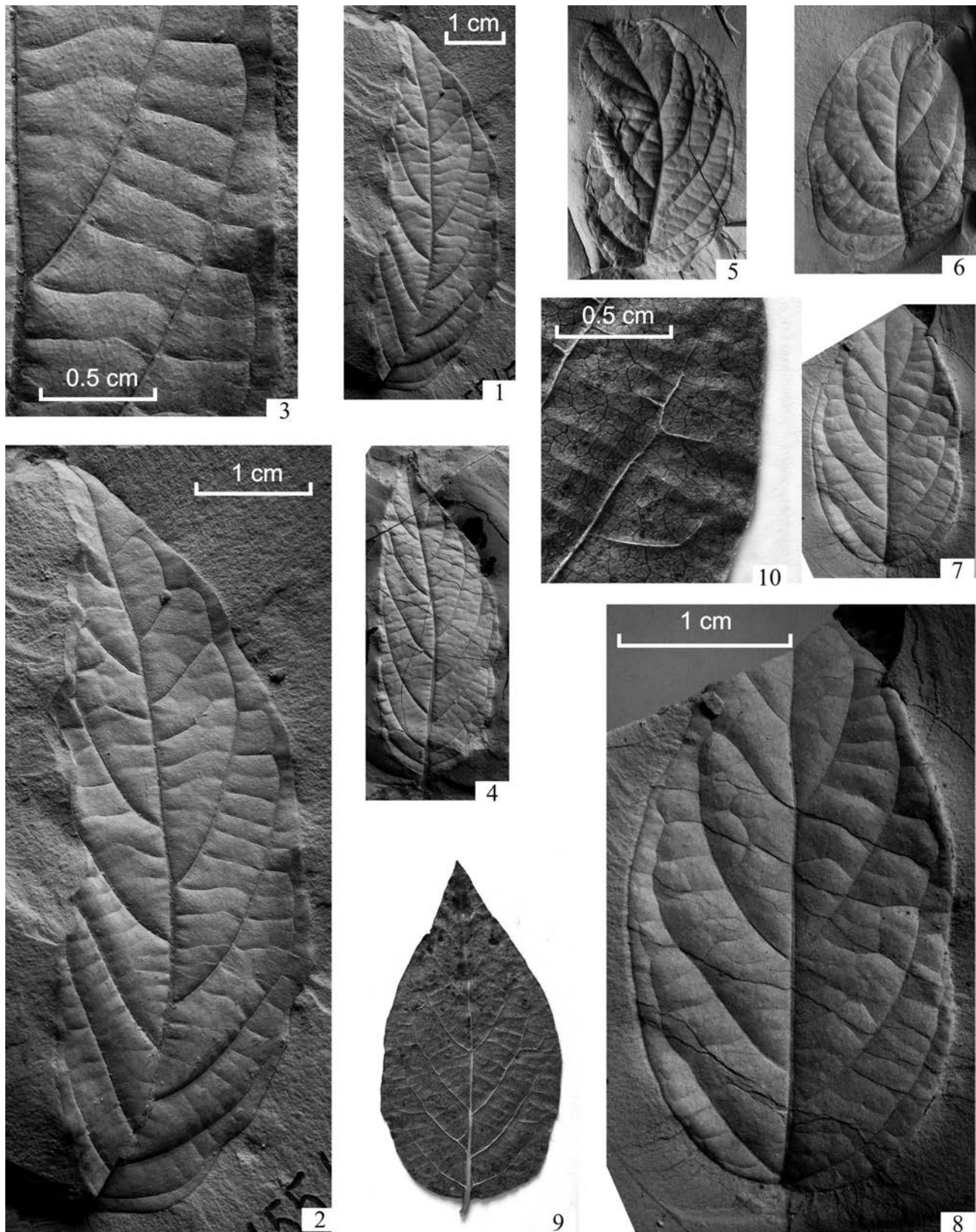
(Fig. 3 6). The margin of lamina is entire, without teeth. Venation is pinnate, camptodromous. The midrib is moderately thick, from straight up curved, much thinner towards the tip. Alternate or opposite secondary veins (5–7 pairs) run from a primary vein irregular intervals at an angle of 45–55°. They gently bend upward, sliding along the edge, and connect to the overlying vein, forming a series of diminishing loops. There have been sporadic inserted veins reaching the main loop. Tertiary veins (up to 5 per 1 cm) through rarely bifurcating, straight to slightly curved. The veins of next orders form a reticulum with tetra- and pentagonal areolations.

**Comparison.** *L. krassilovii* differs from majority known fossil species of honeysuckles in sharply expressed vein framework up to the venation of third order. It should be noted that a full-fledged comparison with known species in some cases difficult because of the poor quality and lack of necessary magnifications of photographic images. Leaves of *Lonicera protojaponica* (Tanai & Onoe 1961) have a smaller lamina, different form of the apex, bifurcation of secondary veins and poorly visible tertiary veins. The difference from *Lonicera* sp. from the Rubeshibe Miocene flora (Tanai & Suzuki 1965) manifested in the form of blade (obovate), the configuration of the secondary veins, reticular veins of tertiary veins. The leaves of *Lonicera ochotensis* Cheleb. (Baranova et al. 1976) differ in the blunt apex, slightly curved secondary veins and oblique orientation of tertiary veins to the secondary ones. The lamina of *Lonicera* sp. from the Miocene Mamontova Gora locality (Baranova et al. 1976) is characterized by more small size, different shape and nearly straight secondary veins. An incomplete leaf of honeysuckle (*Lonicera* sp.) from the Miocene Klassicheskaya Formation of Kamchatka (Chelebaeva 1978) differs in rounded apex and open (up to 60°) angle of running of secondary veins from a primary vein. Leaves of *Lonicera*

**Table 1.** Taxonomical composition of the Miocene flora (Zametnaya Mount Locality)

Family	Species	Specimens
Taxaceae	<i>Taxus sulcata</i> Baik.	2
Cercidiphyllaceae	<i>Cercidiphyllum crenatum</i> (Ung.) R.W. Brown	1
Lardizabalaceae	<i>Sinofranchetia</i> sp. (?)	1
Ulmaceae	<i>Ulmus drepanodontia</i> Grub.	26
–	<i>U. sуйfunensis</i> Goepf.	33
–	<i>U. nezhiboensis</i> Pavlyutkin	3
–	<i>Zelkova elongata</i> Suz.	18
–	<i>Celtis subintegerrima</i> Pavlyutkin	7
–	<i>C. inequilateralis</i> Pavlyutkin	4
Betulaceae	<i>Betula</i> sp.	1
–	<i>Alnus schmalhauseni</i> Grub.	5
–	<i>Carpinus macrophylla</i> Pavlyutkin	9
–	<i>Corylus takaminensis</i> Uemura	1
–	<i>C. cordifolia</i> Pavlyutkin	1
Salicaceae	<i>Salix baikovskajae</i> Pavlyutkin	1
–	<i>Populus zaisanica</i> Iljinskaja	4
–	<i>P. jarmolenkoi</i> Iljinskaja	1
–	<i>Populus</i> sp.	1
Juglandaceae	<i>Pterocarya primorica</i> Pavlyutkin	1
–	<i>P. kryshstofovichii</i> Cheleb.	1
–	<i>Carya miocathayensis</i> Hu et Chaney	1
Clethraceae	<i>Clethra maximoviczii</i> Nath.	2
Rosaceae	<i>Amelanchier</i> sp.	2
Leguminosae	<i>Leguminosites</i> sp.	2
Rutaceae	<i>Phellodendron grandifolium</i> Iljinskaja	5
–	<i>Euodia</i> sp.	3
Aceraceae	<i>Acer nezhiboense</i> Pavlyutkin	14
–	<i>A. monoides</i> Shap.	5
–	<i>A. protomiyabei</i> Endo	1
–	<i>Acer</i> sp.	12
Hippocastanaceae	<i>Aesculus mains</i> (Nath.) Tanai	9
Oleaceae	<i>Osmanthus</i> sp.	3
–	<i>Syringa</i> sp.	6
Alangiaceae	<i>Alangium kryshstofovichii</i> Baik.	5
–	<i>Alangium</i> sp.	8
Cornaceae	<i>Cornus mionaltherii</i> Hu et Chaney	8
Araliaceae	<i>Acanthopanax nstsуйfunensis</i> Pavlyutkin	1
Vitaceae	<i>Parthenocissus</i> sp.	11
–	<i>Ampelopsis</i> sp.	9
Caprifoliaceae	<i>Lonicera</i> sp.	2
–	<i>Lonicera krassilovii</i> sp. nov.	9

Total: 19 families, 29 genera, 41 species.



**Figure 3** *Lonicera krassilovii* Pavlyutkin sp. nov.

1. Holotype, 9155/59; 2. From fig. 1,  $\times 2$ ; 3. Detail from fig. 1,  $\times 4$ ; 4-7. 9155/49; 9155/361; 9155/362; 9155/360; 8. From fig. 7,  $\times 3$ ; 9. *Lonicera maximowiczii* (Rupr.) Regel, Primorye Region, author's collection; 10. Detail from fig. 9,  $\times 4$ . The scale bar for Fig. 1 relates to Figs. 4-7, 9

*mulpensis* Akhmetjev from the Miocene Botchinskaya Formation of Khabarovsk Region (Akhmetiev 1973) are characterized by not sharply pronounced tertiary veins, pattern which is poorly visible, branching of secondary veins near the margin. Leaves referred to *Lonicera* sp. 1 and *Lonicera* sp. 2. from the Miocene Novokachalinskaya Formation (Pavlyutkin 2005) have a different shape and almost straight branched secondary veins.

*L. krassilovii* has similarity with such recent species as *L. maximoviczii* (Rupr.) Regel (Fig. 3: 8, 9), widespread in the Primorye Region, Korea, and Northeast China.

**Remarks.** The collection, besides the described species, includes representatives of several genera having leaf blade with entire margin (*Alangium*, *Cornus*, *Syringa*, *Phellodendron*, *Evodia*). All of them are quite clearly differ from the leaves of this new species in venation, the presence of small rounded glandules along the margin of the leaf and a number of other features.

**Material.** 9 well-preserved leaves from the locality 9155 (Ust-Suifun Formation, Late Miocene).

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