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"Stankiewicz pine" in Crimea: some new taxonomical, chorological and paleo-landscape considerations

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Abstract: The Crimean taxon at issue has long been known as Stankiewicz pine with continuing discussion around its taxonomical rank and origin. In 1995, the authors discovered the new isolated population of the taxon on Papayakaya Mt. in Crimean Sub-Mediterranean. Due to hypothetical paleogeographic reconstruction of Pleistocene coastal landscapes here, together with some newest taxonomical data, authors reinforce the notion of relict and infraspecific status of the taxon that should be related to *Pinus brutia* var. *pityusa*.

Additional key words: *Pinus brutia*, relict, Pleistocene, Crimean Sub-Mediterranean.

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Introduction

The taxon at issue was first discovered in Crimea (Ukraine) in 1905 by Wacław Stankiewicz (1866–1940), known as one of the outstanding forestry specialists in Russia and Poland (Tyszkiewicz 1966).

For a long time, many botanists had taken no notice of morphological differences of the pines grown only in the distant western and eastern parts of Crimean Sub-Mediterranean. These trees were taken as *Pinus pallasiana* D. Don[1] that were common with the region. W. Stankiewicz was pioneered in recognizing some specific features of the pines observed by him near Sudak. He decided to clear up the proper taxonomical position of the pine and gave specimens collected by him to the famous Russian botanist, forester and geographer V. N. Sukachev (1880–1967) for precise determination, in 1906. On the basis of these specimens, Sukachev described the new taxon *Pinus pityusa* Steven var. *stankewiczii* Sukacz. with giving the name of variety in honour of the Polish forester. The taxon has been recognized as endemic to Crimea since then.

Since then, discussion has been continuing about taxonomic rank of the Stankiewicz pine as well as the origin of its populations, including relict and endemic status of the taxon. It has been known to have two populations in Crimea until now: the first, on Aya cape (including adjacent Ayaz'ma and Batiliman stows with irradiation to Balaklava – in general ca.

[1] Nomenclature follows Mosyakin and Fedoronchuk (1999).

430 ha), and the second, in Novy Svet (from Karauloba cape to Sudak town and up to Vesyoloye village, ca. 20 ha) (Wulf 1927; Stankov and Rubtzov 1959; Privalova et al. 1975; Koba 2001).

We discovered the third Stankiewicz pine population in Crimea (Yena 1995) and evolved some new data that encouraged us to undertake the present attempt to solve the long lasting problems associated with the subject. After obtaining more refined data of post glacial Black Sea level change, crucial possibilities have been offered to understand the true taxonomical, spatial and temporal contexts of Stankiewicz pine phenomenon.

Methods

This study was conducted in the Crimean Sub-Mediterranean, on the southern part of Crimean peninsula (Ukraine). We use some traditional descriptive methods of plant morphology and physical geography. Authors pioneered the use of mountaineering techniques to explore endemics in Crimean mountain cliffs (Yena and Yena 2001). The new population of Stankiewicz pine was censused using the age stages characters of the plants. Pine age stages were recognized on the base of approaches of Uranov's plant population school (Smirnova 1989) with having regard to some other methods (Kravchenko 1971). So we recognized: *immatures* (***im***, correlate with age up to 20–25 years) – young pre-generative plants, *virginals* (***v***, period of 20–25 years) – mature pre-generative plants that completely shaped up to start producing cones, *young generatives* (g_1, 25–80 years) – cone-producing plants of cone-shaped crown with no dry branches, *mature generatives* (g_2, 80–160 years) – cone-producing plants with umbrella-like crown with some dry branches, *older generatives* (g_3, plants older than 160 years) – like previous one but with many dry branches.

To better understand the paleogeographic history of Stankiewicz pine in Crimea, we reconstructed the Pleistocene paleo-landscapes following the principles of paleo-actualism (Yena and Yena 1982; Schoonmaker and Foster 1991). To estimate past shoreline, present-day bathymetric depth contours were used (Voris 2000).

Results

During our expedition in 1995, we discovered an unknown population of Stankiewicz pine in Crimea westwards from Sudak (Crimean Sub-Mediterranean). The nearest population of the taxon in Novy Svet (with westmost point on Karauloba cape) is four kilometers westwards of Papayakaya Mt. behind valley of Kutlak river. The pine stand is situated on the coastal cliff (45°–60°) and adjacent steep rocky slopes of Ay-Foka cape that ends Papayakaya Mt. (0,5 ha).

We counted 141 pine trees there that are grouped on the upper part of the cliff, no lower than 50 m. Thus this population appears to be well hidden from the plateau and the sea shore viewing with rock escarpments. Aside from Stankiewicz pine, there is opened stand (less than 20%) consists of *Quercus pubescens* Willd., *Juniperus excelsa* M.Bieb., with shrubs as *J. oxycedrus* L., *Cotinus coggygria* Scop., *Hippocrepis emeroides* (Boiss. & Spruner) Czerep.; herbage is nearly absent (very rare: *Melica taurica* K.Koch, *Chondrilla juncea* L. and some ruderals).

The age structure of the the population skewed toward a large number of pregeneratives (*virginals* and *immatures*) and *young generatives* plants; we could find only few of so called *mature generative* trees. All generatives can reproduce. *Older generative* plants have not been found. So the ratios of the age groups are: $im : v : g_1 : g_2 : g_3 = 31 : 16 : 49 : 4 : 0$.

The population discovered is certain to be a natural, not an artificial stand. It is rather clear for four reasons. First, there are no tracks of benching for forestation; second, the trees grow predominantly on a cliff; third, the population is disaged; fourth, trees are situated unevenly in its stand.

Discussion

Paleolandscape reconstructions

The new Stankiewicz pine's population confirms relict and coastal character of the taxon and affords assumption of its more wide area in the past. So our finding seems to be not just a new locality of relict taxon. In this connection, some fundamental questions have again arisen. Why Stankiewicz pine conserved only in those few localities? What is pre-history of Stankiewicz pine in Crimea? At the same time, we faced old unsolved problem of Stankiewicz pine's taxonomical identification which causes incorrect decisions in floristics and chorology and feeds pseudo-scientific illusions among some botanists. That is why we ought to try to clean up the Stankiewicz pine's taxonomical status here.

As M. D. Crisp wrote, "…historical biogeography… until recently has remained at the periphery of systematics… and related fields" (Crisp 2001: 153). We consider that palaeolandscape reconstructions can clear up some key problems in case of Stankiewicz pine.

For better understanding of Stankiewicz pine pre-history and today's distribution in Crimea, we should elucidate the overall picture of landscape changes in Crimean Sub-Mediterranean during the end of Pleistocene and beginning of Holocene.

Crimean Sub-Mediterranean is a unique landscape district in the south of Crimea. Following our study (Yena 1976), it covers a belt of 200 km long and 1–12 km in wide on the southern macroslope of the Glavnaya Crimean ridge, from Fiolent cape to Ilyi cape (1255 km^2 in total). Todays landscape structure of the region shows two-level set of landscapes including an upper level of forested steep slopes and a lower level of coastal forested amphitheatres. Developing our knowledge of dynamics in the Crimean Sub-Mediterranean during Quarternary, we came to the conclusion that there had been additional lowerest landscape level which was destroyed with cathastrophic see transgression in Holocene (Yena et al. 1999; Yena et al. 2004).

The importance of changing sea levels over geological time has long been considered essential to our understanding the distribution of coastal plants. Sea-level changes at issue are associated with the end of the last glaciation age ca. 10,000 years BP. Pleistocene sea level (during the last glacial maxima 17,000 years BP) is to be estimated 120 m below present level (Schoonmaker and Foster 1991). Our approach is to show the area of exposed land in Crimean Sub-Mediterranean during last Pleistocene glacial using present-day isobaths (Voris 2000). We also accept that such factors as tectonic uplift and subsidence or the accumulation of sediments were too minor factors affecting present day depth contours.

After Würm glacial age, more than 7,000 years ago, global sea level has rose quickly so waters from Mediterranean Sea broke through the Bosphor valley into the ancient Black lake. As a result, sea level was brought up to 150 m there in a dozen years (Nesis 1998) and the Crimean Sub-Mediterranean lost 2/3 of its area (Yena et al. 2004).

Before that flood, the shoreline had coincided with the today's Black Sea shelf escarpment. The lost coastal landscape zone was a gently inclined plane with its bedrock of argillites and aleurolites (upper Triassic-lower Jurassic). Hence it follows that the pre-transgressional shoreline was comparatively linear and bayless, with no capes and amphitheatres, looking like present-day shoreline from Solnechnogorskoye to Morskoye (eastern part of Crimean Sub-Mediterranean). Such a character of palaeo-lanscape seems to be not favorable for considerable differentiation of plant cover there. Todays shoreline was formed by increasing abrasion and extensive slumps during and after transgression. Downsloped limestone massifs and naked diapirs formed a chain of capes and bays along the new shoreline. Amphitheathre-like landscapes developed rather quickly affording diversity of ecotopes and plants (Yena et al. 2004).

Due to some additional factors, the lowest palaeolandscape coastal zone was an extensive refugium harbouring the Mediterranean flora during Würm. Among those factors, we can mention the additional height of the "defence wall" of Glavnaya Crimean ridge (+150 m at the expense of sea regression) and consequently the additional increasing of the average temperature at sea level. Thus we suppose that there was a large area covered by maquis, forests of *Juniperus excelsa* M.Bieb. and *Pinus brutia* Ten. during the first 3,000–4,000 years of Holocene.It seems true that there was a large belt of this pine that was known as the most thermophilous among three Crimean pine taxa. The plausible assumption was the belt of *Pinus brutia* distributed to the Caucasus coast where relict populations of this pine had survived from Anapa to Myussera till now (Kolesnikov 1963; Litvinskaya and Postarnak 2000). The only coastal plane locality of *Pinus brutia* on the Caucasus coast on Pitsunda cape, can resemble palaeolandscape coastal belt of this tree in Crimea.

As to new locality of Stankiewicz pine, Papayakaya Mt. (318 m) closes Kutlak river valley from the west and Voron river valley from the east. The massif (including the cape) is built of middle and upper Jurassic bedrock strata of sandstones, conglomerates, clays and limestones. Intensive sea abrasion in Ay-Foka cape causes bringing down rock blocks together with pine trees periodically. It can explain small size of the population and its stage structure here.

It should be emphasized that along the whole shoreline of the Southern coast of Crimea, middle and upper Jurassic bedrock strata of limestones are absent except of a few points where Stankiewicz pine grows. Those other limestone massifs that occur on the shoreline (e. g. Ay-Todor cape, Genoese Rock in Gurzuf and so on) are not bedrocks for have been downsloped here from the Glavnaya (Main) Crimean ridge wall as large blocks called ''seizured rocks" since the middle Quaternary (Yena 1977). That is why only bedrock shore limestone massifs became lithogenic refugia to relict Stankiewicz pine populations.

In the light of these palaeolandscape data concerning the last Black Sea transgression, it seems to be more clear the chief cause of depleting Mediterranean flora in Crimea. As the famous Russian florist Yu. L. Menitsky expressed, "*Our* Mediterranean is under the sea now" (D. V. Geltman, personal communication).

Taxonomic conclusions

Checking some diagnostic characters of pine trees from the discovered population we confirmed that they belonged to "Stankiewicz pine". However, it is important for our investigation to refine the taxon of what rank we are in fact dealing with.

Exact systematic position of the taxon at issue has long been obscure since A. Fomin made nomenclature combination in 1914 with giving rank of species

Fig. 1. *Pinus brutia* var. *pityusa* in Sudak vicinity (photo by W. Stankiewicz)

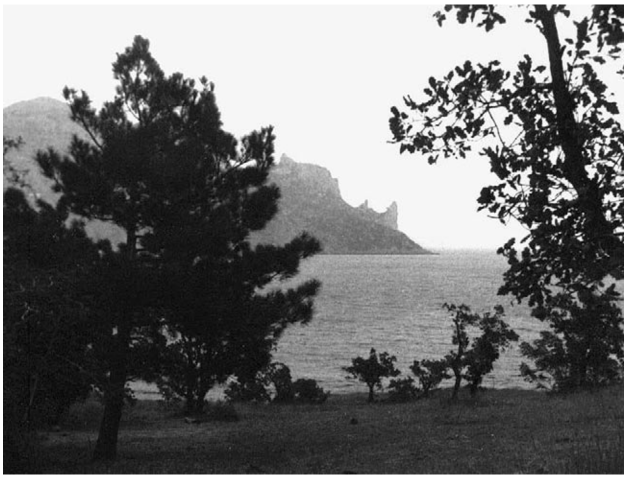

Fig. 2. *P. brutia* var. *pityusa* on Ay-Foka cape with the view on Karauloba cape, Novy Svet (photo by A. Yena)

to the taxon: *P. stankewiczii* (Sukacz.) Fomin (Fomin 1928). "Flora of the USSR" (Komarov 1934) canonized Fomin's combination. E. Wulf (Wulf 1927) recognized that the characters of the Crimean variety of Pitsunda pine was insignificant for distinguishing from typical form; he considered the species rank was too much for the Stankiewicz pine despite the perfect isolation of its area. Even at that time, no any difference was found in needle anatomy of *P. pityusa* and *P. stankewiczii* (Grigoryeva 1930). V. P. Maleev (1949) wrote that Stankiewicz pine of Crimea differed too little from Caucasian *P. pityusa*, and distinctive characters attributed to it are inconstant and blured when examining a great amount of specimens. "Flora Europaea" just followed Fomin's standard (Gaussen et al. 1964). In 1970-ies E. Bobrov considered the taxon again as *P. stankewiczii* with frank note: "This pine is hardly told from Pitsunda pine *P. pityusa* Stev." (Bobrov 1974: 110). N. Rubtzov decided alternately making it as a subspecies of *P. pityusa* (Rubtzov 1971; Privalova et al. 1975) and as separate monotypical species (Rubtzov 1972). A. Takhtajan (1978) could not help criticizing decisions like those; by him, Stankiewicz pine is worthy of subspecies rank as a maximum, though *P. pityusa* itself looks like *P. brutia*'s subspecies. Any way, authors of "The Manual of hihger plants of Ukraine" (Barbarich and Lypa 1987) kept to hold on to standard of "Flora of the USSR". S. K.Cherepanov (1995) could not dare to overcome his strict monotypical species concept in his own way and just included Stankiewicz pine in synonymy of *P. pityusa*.

Ya. P. Didukh, in his monograph on the plant cover of the Crimean Mountains (1992), treats the taxon as

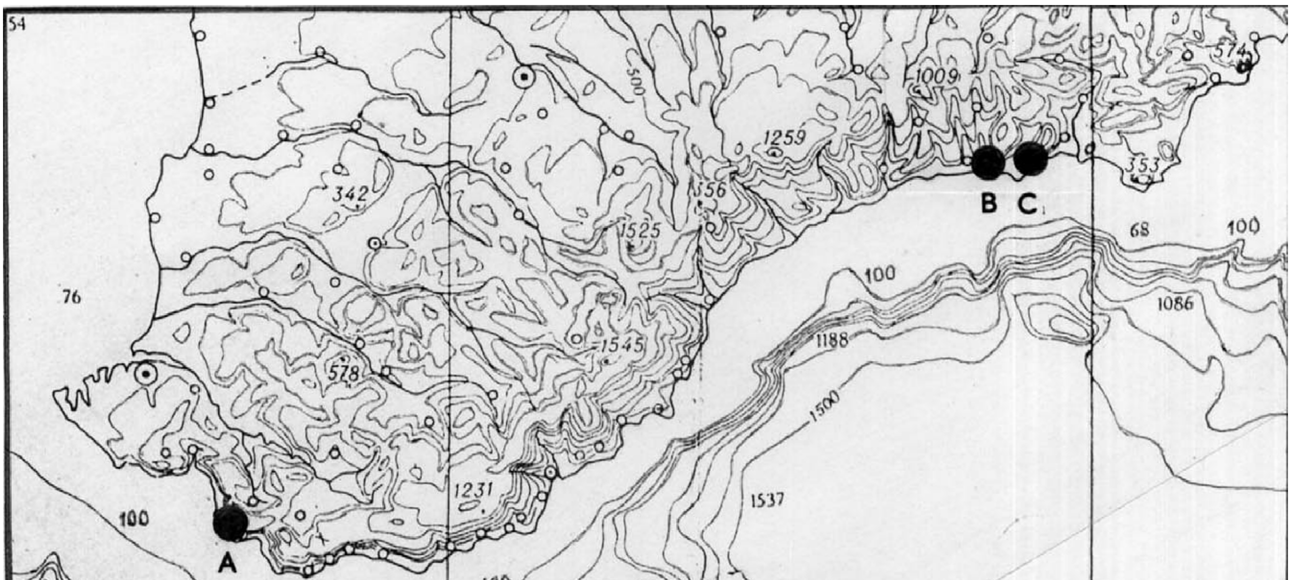

Fig. 3. Distribution map of *P. brutia* var. *pityusa* in the Crimean Sub-Mediterranean. Localities: A – Aya cape, B – Ay-Foka cape, C – Novy Svet. The isobathe of 100 m shows the shoreline before the last transgression

P. pityusa but in "Red Data Book of Ukraine" (1996) as *P. stankewiczii*. The authors of recently edited checklist of Ukrainian vascular plants (Mosyakin and Fedoronchuk 1999) left Stankiewicz pine with its variety status within *P. pityusa* as it was done by V. N. Sukachev. V. P. Koba (2001) calls the taxon *P. pityusa* treating it as Crimean-Caucasian form of *P. brutia*. The last four authors mentioned made their nomenclature choice without discussing it.

Some taxonomists do accept Stankiewicz pine precisely as infraspecific taxon *P. brutia* Ten. (e. g. Mirov 1967; Jalas and Suominen 1973; Sokolov et al. 1977; Kondratyuk 1985). The principal expert in Gymnospermae A. Farjon does not confirm any taxonomical specificity of the Stankiewicz pine today, recognizing only *P. brutia* var. *pityusa* (Steven) Silba (Farjon 2001).

Just the same, in L. Orlova's newest reviews of the genus *Pinus* (Orlova 2001a; 2001b; 2002), Stankiewicz pine is kept treating as the species – *P. stankewiczii*. Moreover, she added some new severity to the problem of recognition of subordinate taxons in *Pinus pityusa* s. l. with descripting a new nothospecies *P.* × *istratovae* L. Orlova as a hybrid of *P. pityusa* s. s. and *P. stankewiczii* (!). For better recognizing Stankiewicz pine here, Orlova tryes to use some vegetative characters, e. g. Stankiewicz pine has lanceolate and set together bud-scales unlike nearly awl-shaped and far-between arranged of *P. pityusa* s. s. However many features that Orlova presents in her articles (such as size of a terminal bud and imperseptible colour transitions of brachyblast scales, bud-scales and even width of young stems) are seemed to have little force. Unfortunately, it is unknown whether L. Orlova examines branches from the top or lower part of trees, from north- or south-oriented half-head, or even from what population. Seems to be true, L. Orlova can not overcome the bias that roots stretching back into the era of "Flora of the USSR".

We are prone to consider that overstating the taxonomic rank of Stankiewicz pine (that can be observed till now) is a manifestation of strict monotypic species concept that has predominated among botanists in former USSR, together with embodying of a desire to have "special" pine species within "home dendroflora", despite the absence of true distinctive characters. In this regard, a monograph by A. Kolesnikov (1963) that is devoted to "Pitsunda pine and close related species", shows a remarkable example: after wide discussing comparative characters of the taxa of our interest with no essential differences (it is stated even in text) and with not given size of sample, author concludes that there is enough data to treat the taxa as separate species (!). As the most forcible argument, isolated areas therewith are given.

As it was stated by Crimean dendrologists (Podgorny et al. 1975; Koba 2001), Pitsunda pine s. l. (including Stankiewicz pine) showed a wide range of variability in many characters. This data is in complete agreement with those of *P. brutia* in the East Mediterranean with more variability on low-altitude sites that can be explaned by transgression as well (Petrakis et al. 2000).

The newest effort to clear up the level of Stankiewicz pine's taxonomical differentiation was made by G. Goncharenko et al. through genetic analyses of 24 allozyme locis of the three close related taxa (1998). It has been found that Pitsunda pine, Stankiewicz pine and Calabrian pine have differences within less than 2% of their structural genes. This fact evidences unambiguously that all three taxa belong to the same species. "Consequently, taking into account priority of description, Pitsunda and Stankiewicz pines should be treated as Calabrian pine's representatives with growing in isolated populations on the north-east of the area" (Goncharenko 1998: 566).

To be more precise, the meanings of the so called genetic Nei-distance should be cited here A Nei-distance for "good" species is common to be more than 0.1; for close related pine species with no reproductive barrier it is 0.06–0.13; genetic distance between Pitsunda and Stankiewicz pines is 0.010, between Pitsunda and Calabrian pines is 0.016, between Calabrian and Stankiewicz pines is 0.019 (Goncharenko 1998). To be noticed, an attempt to find chemotaxonomical relationships between the same taxa gave the results showed their very high similarity too (Mirov 1967).

On the base of meanings of genetic Nei-distance, a dendrogram was modelled by G. Goncharenko (1998) that shows even the time of divorcing the three closely related pine taxa mentioned above. It has engaged our attention that the presumed time of Pitsunda and Stankiewicz pines' differentiation is coincident with the last Black Sea transgression that brings about increasing sea level up to 150 m. To our opinion, it is not an accidental coincidence.

Goncharenko's studying (l. c.) seems in particular to be much more strong evidence against Orlova's reasoning (l. c.) for the first of them deals with a 158 pine trees with applying precise methods, and the second one does not present the size of sample using hardly distinctive and often overlapping characters. As we can see, the choice of taxonomical rank should meet not only the newest morphological and genetical but also paleogeographical data.

That is why we are prone to accept the point of view of A. Farjon (2001). So here is the most full list of synonymy related to Stankiewicz pine:

***Pinus brutia* Ten. var. *pityusa* (Steven) Silba**

P. pityusa Steven var. *stankewiczii* Sukacz.; *P. stankewiczii* (Sukacz.) Fomin; *P. pityusa* Steven subsp. *stankewiczii* (Sukacz.) N. I. Rubtzov; *P. brutia* Ten. subsp. *stankewiczii* (Sukacz.) Nahal; *P. halepensis* subsp. *stankewiczii* (Sukacz.) E.Murray; *P. brutia* Ten.

var *stankewiczii* (Fomin) Gaussen; *P. brutia* Ten. var *stankewiczii* (Sukacz.) Frankis in Taskin.

Thus, we have to exclude Stankiewicz pine from endemic taxa of the Crimean flora, which are 142 in number according to our study (Yena 2001), i. e. 141 since now. But we ought to emphasize that it is not the ground for depreciating conservational status of the taxon, which is still one of the most threatened tree in Crimea being designed as *vulnerable* (II) in the Red Data Book of Ukraine (Didukh 1996).

Afterword

When we were starting to work with the paper, on August 2001, posterity of Wacław Stankiewicz visited Crimea. They were the three charming women – Stankiewicz's granddaughter Mrs. Maria Chodorek and her own daughter and granddaughter. We were invited at the Crimean Museum of Local Lore by its vice-director E.B. Vishnevskaya to take part in the special meeting of Simferopol's scientific community. M. Chodorek shared her remembrances of her grandfather the forester with the public and presented lots of photos and papers on the subject to the Museum. Later all the three set out to the Crimean Sub-Mediterranean. As it turned out, the guests took this travel specially to take a look at the very pine, which was discovered by their famous ancestor.

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