The tobacco beetle in Egyptian mummies

Ethno biology supports transatlantic interactions by early humans

By Dominique Görlitz

Introduction

One of the main questions in respect to modern archaeology is whether the earliest civilisations of the Old World had cultural interactions with the pre-Columbian people of the New World. Findings from remains of the tobacco plant *Nicotiana tabacum* L. and its main pest *Lasioderma serricorne* Fab. in the tomb of Tutankhamen have added further arguments for such a transoceanic exchange before Columbus.

In an attempt to put the emotional as well as ideological disputes about ancient transatlantic contacts on a more scientific fundament, the author wants to examine this paradigmatic subject with new results of invasion biology and archaeoentomology.

The question of whether tobacco (*Nicotiana tabacum* L.), a plant native to the Americas, was found in ancient Egypt cannot be solved by geobotanical data alone. Of course, fragments of tobacco were found over 32 years ago in the abdominal cavity of the mummy of Ramses II in Paris 1976 (Layer-Lescot 1985). Over the intervening years, an extensive literature has arisen about the results of this discovery. In 1992, forensic scientists in Germany used sophisticated instrumentation to examine Egyptian mummies in order to learn more about the ancient use of hallucinogenic or narcotic substances. They found chemical residues of tobacco, cocaine and hashish in the hair, soft tissues, skin and bones of mummies, including metabolically processed derivatives of the drugs, signifying that the drugs were ingested while the subjects were alive. However, none of this evidence has ever convinced Egyptologists that the ancient Egyptians had a certain access to these shamanic and narcotic plants of the New World.

The core of the controversy is of course that, according to the standard paradigm of plant geography, tobacco "should not" have appeared in Egypt at all or anywhere else in the Old World until after Columbus. The majority of scholars still hold the opinion that the presence of these alkaloids is neither the result of neither contaminations by tobacco-smoking cave robbers nor the existence of relict-endemedic species in the prehistoric Africa. These controversial discussions are completely overlooking the findings of the tobacco beetles in Ramses II as well as in the cave of Tutankhamen. This insect is clearly a Neozoon and has its genetic origin exclusively in the Americas before Columbus. New studies about the long distance dispersal of *Nicotiana tabacum* and experiments in respect to the seaworthiness of pre-Egyptian rafts on the North Atlantic deliver new evidence for the hypothesis than that *N. tabacum* and its pest *Lasioderma serricorne* were already introduced into the Old World by transatlantic voyagers in antiquity.

Keywords: alkaloids, chemism of psychotrop plants, cocaine, Coleoptera, entomology, ethno botany, long distance dispersal, nicotine, pre-Columbian interactions, prehistoric navigation, tobacco, tobacco beetle (*Lasioderma serricorne*, Tabakkäfer), tropanal alkaloids,

1. The tobacco-nicotine-controversy

According to the doctrine represented by scientists until now, tobacco plants appear outside of America before 1492 only in the form of a few relict endemisms in Australia, some South Pacific islands and the modest occurrence of *Nicotiana africana* in Namibia. This doctrine is opposed by the following discoveries which point to an early import and use of the tobacco plant in the Old World cultures:

1. The discovery of tobacco beetles in the tomb of Tutankhamen in 1922
2. The discovery of tobacco sheet leftovers as well as the tobacco beetle at or in the mummy of Ramses II in 1976
3. The discovery of nicotine, cotinine and even cocaine in human material in Egyptian mummies between 1992-1997

These discoveries raise the question of possible transatlantic cultural interactions and stimulations in pre-Colombian time for which there is no direct evidence according to the present state of research. Wolfgang Cremer (2004, 105) comes to the conclusion, „that for many tobacco historians this subject may be superfluous because they refuse to take note of it generally or to discuss even still. In their eyes only the misled, fantasts or gullible can suppose that there was tobacco in Old Egypt. Although I am [Cremer] convinced as well that this much-discussed plant of the solanaceous family did not exist in the Old World, I do not refuse them from the outset, however, getting to know the arguments and hypotheses of the advocates, particularly as I have the impression that they are hushed up in Germany“.


Fig. 1 & 2: The mummy of Ramses II was transported to Paris due to damages on the body in 1976. There an interdisciplinary team of scientists investigated and preserved the human remains of the pharaoh. At this occasion, they found several evidences for presence of nicotine, tobacco leaves and even its pest, the tobacco beetle.

Nevertheless, for many proponents of prehistoric contact (so-called diffusionists) these discoveries are »the ultimate evidence« that there was a regular exchange and cultural interdependency between the people of the Old and New World in antiquity. The scientific world rejects the findings as not proven. Only few researchers have academically discussed these findings (Cremer 2004). During the restoration of the mummy of Ramses II in 1976, Prof. Layer-Lescot (National Museum Paris) discovered ground tobacco leaves inside the body. They were taken from the abdomen and in the cervical region of the mummy and were examined and analysed by scanning electron microscopy (SEM), gel permeation chromatography and paper electrophoresis technology.
Layer-Lescot illustrates her findings of investigation as: „The materials to be examined limit themselves to very low parts [...] which are included in the abdominal cavity, and other components which were on the mummy“ (Layer-Lescot 1985, 182f). Some grams of the smelling substances, contained in the contents of the abdominal cavity of the mummy of Ramses II are of special interest: „It consists of a powdery substance, homogeneous in its appearance, brown with a revolting smell, indefinable, lightweight and compact. It contains the chopped remains of different plants in uniform matter. What was not to be expected in this analysis was the identification of *Nicotiana* spez. in the form of chopped leaves. It concerns a species which is not mentioned in the flora of the pharaonic epoch (Layer-Lescot 1985, 182ff). The French scientist's team could prove the existence of the tobacco plant and their main alkaloid, the nicotine, in the mummy's fabrics. Besides they discovered in the bandages the imago of a tobacco beetle of the New World type *Lasioderma* (Layer-Lescot 1985, 182ff; Paris & Drapier-Laprade 1985).
The discoveries were noticed by professional experts, but did not receive the degree of attention an evidence for disjunct tobacco spreading beyond the New World would normally deserve. Only after the discovery of nicotine in prehistoric human material in the 1990s the question of a possible occurrence of tobacco in early Egypt was raised again. Hair, skin as

well as muscle specimens were taken from several mummies in the head and abdomen area. The investigation results showed the existence of nicotine, cotinine, cocaine and Tetrahydrocannabinol (THC) (Balabanova 1997, 15).
The experiments unprecedentedly revealed that the highest nicotine concentrations existed in man-made mummified bodies from Old Egypt. Average concentration levels of 1330 ng/g were found, compared with circa 47 ng/g within the natural mummified bodies, and 38 ng/g nicotine in today's smokers' tissue. This indicates that tobacco leaves were probably used for the embalmment, in order to protect the body against putrefaction and bacteria (Balabanova et al. 1997). Therefore the question arises of either the possible existence of a tobacco plant species in Ancient Egypt or, a possible transatlantic contact.

Fig. 3: The inflorescence of Nicotiana tabacum. In accordance to the majority's opinion, this species was introduced by seafarers after the rediscovery of America in 1492. The detection of remains of nicotine and cotinine in ancient human material led to hypothesis of the presence of this alkaloid as well as this plant in the Old World before Columbus. In the upper left corner the structural formula of nicotine.

It is long known that also various wild plants in the Old World contain nicotine. Representatives of the Solanaceae herb, but also species of unrelated plant families possess nicotine as a secondary alkaloid in greater or lesser concentrations. Among these plants are herbs of the Solanaceae (*Datura stramonium* L., *Atropa belladonna* L., *Hyoscyamus* L., *Withania somnifera* L. etc.), the sour cherry (*Cérasus vulgaris* Million), the common polypody (*Polypódium vulgare* L.) or the stone crop (*Sédum* L.). However, in all these enumerated species the alkaloid concentrations are too low to define them as a source for the nicotine in the human material (Balabanova 1997). Moreover, the leaf traces found on the mummy of Ramses II clearly stem from the tobacco and not from an Old World plant. Nevertheless the majority of scientists do not accept the pollution of the mummy of Ramses II and other Egyptian mummies by ancient seafarer contacts with the New World. They cite numerous explanation models for an origin of these alkaloids which can only be mentioned briefly here:

1. Contamination theory 2. Relict endemism theory 3. Theory of extinct secondary nicotine-containing plants in the Old World 4. Forgery theory 5. Theory of the mummies with forged or unclear origin

It is impossible here to challenge all theories on their validity. The doubts most often expressed concern over the additional contamination by grave robbers who smoked or Egyptologists. However, those reservations do not stand up to scrutiny (Layer-Lescot 1985; Balabanova 1997, 56). One major argument against these theories, amongst others, is the fact that the specimens were taken from Ramses II with long biopsy tweezers from inaccessible sites, through previously made artificial openings in the mummy. According to Layer-Lescot (1985, 183ff) they isolated and identified chopped tobacco sheet leftovers from a homogeneous substance extracted from inside the mummy, so that a contamination from "outside" has to be regarded as impossible.
As another argument one can state that the specimens taken from the mummy were surrounded by the resin used within the embalmment (Balout & Roubet 1985). The mummy of Ramses II which was afflicted by fungi was cleaned. However, the resinous layer was not

liquefied. This admits only one conclusion: „A substance enclosed in resin could get there only before or during the embalmment. Therefore the identified leftovers of tobacco sheets and their alkaloid nicotine cannot be contamination (Balabanova 1997, 60)". Although the scientists L. Balout & C. Roubet (1985) which carried out the investigation of the Ramses mummy have pointed to this fact often, these findings are ignored to this day, according to the principle "that what must not be, cannot be" (Balabanova 1997, 60).
The tobacco beetles discovered from the grave of Pharaoh Tutankhamen in 1922 as well as the investigation of Ramses II in Paris in 1976 form another argument which could provide evidence for the temporary use of tobacco in Old Egypt.

2. Insects assist in the investigation of pre-Colombian tobacco in Old Egypt
The investigations of the mummy of Ramses II proved that it was afflicted by several Coleoptera species. Both taxa Dermestidae (larder beetles) and *Lasioderma* (tobacco beetles) are significant. *Lasioderma serricorne* was found in the herbal filling of the abdominal cavity in the mummy of Ramses II (Steffan 1982, 532). Human corpses are receptive to insect affection, above all from representatives of the orders Diptera (flies), Lepidoptera (butterflies), Coleoptera (beetles). Although Diptera dominates, they are rarely found in mummies, because the larvae usually only settle in humid habitats. Therefore, nymphs ready to hatch could set up there only before or during the embalming. However, many representatives of the Coleoptera were found in mummies as well as in Egyptian graves (Steffan 1982, 533f).

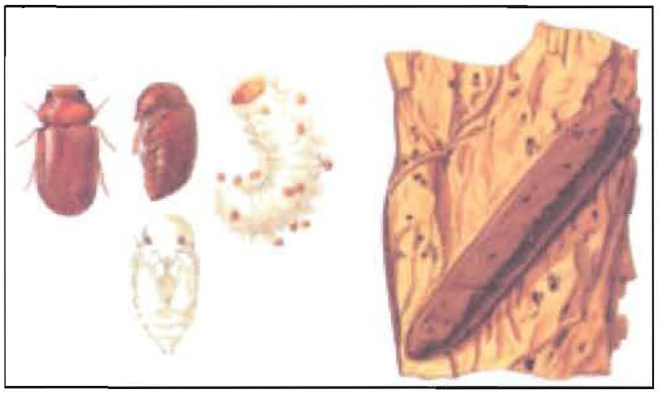

Fig. 4: The developmental stages of the tobacco beetle Lasioderma serricorne. It is the native pest of the tobacco plant and one of the insects which is resistant against the nicotine alkaloid. The nicotine resistance is the result of an endosymbiosis in the intestinal und thus an indication of a long Co-evolution in the Neotropics where the genetically centre of the genus Nicotiana is located.

About the origin of the tobacco beetle in the ancient Egypt, the Egyptologists act on the assumption of a post-Colombian contamination (Cremer 2004; Rätsch 2003). However, there are still several theories about their origin. The investigation of their biology and history of distribution delivers arguments for their ancient dispersal from the New to the Old World.
The *L. serricorne* found in Ramses II were probably hidden in the material used for stuffing the abdominal cavity (Steffan 1982). These insects belong to the family of the Anobiidae. [Author´s note: Within the "Catalogue of Palaearctic Coleoptera", Vol. 4, Ed. Löbl & Smetana 2007 the tobacco beetle newly belongs to the Family of Ptinidae]. Although the tobacco industry considers the tobacco beetles as important pests, *L. serricorne* is a stenoecious phytophagous. These beetles are extremely resistant to nicotine. They have such a preference for tobacco plants that they are assumed in scientific literature as "tobacco beetle" (Reed & Vinzand 1942). This beetle species is able to decompose the nicotine which is toxic for all other creatures by forming a symbiosis in his intestinal. The symbiont inherits the larva while it is eating through the egg integument (Ashworth 1993). This is an expression of the high adaptation of food plant, symbiont and tobacco beetle which has developed just over an evolutionary long period and it delivers an evidence to the geographical origin.
The beetles of the genus *Lasioderma* are still named invasive species among zoologists. It is a hemerophil species and successfully colonized all countries beyond America through the

worldwide distribution of the tobacco cultivation [personal note of Ronald Bellstedt, Museum of Natural History Gotha 2008]. In accordance to the majority's opinion this insect was spread by anthropogenic interactions after the re-discovery of Christopher Columbus in 1492. How it came into the mummy of Ramses II is still an unsolved enigma of invasion biology.
Steffan (1982) joins the interpretation of Layer-Lescot in his study about the origin of the chopped tobacco leaf blades: "Chemists and botanists have made the most astonishing discovery: Thirty centuries ago the mummy was primarily stuffed with the leaves of a *Nicotiana* species, especially *N. tabacum*" (Steffan 1982). Nevertheless Steffan (1982) believes that *Lasioderma* did not end up in the mummy during pre-Colombian times with *Nicotiana tabacum* from the New World. Therefore, the existence of the tobacco beetle in Ramses II is not considered as evidence of an ancient anthropogenic dispersal of insects with American origin. They are considered pollutions from post-Colombian time such as the tobacco leaf findings and nicotine traces from his inside (Cremer 2004, 110).
Although the other species of the Coleoptera also provide no direct evidences of a settlement of the Egyptian insect fauna before or during the embalmment, the tobacco sheet leftovers and resinous containments cannot be explained by additional contaminations for Layer-Lescot (1985), Balout & Roubet (1985) as well as Balabanova (1997). In contrary, the generally low concentration of insect species within the abdominal cavity may in fact be owed to the high concentration of nicotine which deterred insects from settling within the material during and especially after the embalmment. All indicators for, as well as against a pre-Colombian invasion by *L. serricorne* in Ramses II, deserve a thorough evaluation. Today the discussion could be enlightened by a simple radiocarbon dating. Unfortunately, this is not possible at the present time because the investigation material is missing after the studies in Paris (personal note of Germer 2008).

3. The tobacco beetles from the grave of Tutankhamen

The same destiny also overtook the tobacco beetle findings from the grave of Tutankhamen, although this material was intensely investigated several times after the discovery. Nevertheless, the circumstances of the finding show some differences to Ramses II which lie in particular in the rediscovery of the untouched Pharaoh's tomb. According to today's state of research this Egyptian tomb has been closed since the funeral for more than 3,266 years. The care with which the excavation leader Howard Carter investigated the archaeological site is unrivalled. The work on the grave of Tutankhamen lasted several winters. There is no space here to describe them exactly. Zoologists also took part in the investigations. Their research shows that the burial chamber of Tutankhamen (15th Dynasty New Empire 1,332 – 1,322 B.C.) also contains tobacco beetle of the species *Lasioderma serricorne* (Alfieri 1932, Steffan 1982, Buckland & Panagiotakopulu 2001).
Alfieri (1932) and Zacher (1937) refer to the fact that in the antechamber of the tomb of Tutankhamen some biscuit beetles (Anobiidae) were found on the ground of a wooden box as well as in the sticky leftovers of probably grape juice on an alabaster vase. In both cases they were accompanied by a great number of *L. serricorne*. According to Alfieri (1932) *Lasioderma serricorne* was found in the untouched grave of Tutankhamen. The beetles stuck in a liquid which was grape juice for Carter & Mace (1933) and grape or date juice for Lucas & Harris (1962). With certainty the beetles were attracted by the fermentation of the juice. However, the beetles found cannot have arisen from it (Steffan 1982, 533). It is a determining point in the discussion of the tobacco beetle debate that Howard Carter mentions no insect findings in the original excavation lists in the wooden box as well as in the open alabaster vases (Griffith Institute 2004). Carter indeed documented sticky, partly dark fatty substances in or at the vessel for the open alabaster vases but no registrations about any insect species in the excavation lists. Furthermore it is known that Carter complained several times on the

invasions of living insects during the recovery work which hindered his works (personal note of Germer 2008).
This stands in the contrast to the report "Les insects de la tombe de Toutankhamon" published by Alfieri in 1932. Therein Alfieri (1932) describes that the unlocked vessels 16, 58, 60 and 61 with partly fatty substances were contaminated by tobacco beetles.

Fig. 5: The finding situation of artefacts when Howard Carter opened the tomb of Tutankhamen. The tobacco beetles were found on the upper fatty and sticky fringes of the vessels No. 58, 60 and 61.

The studies about the existence of *L. serricorne* in and at the grave goods of Tutankhamen were made by Alfieri after the clearance of the burial chamber. Alfieri refers in his report to the preliminary works of E.W. Adair, who already specified the insects in 1923, according to his own record (Alfieri 1932, 188). It does not arise from the documents whether Adair carried out the determinations still in the untouched tomb or in the laboratory.
It is supposed that within the funeral and embalmment of Tutankhamen, tobacco leaves and flower parts were used which were contaminated by imagines or larvae of the tobacco beetle. Balabanova et al. (1994) says about the origin of the tobacco beetles:„ In the first time the larvae of *L. serricorne* presumably exterminated the *Nicotiana* plants, then they have fallen death from starvation what could also explain the absence of remains of the *Nicotiana* plant in the burial chamber“. The question arises how the tobacco beetles could get into the tomb. They have continued to live for some time after the closing of the burial chamber, because the dead tobacco beetles were discovered scattered on the ground and sticking in the dried grape juice remains (Alfieri 1932). These findings are not surprising, because after closing the burial chamber the stenoecious tobacco-phytophagos could also have accepted the host-unspecific food resources after they had eaten the brought-in tobacco plants Balabanova et. It is theoretically possible fact that the carefully secured findings had been contaminated afterwards in the lab, but is rather unlikely in consideration of the descriptions of the zoologists. This scenario presupposes that the entomologists have been exposed to insect infestation during the analysis process of the specimen and would have described the insect fauna that surrounded them in the laboratory afterwards. Moreover, to make no mention of insect infestation is not surprising for Howard Carter. He is an Egyptologist, no entomologist. This is why he does not look for insect infestation immediately. Considering the mass of duties and responsibilities, the difficult conditions of excavation and especially the small size of the Anobiidae, it is likely to be overlooked. Furthermore, the tobacco beetle is a drought-resistant insect and will never search for green tobacco plants. As a hemerophil insect it has always been transported with dry and storaged tobacco. The tobacco beetle will never explore new area by an active survey (personal note of Ronald Bellstedt, Museum of Natural History Gotha 2008).
Therefore the tobacco beetles of Tutankhamen attain a great importance for the evaluation of questionably classified tobacco findings in Old Egypt up to now. They could document not only the existence of the New World tobacco pest in early Egypt in pre-Colombian time, but also supply further arguments against the relict endemisms and contamination theory.

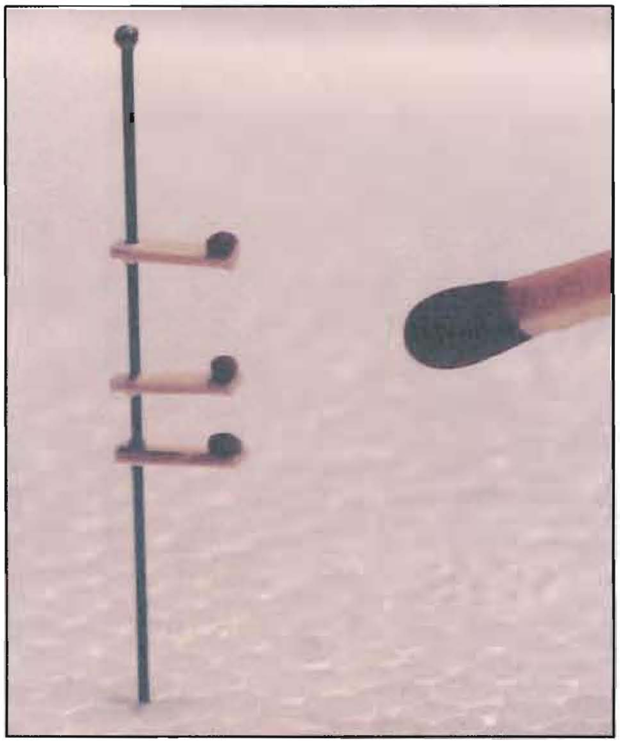

Fig. 6: The picture shows three tobacco beetles beside the head of a match. One can see the tininess of these insects and how easily one can overlook them when they were attached to the upper fringes of the vessels or at the bottom of the box No. 115.

Should this interpretation turn out to be correct, the tobacco beetle has not to be classified as an invasive alien species (Neozoon, invasion after 1492), but as an Archaeozoon, (alien species invasion before 1492). Invasion biology uses parasitology (including stenoecious phytophagous) as one of the most important tools to reconstruct the dispersal routes of foreign species. This scientific discipline documents with countless examples that pests almost never migrate without their hosts across great distances to foreign territories (i.e. camel louse). As opposed to the genus *Nicotiana*, the representatives of the beetle genus *Lasioderma* show no disjunctive dispersal area. Furthermore the tobacco beetle flies only short distances and therefore it is extremely improbable that he crossed the Atlantic Ocean on his own. In accordance to all entomologists these insects exclusively appeared in the New World in pre-Colombian times only. In a long process of co-evolution and symbiosis they have acquired a nicotine resistance to the main active substance of the tobacco plant, as well as adapted themselves to follow their host to the tobacco plantations of the people.

The importance of the tobacco beetles as an Archaeozoon is not considered sufficiently by archaeology up to now to solve the nebulous origin of the nicotine in Egyptian mummies. The use of tobacco seems possible, in particular in consideration of the high cultural achievements Egyptian civilisation.

4. The chemism of the psychotropic plants deliver further arguments

While it is surprising to find nicotine and also tobacco beetles inside of Egyptian mummies, it is almost impossible for science to explain the origins of the cocaine findings in the ancient Egypt. According to the current state of research, these finds of cocaine can originate only from the two New World species *Erythroxylum coca* Lam. or *E. novogratense* (D. Morris). The genus *Erythroxylum* is, just like tobacco, largely disjunct with two major areas of dispersal, which are the results of Tertiary land bridges (Evens et al. 2008). As studies on the widely disjunct spread of the species show, only two of more than 300 *Erythroxylum* species actually have the capability to synthesize cocaine in physiologically high concentrations (Rätsch 2004, 242ff). They only exist in one limited region of the New World and have no closer relationship to those in tropical Africa and Madagascar. For that reason it is plausible that cocaine-producing species have only differentiated themselves from their New World lineage species after the separation of the African continent. This is a typical phenomenon of vegetation geography and is characterized as vicariance (Fukarek et al. 2000, 21). These synthesizing abilities are described as the result of local advancement within the section (*Archerythroxylum*). The complete absence of any cocaine in all other taxa of *Erythroxylum* in Africa as well as in Madagascar, in Asia and Australia (Yahia et al. 1987) underlines that the

ability to synthesize Cocaine presumably developed only after the separation of land bridges between South America and the Antarctica.
The field studies of Plowman & Rivier (1983) document that the coca plant originating from the higher Andes show a higher production of cocaine within the variety *Erythroxylum coca* var. *coca* when compared to the subspecies *Erythroxylum coca* var. *idapu*, which are found in the lower regions of the Amazon basin.
Schulz (1907, 13) already mentions the existence of some other species with significantly lower cocaine concentrations in the Amazon basin. In the study of Plowman & Rivier (1983), cocaine was proven to exist in the leaves of 13 out of 29 tested wild species in the Neotropis. The concentrations ranged from 0,0003 to 0,3 mg per 100 g dry matter. In comparison, the cultivated species *E. coca* var. *coca* show concentrations between 0,23 and 0,96 mg, while *E. novogranatense* var. *truxillense* shows between 0,42 and 1,02 mg per 100 g dry matter.
No cocaine traces were measured in the two selected species of the Palaeotropis (Plowman & Rivier 1983). Equally, Evans (1981) reports with great conviction that the Old World species of this genus contains no cocaine. However, a certain number of Old World *Erythroxylum* species possess Tropane alkaloids (Evans 1981; Hegnauer 1981), which are related to cocaine. Cinnamoylcocain was detected in in *E. monogynum* Roxb, whose centre of distribution is in southern India and on Sri Lanka (Chopra & Ghosh 1938).
A research team at the University of Nottingham comes to a similar conclusion during the analysis of the chemical structure of South African *Erythroxylum* species. It was shown that the largest number of different alkaloids can be found in the African species *Erythroxylum zambesiacum* N. Robson. Generally, this alkaloid mix is similar to that of *Erythroxylum monogynum* (Section *Sethia*, South India). But the range of alkaloids and ingredients of *Erythroxylum zambesiacum* is considerably wider, especially with the presence of organic and phenylacetic acids. Even a completely new Nor-Tropanal was discovered, which could be identified as 3α-(3,4,5-trimethoxybenzoyloxy)nortropan. But even in this study no cocaine could be identified in the Old World taxa (Yahia et al. 1987).
The samples of the alkaloid study by Yahia et al. (1987) represent seven sections of the genus *Erythroxylum* as identified by Schulz (1907). They cover the principal areas of dispersal in the world. The distribution patterns of the acids are notable evidence to the four sections, which originate from southeast Africa and led to a diversification of the genus there. The distribution patterns and the existence of TmbA (3,4,5-trimethoxybenzoic acid), TmcA (3,4,5-trimethoxycinnamic acid), organic acids and benzolic acids within the Palaeotropis clearly differ from the specimens of the Neotropis. Particularly the New Word species *Erythroxylum coca* representing the section *Archerythroxylum* shows, according to Yahia et al. (1987), no ester or acids in the root bark at all.
The study on alkaloids in *E. zambesiacum* therefore delivers no evidence for a closer relationship in the chemism of both sections. The same is valid for the Australian species *Erythroxylum australe* F. Muell. (Sektion *Coelocarpus*). This chemical research not only confirms the morphological observations of Schulz (1907) that the few species of tropical Africa have no closer kinship to those of the Americas, but also substantiates the hypothesis that the cocaine synthesis of the Andean species is the result of a vicariance process.
As elaborated on the example of the *Nicotiana* species, even an unexpected discovery of a hypothetical, cocaine-containing plant in southern Africa would not serve as a new approach to explain the cocaine source in ancient Egypt. All *Erythroxylum* species in Africa fall victim to the same cultural insignificance as it applies to their wild cousins in South America. Only the two cocaine-containing cultivated species in the new world would be nurtured by the native population and subsequently distributed by humans across large areas within America.
This conclusion has far-reaching consequences for the trans-Atlantic evaluation of a potential cocaine use in the process of mummification in early Egypt. Africanists and ethnologists both

agree that cocaine plants or their alkaloids have found their way into southern Africa only in modern age (Cremer 2007; Rätsch 2004).
The studies on the chemism of *Erythroxylum* species currently lead to the conclusion that the existence of related tropanal alkaloids as well as organic acids within the *Erythroxylum* taxa can be used as a systematic attribute (Plowman & Rivier 1983; Yahia et al. 1987). They confirm the morphological differences of *Erythroxylum* species in Neo- and Palaeotropis (Schulz 1907, 10ff). Cocaine is a special representative of tropanal alkaloids which can only be found in America and not in Africa. "It may sound unbelievable first, but the only realistic explanation for the existence in Egyptian mummies seems to be, that trade relations existed between the Egyptian world and America" (Collins 2005, 133).

5. Conclusions

In the history of agriculture, man has always spread animals and plants from the very first beginning. The long distance dispersal of domesticated plants and animals is very often the result of anthropogenic dispersal. This dispersal is linked to the development of seagoing vessels. Based on entirely new discoveries of boat rock drawings in Northern Spain it must be assumed that the beginning of deep sea navigation already started before the last Ice Age (Görlitz 2008). This statement is supported by molecular biological data of *Lagenaria siceraria* (Mol.) Standl. which are indicating its anthropogenic dispersal from Africa to America at least 9,000 to 13,000 years ago (Decker-Walters et al. 2004).
Findings of tobacco and its pest, the tobacco beetle, give us new evidence that an intercontinental cultural and biological exchange has existed before the advanced civilizations. Both species are mainly native in the Neotropics. Particularly the tobacco beetle, except for its findings in the Egyptian tomb of Tutankhamen as well as Ramses II, has no other distribution evidence in the Old World. According to the prevalent point of view, this species is a Neozoon which was actually introduced into the Old World after Columbus. The discovery of *Lasioderma serricorne* in the ancient Egypt is an indication that this opinion is wrong. This observation might be a strong evidence that this pest reached Egypt as a "blind passenger" on board of ancient tobacco traders.
The investigation of the chemism of the cocaine of the genus *Erythroxylum* comes to similar conclusions. All Old World specimen of *Erythroxylum* do not contain traces of cocaine. Only two species of the New World possess sufficient concentrations of this tropanal alkaloid. This observation excludes all explanations that the contaminations in ancient Egyptian mummies are the result of relictendemits. The investigation of the chemism of these American psychotrop plants also brings to light the Namibian tobacco species *N. africana*. It belongs to the primitive australo-pazifian subgenus *Suaveolentes* which contains almost no nicotine (Merxmüller & Buttler 1975). Therefore the source of nicotine and cocaine has to be supposed only into the Americas before Columbus.
Although the majority of scholars do not accept theses evidences as a proof for transatlantic interactions, a revision of all available data leads to new interpretations. Especially the existence of *Lasioderma serricorne* in ancient Egyptian mummies delivers strong arguments for this hypothesis. Owing to the fact that *Lasioderma serricorne* as well as the alkaloids nicotine and cocaine have their biological origin exclusively in the New World it must be accepted that these species were introduced from there into the Old World cultures. We do not have strong indications today about who and which society realised these cultural interactions. It seems likely that people from the young Palaeolithic cultures in Spain or their descendants – the Basques – were responsible for this pre-Columbian net work trade. Thus the existence of *Lasioderma serricorne* in two Egyptian findings is helping to solve an archaeological enigma.

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7. Picture references

Fig. 1, 2	Balout, Lionel, Roubet (1985): La Momie de Ramsés II, Recherche sur les Civilisations, Paris
Fig. 3, 4	www.puro-club.com/images/
Fig. 5, 6	Carter, H., (1923-1927): The Tomb of tut-Ankh-Amen, 2 Vol., éditeurs Cassel and Company Ltd., London
Fig. 7, 8, 9, 10	Dominique Görlitz (1999-2007)

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