

TOPICS IN **Perek** DAF YOMI MENACHOS PEREK 4 **HaTecheiles**

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Techeiles Revisited

Rabbi Berel Wein

One of the enduring mysteries of Jewish life following the exile of the Jews from the Land of Israel was the disappearance of the string of techeiles in the tzitzis garment that Jews wore. Techeiles was known to be of a blue color while the other strings of the tzitzis were white in color. Not only did Jews stop wearing techeiles but they apparently even forgot how it was once manufactured. The Talmud identified techeiles as being produced from the “blood” of a sea creature called the chilazon. And though the Talmud did specify certain traits and identifying characteristics belonging to the chilazon, the description was never specific enough for later generations of Jews to unequivocally determine which sea creature was in fact the chilazon. It was known that the chilazon was harvested in abundance along the northern coast of the Land of Israel from Haifa to south of Tyre in Lebanon (Shabbos 26a). Though techeiles itself disappeared from Jewish life as part of the damage of exile, the subject of techeiles continued to be discussed in the great halachic works of all ages. Just as the Jews did not forget Zion and Jerusalem, their subconscious memory of past glory and spiritual greatness kept techeiles alive, in their memory if not in actual practice.

There are a number of basic questions that require study in order for any determination of the possibility of observing techeiles in our time. The three main questions are: 1) When and why did techeiles disappear from the Jewish world? 2) Which sea creature is the chilazon and how can blue dye be manufactured from it? and 3) Even if the chilazon can be positively identified and techeiles processed from it, is it within our halachic power to revive a “lost” commandment, the tradition (mesorah) of which has also been lost? These questions, which have always existed and been discussed in halachic and rabbinic literature, began to move from the realm of purely intellectual and speculative

to the arena of Jewish practice about one hundred thirty years ago. Since then, the search for the chilazon and the debate about renewing the observance of techeiles has intensified until it has now achieved the status of discussion regarding practical observance.

There are various dates and reasons attributed to the demise of techeiles in the Jewish world. In the ancient world (and later in the world of Rome), the colors of purple and blue were reserved for royalty and the upper classes. The Romans were especially zealous about their governmental monopoly on dye production for the royal purple and blue. The Talmud



“Color is an emotional experience. Techeiles is the emotional reminder of the bond between ourselves and Hashem and how we get closer to Hashem with Ahavas Hashem, the love of Hashem, the love of Torah and Mitzvos,”
Rabbi Abraham J. Twerski



The seal of the Rebbe of Radzyn,
Rav Gershon Henoch Leiner, z"l

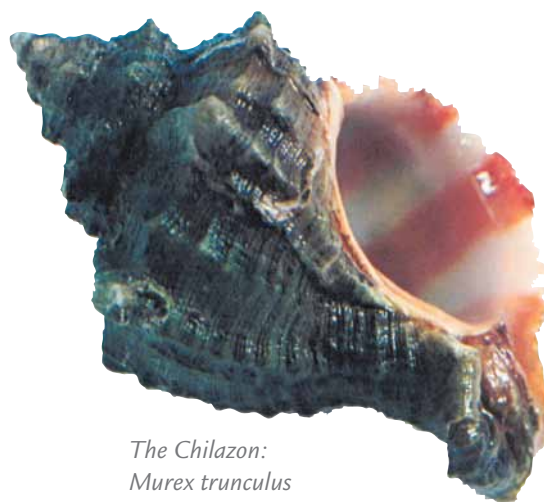
records the arrest of two rabbis from Israel who were smuggling techeiles into the Jewish community of Babylonia (Sanhedrin 12a). The Talmud also records that techeiles was brought to Babylonia in the time of Rav Achai c. 500 CE (Menachos 43a). There is no specific reference in the Talmud that Jews were not able to obtain and wear techeiles. Since the final redaction of the Babylonian Talmud occurred c. 570 CE, Rabbi Isaac Halevi Herzog, the first Chief Rabbi of Israel, in his seminal work on techeiles, assumes that the techeiles manufacturing factories in the Land of Israel were destroyed during the time of the Moslem conquest of the country, in c. 638. In any event, the range of dates advanced for the disappearance of techeiles in the Jewish world extends from the late fifth century (Rabbi Yehoshua Kutner in Yeshuat Malko, Orach Chaim, 2:1-3) to the fifteenth century with the fall of Constantinople to the Moslems in 1453 (mentioned by Rav Herzog as a possibility, though he personally rejects it.) Mar Shalom Gaon (died 859), Rav Nachshon Gaon (died in 889) Rav Shmuel ben Chafni Gaon (died 1034), Rav Yitzchak Alfasi (died 1103), Rambam (died 1204), and many other great Geonim of Babylonia and Rishonim of Spain and France bemoan the disappear-

ance of techeiles from the Jewish scene. From all of this it seems clear that techeiles was no longer available by the time of the zenith of the Moslem conquests in the Mediterranean basin and the Balkans in the seventh century. Rabbi David ben Zimra (Radvaz) of Cairo stated at the end of the fifteenth century that the chilazon may certainly yet exist in the waters of the Mediterranean but "we are unable to harvest it." This situation remained in effect until the end of the nineteenth century.

As for the remaining two questions regarding techeiles – the identity of the sea creature called chilazon and whether a "lost" commandment and tradition can be revived after centuries of absence – there entered on the scene in 1889 Rabbi Gershon Henoch Leiner, the Radzyner Rebbe. Rabbi Leiner claimed that the chilazon was a type of squid called the cuttlefish and he actually produced thousands of sets of tzitzis that included a blue string made from a dye obtained from that squid, which he believed was techeiles. He defended his contentions in a massive three-volume work of Torah scholarship entitled *Sfunei Tmunei Chol*, *Psil Techeiles*, and *Ein Hatecheiles*. However, Rabbi Herzog in his 1913 dissertation proved that Rabbi Leiner's squid was not the chilazon. Rather, Rabbi Herzog advanced the theory that the chilazon was a snail, *Murex trunculus*, that had been discovered in Mediterranean waters by a French zoologist, Henri Lacaze Duthiers, in 1857. However, Rabbi Herzog was disappointed by the fact that the dye obtained from this snail was purple in color and not the blue indigo necessary

for techeiles. The problem that Rabbi Herzog raised was solved by a chance discovery of Dr. Otto Elsner of the Shenkar Institute in Tel Aviv in the early 1980's. He discovered that the liquid extracted from the gland of the snail, when exposed to the air, turns purple in color. However, during the dyeing process, when it is exposed to direct sunlight it turns into a brilliant indigo blue. The many thousands of Jews who wear techeiles today in their tzitzis obtain their techeiles strings from the dye of this *Murex trunculus* snail (except of course for the Radzyner Chasidim who follow their Rebbe's opinion that the chilazon was a squid.) There seems to be little doubt today that the snail, *Murex trunculus*, is indeed the long-lost elusive chilazon.

The question of reviving techeiles use has been hotly debated in rabbinic circles for over a century. Rabbi Yosef Dov Soloveitchik, the rabbi in Slutzk and Brisk in the middle and late 1800's, discussed Rabbi Leiner's techeiles and rejected it. Unfortunately, the Beis Halevi's actual responsa was lost and two versions of his reckoning have come down to us. The Radzyner Rebbe, quoting the Brisker Rav in order to answer his objection, presents Rav Soloveitchik's contention that since this squid was well known to the rabbis of all the ages,



The Chilazon:
Murex trunculus

yet they did not regard it as being the chilazon, this in effect constitutes a negative tradition regarding equating the squid with the chilazon. However, if the chilazon was instead found to be a newly discovered sea creature that was unknown to the rabbis throughout the centuries, the lack of rabbinic tradition would not necessarily disqualify the techeiles produced from this recently discovered sea creature, assuming, of course, that the prospective chilazon and techeiles met the criteria set forth in the Talmud. Within the Brisk family, though, a different line of reasoning is attributed to the Beis Halevi. They claim that the Brisker Rav required a positive tradition regarding the identification of the chilazon, and once that line of mesora was broken, the halachic determination of the chilazon and wearing techeiles derived from it would have to wait for Messianic times (see Rav Yosef Dov

Soloveitchik, the Beis Halevi's great grandson, in *Shiurim L'zecher Abba Mari z"l* vol. 1, p. 228). Clearly, this discrepancy regarding the Beis Halevi's position has ramifications regarding techeiles obtained from the *Murex trunculus* since the recent discovery of the existence of this snail and the even more recent discovery of how to obtain blue indigo dye from its gland, would be sufficient in terms of the first position attributed to the Brisker Rav, and on that basis some feel that it is obligatory to wear techeiles in our very time.

There is a statement in the Midrash [Midrash Tanhuma (Shelach 28); Bamidbar Rabba (17:5).] that techeiles was "nignaz" – "put-away/hidden." There are those that maintain that this statement also precludes the use of techeiles in our time. But it seems clear that this was not the intention of the Midrash, especially since techeiles was still in use after the time of the writing of this Midrash. Rabbonim such as Rabbi Yechiel Michal Tukachinsky have interpreted the Midrash as meaning that techeiles became less and less common but not that it disappeared completely, nor was this Midrashic statement intended to prevent the use of



Seated from left to right: HaRav Reuven Katz, HaGaon Rav Dov Weidenfeld of Tzivin, HaRav Shmuel Yitzchak Hillman, and Chief Rabbi Isaac HaLevi Herzog.

techeiles amongst Jews of later generations. There is no unanimity in current rabbinic opinion regarding this question of the reintroduction of techeiles into Jewish life and practice, though as an empiric observation, the use of techeiles continues to spread widely throughout the Jewish people. One thing is certain: techeiles has become a living issue and has left the exclusivity of the study hall and entered into the everyday life of tens of thousands of Jews the world over.

"There is an obligation upon all who are capable, to search for [tekhelet], to merit Israel with this commandment, which has been forgotten for the last several centuries. And he who succeeds in this, will surely be blessed by God."

RABBI G.H. LEINER, THE RADZYNER REBBE



The Radzyner Map of Eretz Yisrael. Printed in *Sidrei Taharos*.

Principles Regarding Tying Tzitzis with Techeiles

Collected Sources

Although the method for tying white tzitzis is fairly standardized, the situation regarding tying tzitzis with techeiles is the subject of widespread machlokes. There are many aspects dealt with by the Gemara and Rishonim:

NUMBER OF STRINGS ON EACH CORNER

תנו רבנן כמה חוטין הוא נותנין בית שמאי אומרים ד', ובית הלל אומרים ג'... מנחות מא:

The Rabbis taught, How many strings does one place [on each corner]? Beis Shammai say four and Beis Hillel say three... MENACHOS 41B

RATIO OF WHITE TO TECHEILES STRINGS

מכמה גדילים אתה עושה? אין פחות משלושה - דברי בית הלל. בית שמאי אומרים: שלושה של צמר ורביעיית של תכלת. והלכה כבית שמאי. ספרי שלח (קטו)

How many strings must one place? Not less than three – this is the opinion of Beis Hillel. Beis Shammai say: Three [strings] of [white] wool and a fourth of techeiles. And the halacha is according to Beis Shammai. SIFRE SHELACH (115)

כמה גדילים נעשים? אין פחות משלושה חוטים כדברי בית הלל. בית שמאי אומרים: מארבעה חוטים של תכלת וארבעה חוטים של לבן... והלכה כדברי בית שמאי. ספרי כי תצא (רלד)

How many strings are placed? Not less than three strings according to Beis Hillel. Beis Shammai say: Four strings of techeiles and four strings of white. And the halacha is according to Beis Shammai. SIFRE KI TETZEI (234)

Note: The Vilna Gaon claims that the correct version of this Sifre is – “בג' חוטין של לבן ורביעיית של תכלת” – “With three strings of white and a fourth of techeiles.” This change would harmonize the two quotes from the Sifre.

There are three different opinions of the Rishonim regarding the ratio of white to blue strings:



Rambam (הל' ציצית א'ו) – Half of one string (when folded becomes one of the eight strings) is techeiles. The Rambam understands the posuk in Bamidbar in the following manner: – ונתנו על ציצת הכנף (= לבן) פתיל תכלת – put upon the fringe of each corner (= white) one thread of blue. Only the windings (פתיל) around the white core (כנף) must be techeiles.



Raavad (השגות הל' ציצית א'ו) and the Aruch (ערך תכלת) – Based on the Sifre in Shelach hold that one full string (when folded it becomes two of the eight) must be techeiles.



Tosfos-Rashi (מנחות לה. ד"ה התכלת) and Tosfos (שם וכן מא: ד"ה בית שמאי) – Two full strings (four of the eight) are techeiles.

ISSUES REGARDING THE WINDINGS (KRICHOS)

CHULYOS

וכמה שיעור חוליא? תניא, רבי אומר כדי שיכרוך וישנה. תאנא, הפחות לא יפחות משבע, והמוסיף לא יוסיף על שלוש עשרה. הפחות לא יפחות משבע – כנגד שבעה רקיעים, והמוסיף לא יוסיף על שלוש עשרה – כנגד שבעה רקיעין ושה אירין שביניהם. מנחות לט.

And what is the measurement of a chulya (link)? We learned in a Braisa, Rebbe says so that you can wind once, then again, and a third time. We learned in a Braisa, one who minimizes should not have less than seven, and one who maximizes should not exceed thirteen. One who minimizes should not have less than seven – this is analogous to the seven heavens, and one who maximizes should not exceed thirteen – this is analogous to the seven heavens and six spaces between them. MENACHOS 39A

According to the Gemara, when tying tzitzis, there is a concept of chulyos (literally, links or vertebrae). There is an argument as to what the numbers seven and thirteen refer. Most Rishonim explain that these numbers refer to the amount of chulyos (each of which is made up of three twists as Rebbe states). Some Rishonim explain that each chulya can have between seven and thirteen twists, and they explain Rebbe's three twists as referring either to the number of techeiles twists in each chulya (and

the number seven includes both the white and the techeiles), or that Rebbe is talking about the absolute minimum required to fulfill the mitzva (bedieved deoraysa), but the best method (lechatchila derabanan) should have between seven and thirteen twists.

COLOR OF TWISTS

תנא, כשהוא מתחיל, מתחיל בלבן – 'הכנף', מין כנף, וכשהוא מסיים, מסיים בלבן – מעלין בקודש ולא מורידין. מנחות לט.

We learned in the Mishna, when one begins, he begins with white – "[the fringe of each] corner," the same kind as the corner [i.e. the same color as the garment]; And when one concludes, he concludes with white – one always increases holiness and never decreases. MENACHOS 39A

There is an argument as to the explanation of this passage:

- **Rav Amram Gaon** (גאוןיקה ח"ב עמ' 330-331) holds that the first chulya is white, the next is techeiles, and so on alternating white and techeiles for seven or thirteen chulyos. These chulyos of alternating colors are termed *l'sayugin*.

- **The Rambam** (הל' ציצית א' ב' ג') holds that the first twist of the first chulya and the last twist of the last chulya are white, and all the other twists are techeiles.

- **The Raavad** (השגות הל' ציצית א' ז') holds that the twists of each chulya alternate between white and techeiles.

CHULYOS IDENTIFIED



Left to right: *L'sayugin*, Yemenite, ARI z"/>, Radzyn, Raavad.

THE KNOTS

KESHER ELYON

ואמר רבה שמע מינה קשר עליון דאורייתא. מנחות לט.

Rabbah says, this implies that the uppermost knot is required from the Torah. MENACHOS 39A

Rashi (מנחות לט. ותוספות שם) brings down two possibilities regarding the placement of the uppermost knot.

- Closest to the garment, in order to connect the strings to the garment
- At the end of all the twists, which adds stability to the windings

DOUBLE OR SINGLE KNOTS

There is an argument as to the nature of the knots of the tzitzis. The Geonim (גאונים ח"ב עמ' 331) hold that a knot can be one string tucked under itself. Rabbenu Tam (מנחות לט. ד"ה לא) compares the knots of tzitzis to knots in other laws like Shabbos, and therefore requires a double knot. According to Rabbenu Chananel, the knot is made by looping one string around the rest, whereas The Mordechai holds that all the strings are used (by looping four around the other four).

KNOTS ON EACH CHULYA

אמר רבא שמע מינה צריך לקשור על כל חוליא וחוליא מנחות לה:

Ravah says, this implies that one must tie a knot after each and every chulya. MENACHOS 38B

FIVE KNOTS

ציצית, שש מאות. שמונה חוטין וחמישה קשרים, הרי שש מאות ושלוש עשרה. תנחומא, קרח י"ב

[The word] tzitzis is numerically equivalent to 600. 8 strings and 5 knots add up to 613. TANCHUMA, KORACH 12

THE LENGTH OF THE WINDINGS AND THE STRINGS

אמר רב הונא אמר רב ששת אמר
רב ירמיה בר אבא אמר רב... ונוי
תכלת שלישי גדיל ושני שלישי ענף.
מנחות לט.

Rav Huna said in the name of Rav Sheshes in the name of Rav Yirmiyah bar Abba in the name of Rav: The most ornate techeiles ought be one third windings and two thirds hanging threads. MENACHOS 39A

VARIOUS OPINIONS REGARDING THE KRICHOS FOR TZITZIS WITH TECHEILES

Disclaimer! Very few Poskim define their shittah in complete detail. Often they discuss one issue (for example, alternating the colors of the chulyos), but leave another (e.g. the type of knot) unexplained. In the following list of shittos, some details are the result of speculation in order to determine a complete practical method of tying.

The principles discussed above are applied differently by the Poskim. They correspond to the accompanying pictures. The following is an (incomplete) list:

RABBI MEIR USED TO SAY:

“What distinguished Techeiles from all other types of dyes? Because the techeiles is similar to the sea, and the sea is similar to the sky and the sky is similar to the throne of Glory.”

MENACHOS 43B



Rav Amram Gaon – seven or thirteen chulyos alternating white then techeiles. A knot at the beginning and at the end (according to the Baal Haitur, a knot after each chulya). (These knots are not double, but rather the winding string tucked under itself. According to the Shaalos U’tshuvos Binyamin Zeev, the knots are double knots.)



The Vilna Gaon – thirteen chulyos, alternating white and techeiles, distributed between five double knots. Between the first and second knot – four chulyos (white, techeiles, white, techeiles) and the same between the second-third, and third-fourth knots. Between the fourth and last knot – one chulya of white.



The Raavad according to Rav Natronai Gaon – five knots. Between each knot, seven to thirteen twists, with the twists alternating white then techeiles. Between the second and third knot, the amount of twists is not definite, but most probably still alternate between techeiles and white.



The Rambam – all twists are techeiles except the first and last. Seven or thirteen chulyos are tied with a knot between each that keeps them in place and separate from each other. The Yemenites have a tradition (even with white tzitzis) of tying each chulya into a special knot.



Tosfos – first a double knot, then one chulya of white and one of techeiles, then a second double knot, again white then techeiles and a knot, then again white and techeiles then a knot, and finishing with one white chulya and a double knot. This has seven chulyos and five knots.

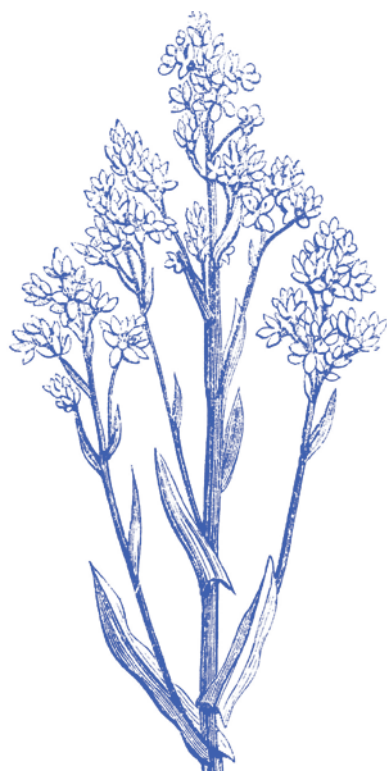


The Rambam according to the Ari z”l and the Radzyner – has all the twists techeiles except the first and last. There are five knots: between the first and second knot there are seven twists, between the second and third – eight twists, between the third and fourth – eleven twists,

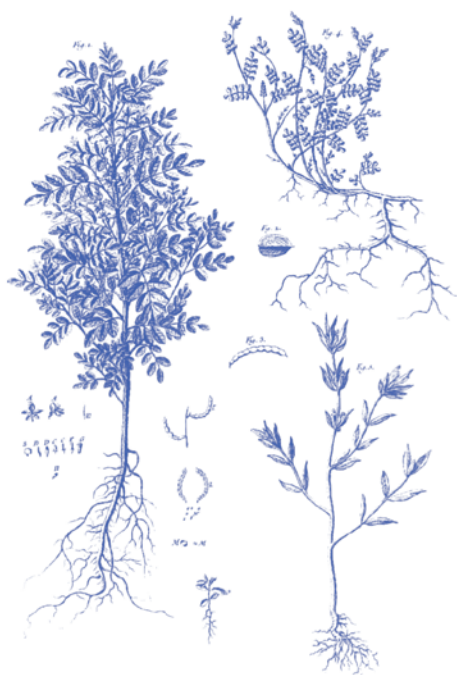


The Chinuch – thirteen chulyos, alternating white and techeiles distributed between five double knots. Between the first and second knot – three chulyos (white, techeiles, white). After the second knot another three chulyos, (techeiles, white, techeiles). After the third another three (white, techeiles, white), and after the fourth – four chulyos (techeiles, white, techeiles, white).

and between the fourth and last – thirteen twists (similar to the way we tie tzitzis without techeiles). Each group of three is separated by winding the techeiles around and inside to hold them together.



Isatis tinctoria— the woad plant



Indigofera tinctoria — the indigo plant

Kala Ilan

Rabbi Ari Zivotofsky

The Gemara in Menachos (41b) states:

ת"ר: טלית שכולה תכלת - כל מיני צבעונין פוטרין בה, חוץ מקלא אילן.

The Rabbis taught in a Baraisa: With respect to a garment that is made entirely of techeiles, threads of all colors satisfy the tzitzis obligation in it, with the exception of kala ilan.

Rashi explains the reason why the kala ilan dye is unacceptable:

דדמי לתכלת וזימנין דמזבן לה לאינש אחרינא וסבר דכל חוטיה תכלת וכי מצריך לטלית אחריתי שקיל תרי חוטים מהכא ונותן שם... ושדי קלא אילן עם לבן בציצית והוי כלאים בלא מצוה.

Since it is similar to techeiles and it may happen that the tallis is sold to another person who assumes all the strings are made of techeiles. And when he needs them for another tallis, he will take two strings from this [tallis] and put them on the other one... and he will have kala ilan with white on the tzitzis thus making kelaim without any mitzvah.

Kala ilan is a fraudulent dye which is visually indistinguishable from the more expensive techeiles. It is therefore imperative to ensure that one not substitute kala ilan for techeiles either maliciously or by accident. As the Gemara explains previously (Menachos 40a), the mitzvah of placing techeiles on one's tallis overrides the issur of shaatnez, and as such, one is obligated to put techeiles (which by definition is of wool, c.f. Yevamos 4b) on a tallis made of linen. This, of course, is true only when using authentic techeiles, but if the wool strings are dyed with the counterfeit kala ilan, the prohibition of shaatnez would remain intact, hence the injunction against any use of kala ilan was instituted in order to avoid any possible confusion.

(see for example)

(הלכות קטנות לרא"ש (מנחות) הלכות ציצית סימן א').

Although the white (i.e. non-techeiles) strings of the tzitzis can theoretically be made of any color, the injunction against using kala ilan (instead of white) is so severe that Rav Moshe Feinstein felt that even if one had true techeiles strings that were afterwards dipped in kala ilan (to increase their luster), they would still be prohibited.

(Igros Moshe, Yoreh Deah, vol. 2; 133) Since kala ilan was identical to the much more expensive techeiles, unscrupulous people might attempt to pawn off strings dyed with it in place of genuine techeiles. The Sifri (Bamidbar, 115) warns against this:

אני ה' אלהיכם אשר הוצאתי אתכם מארץ מצרים, וכי מה ענין יציאת מצרים לכאן אלא שלא יאמר הרי אני נותן צבעונים וקלא אילן והם דומים לתכלת ומי מודיע עלי בגלוי אני ה' אלהיכם דעו מה עשיתי להם למצריים שהיו מעשיהם בסתר ופרסמתים בגלוי.

"I am Hashem your God who took you out of the land of Egypt." What does leaving Egypt have to do with this [parasha of tzitzis]? Rather one should not say, "Behold I put other dyes and kala ilan which are identical to techeiles and who can make this information public?" "I am Hashem your God." Know what I did to the Egyptians whose misdeeds were done in private and I advertised them in public.

This idea is brought down in a number of additional places including Bava Metziah (61b), Rashi on the posuk in Shema (Bamidbar 15;41), and Sheiltos D'rav Achai Gaon (Vaera 43). These sources show that the similarity between kala ilan and techeiles

was absolute, in that only Hashem can distinguish between them. Nevertheless, this assertion is challenged by the Gemara in Menachos (42b):

ת"ר: תכלת אין לה בדיקה, ואין נקחית אלא מן המומחה... ותכלת אין לה בדיקה? והא רב יצחק בריה דרב יהודה בדיק ליה, (ס' בגשם) מיייתי מגביא גילא ומיא דשבילתא ומימי רגלים בן ארבעים יום, ותרי לה בגוייהו מאורתא ועד לצפרא, איפרד חזותיה - פסולה, לא איפרד חזותיה - כשרה.

The Rabbis taught in a Braisa: Techeiles has no means of examination, and therefore it may be bought only from an expert... Does techeiles actually have no means of examination? But Rav Yitzchak the son of Rav Yehudah would test [techeiles] for authenticity. (BeGeSheM is a mnemonic for the items that he used in his test.) He would bring alum, sap of fenugreek, and urine that is forty days old, and he would soak [the techeiles] in them from evening until morning. If its color faded, [the thread] was deemed unfit, for fading indicates that it is kala ilan, and if its color did not fade, it was deemed fit, for this indicates that it was genuine.

The Rambam (Hilchos Tzitzis, 2;5) agrees that although the two are visually identical, chemical tests can distinguish between kala ilan and techeiles. It is generally agreed that the tests recounted here are difficult to understand and are therefore inconclusive (ש"ת שאילת) (יעבץ חלק א סימן נו).



Isatis tinctoria – the woad plant



Indigofera tinctoria – the indigo plant

KALA ILAN AND ISATIS

The Aruch defines kala ilan as indigo (פירוש אינדק"ו) and the Mosif adds "Binyamin said: That is its Greek name, it is a type of dye that is similar to techeiles." The Nemukay Yosef (לד, ע"א בדפי הר"ף) also identifies kala ilan with indigo and the color blue. The Teshuvos Hageonim (גאוניקה לגיטבורג, כרך ב' עמ' 33) notes that in Arabic it is called nil (which is indigo).

Another dye mentioned by Chazal as similar to techeiles, and identified with the Arabic nil is isatis (איסטיס) (Kaftor Vaferach, ch. 48, Radvaz in Teshuvah 685, Rav Bartenura on the Mishnah in Kela'im 2; 5, Pachad Yitzchak, vol. 4, p. 78 – see Rav Shlomo Teitelbaum in Lulaot Hatecheiles, pp. 235-240).

Although both isatis and kala ilan denote indigo and are both similar to techeiles, the terms are not used interchangeably. The Rambam (Hilchos Tzitzis, 2; 1) does seem to use isatis in place of kala ilan. Most probably the two were associated with different plants which both produced the same dye (indigo). Isatis referred to the woad plant (Isatis tinctoria) which is indigenous to the temperate regions of northern Europe, while kala ilan corresponded to Indigofera tinctoria which was cultivated in warmer climates (specifically China and India) and yields much higher concentrations of indigo.

KALA ILAN AND ARCHEOLOGY

In 1961, Yigal Yadin excavated a cave near Ein Gedi which had served as Bar Kochba's command center. Yadin found an archive of letters, documents, and other artifacts that shed light on the life of the leaders and participants of the Great Rebellion against Rome. One of the finds was "a bundle of wool... wrapped in a piece of woolen mantle with colored bands and a linen cloth." The chemical analysis of the wool showed it to be dyed with a mixture of indigo and kermes (which is the Biblical tolaat shani). Yadin came to the conclusion that "this wool was intended for the petil techeiles of the ritual tassels (tzitzis)." Since the wool was dyed with plant indigo and not dye derived from a chilazon, Yadin came to the conclusion that this was in fact kala ilan, and not real techeiles.

Subsequent investigation and deliberation regarding Yadin's find have raised serious doubts as to whether the bundle of wool was intended for use as tzitzis. Professor Feliks also wondered why the fraudulent dye – ostensibly used in place of the more expensive genuine color – would incorporate tolaat shani, which was at least as costly as techeiles! Yadin also "proved" that the wool was used for tzitzis from the fact that it was tied with a linen cord, and that this was done deliberately since tzitzis must be shaatnez. This, of course, does not correspond to the Halacha as we know it. Taking all this into consideration, the question of Yadin's find and its link to kala ilan and techeiles is quite tenuous. (See Rav Menachem Borstein's discussion in Hatecheiles, Sifraiti, 1988, pp. 73-74 and the picture of the wool found in the Cave of Letters on page 48, no. 8.)



Recently unearthed at the archaeological dig on Mount Zion in Jerusalem, this specimen dates from the first century C.E. – the years before the churban Bayis Sheni (destruction of the Second Temple). The area has been identified as the houses where the Kohanim lived. A few tens of Murex trunculus shells were found.

ORIGIN OF THE TERM KALA ILAN

Rav Herzog (*Biblical Blue*, page 94) suggested a number of possibilities explaining the origins of the term kala ilan. Kala in Sanskrit means black or deep blue and nilam is indigo (similar to the Arabic nil). Kala ilan may mean the kala derived from trees (ilan in Hebrew) or perhaps it is a corruption of kala-nil(am). Rav Herzog also posits that the Chinese lan (= indigo) might be involved. This may be lent additional support by the fact that in ancient Chinese, the term for indigo was actually k'lan which is very similar to kala ilan (*Indigo Textiles*, Gösta Sandberg, Black, 1989).

The Chinese character for indigo (lan) is made up of three elements – an eye, a person, and a vessel with water. Taken together, this represents a reflection in the water (perhaps of the sky).



The inconclusive nature of this find notwithstanding, people continue to refer to Yadin's find as categorical evidence of the discovery of ancient tzitzis with techeiles. One modern source (Moznaim edition English translation of the Rambam, Hilchos Tzitzis, page 199 footnote) goes so far as to claim that Yadin found techeiles strings according to the shitta of the Rambam! Needless to say, this assertion is unsubstantiated.

KALA ILAN AS A BASIS FOR IDENTIFYING TRUE TECHEILES

Kala ilan and techeiles are impossible to tell apart (at least with the naked eye), and so one should be able to make use of this property when attempting to identify true techeiles. If one finds a candidate for the techeiles – producing chilazon, the most important test would be to see if the color of the dye is the same as that of indigo. In fact, the argument can be taken one step further, namely, that if one finds any marine organism that yields a dye which is permanent and the color of indigo, then that dye must be kosher for techeiles. This is the opinion of both of the greatest authorities on techeiles – Rav Gershon Henoch Leiner of Radzyn and Rav Yitzchok Isaac Halevi Herzog. The Radzyner writes:

אם אחר החיפוש נשיג ידינו למצוא דם איזה מין חלזון שיהיה שנוכל לצבוע בו צבע התכלת צבע עומדת ביפיה ולא תשתנה, ודאי יכול לקיים מצות תכלת בלא שום ספק. (שפוני טמוני חול, עמ' י"ד)

If, after searching we would be able to find the blood of any kind of Chilazon that would enable us to properly dye the color of techeiles which would retain its original beauty and would not fade, then certainly we would be able to fulfill the mitzvah of techeiles without any doubt. (SEFUNEI TEMUNEI CHOL, PAGE 14, 1999 EDITION)

Both Rav Herzog (*The Royal Purple and Biblical Blue*, Keter, 1987, page 73) and the Radzyner offer the same line of proof for this assertion. If there is another chilazon whose dye satisfies these criteria, but is not kosher for techeiles, then why would Chazal not warn us regarding its use? The only caution recorded in the Gemara is with regard to kala ilan – indigo derived from a plant source – but there is no admonition against using another sea animal that is not the chilazon shel techeiles. Therefore, either that species' dye is also kosher for techeiles, or there is only one species in the world (or in the Mediterranean) that satisfies both those criteria. In either case, any sea creature which produces a permanent dye the color of indigo must necessarily be kosher for use as techeiles.



Dyeing Techeiles

Dr. Baruch Stermann

The Gemara in Menachos (42b) relates:

אמר ליה אבוי לרב שמואל בר רב יהודה: הא תכילתא היכי צבעיתו לה? אמר ליה: מייטנין דם חלזון וסמינין ורמינין להו ביורה [ומרתחינין ליה], ושקלינא פורתא בביעתא וטעמינין להו באודרא, ושדינין ליה להווא ביעתא וקלינין ליה לאודרא.

Abaye said to Rav Shmuel bar Rav Yehudah: This thread of techeiles, how do you dye it? [Rav Shmuel bar Rav Yehudah] replied: We bring the blood of the sea creature chilazon and certain herbs, and we put them in a pot and boil it up. Then, we take a little bit of the dye in an eggshell and test it with a wad of wool. Then we spill out the dye left in that eggshell and we burn the wad of wool that was dyed for the purpose of testing.



The chilazon after being broken open (petziah), showing the gland where the precursor to the dye is stored.

The dye process recounted here is similar to that brought down by the ancient Greek and Roman scholars. Aristotle (d. 322 BCE) and Pliny the Elder (d. 79 CE) describe the procedure used in dyeing with the porphyra. Pliny elaborates on the method:

The vein of [the snail] is removed and to this salt has to be added... and it should be heated in a leaden pot, and with 50 lbs of dye to every six gallons of water kept at a uniform and moderate temperature by a pipe brought from a furnace some way off.

This will cause it gradually to deposit the portions of flesh which are bound to have adhered to the veins, and after about nine days the cauldron is strained and wool that has been washed clean is dipped for a trial. (Natural History, Book IX. LXII. 133)

This procedure has been reenacted by researchers in Israel and England who have been able to produce beautiful blue dyed wool. With the advances in our understanding of dye chemistry, however, much more efficient methods can be used which yield results in a consistent and reliable manner.

Techeiles belongs to a group of colorants known as vat dyes. These must undergo specific chemical processing before they can be bound to fabric. One of the main characteristics of techeiles is its fastness – it does not fade with time or wash out of the wool. The Gemara (Menachos 43a) explains that even after chemical testing חזוניה לא איפרד – its color does not fade, or as the Rambam puts it (Hilchos Tzitzis 2;1), שעומדת ביפיה – it remains beautiful and does not change.

This trait of steadfast stability in a dye translates chemically into the fact that the dye pigment does not readily bind to water or soap or other substances that could serve to remove it from the fabric. However, if a dye is hard to get out of the wool, it is equally hard to get it into the wool, i.e. to dye the wool in the first place! Overcoming this obstacle is the major difficulty facing the vat dyes.

In order to dissolve the techeiles molecule in water and introduce it into the wool, it must undergo the chemical process known as reduction. In ancient times this was accomplished through fermentation, where the meat and dye-containing parts of the snail were heated on a low flame for a few days (as described by the Gemara and by the classical scholars). Bacteria that live on the snail meat ferment the dye and reduce it. In modern times, that

same result can be accomplished much more quickly by adding a strong reducing agent (such as sodium dithionite). In this reduced state, two important things can happen. Firstly, the dye molecule dissolves in water, allowing wool to absorb the solution and take up the dye. Secondly, the chemical bonds are weakened so that exposure to sunlight removes the purple tint from the dye molecule (present when taken from the snail), and leaving it the beautiful sky-blue that is techeiles.

When the dye is in the vat (יורה) in the reduced state, it does not have the same color that it will ultimately have in the wool. Rather the solution has a yellow-green hue, as can be seen in the accompanying picture. This may help us understand the second part of Rav Shmuel bar Yehudah's statement (echoed by Pliny) regarding the need to "test" the dye by pouring out some dye into an egg shell and dipping wool into it. Why not just look at the dye solution and see if it is the right color? Since the dye in its reduced state gives no indication of the color that the dyed wool will have, the only way to accurately determine this is to dye some wool which brings it out of reduction by exposing it to the oxygen in the air. In the picture one

can see the lustrous blue techeiles of the wool in its final state, and the yellow-green of the dye solution.

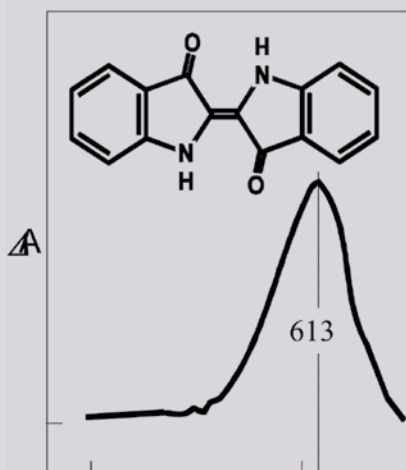
The chilazon stores the techeiles inside a gland. (These dye compounds are actually formed as the snail digests its food.) In order to become the dye, two additional things are necessary; an enzyme called purpurase which is also present in the snail, and air. The enzyme decomposes quickly after the snail dies, so the dye must be extracted and exposed to air while the snail is alive or shortly after its death. This accords well with the sugya in Shabbos (75a) which discusses whether breaking open a chilazon and extracting its dye should make one liable for the transgression of taking a life on Shabbos,



since killing the snail is actually detrimental to the dyeing process.

דכמה דאית ביה נשמה - טפי ניחא ליה, כי היכי דליציל ציבעיה.

The more life it has, the more it pleases, so that the dye will be clear.



The posuk in krias shema says that by looking at the tzitzis one will remember all of Hashem's mitzvot. Rashi explains that the word tzitzis is numerically equal to 600. Add to that the 8 strings and 5 knots, and you have 613, the number of mitzvot in the Torah. The Ramban and others disagree with Rashi and claim that it is the string of techeiles itself that serves as the reminder. The sky-blue thread evokes contemplation of the heavens and of God's throne, which leads one to remember the mitzvot.

Interestingly, work by Dutch scientists* regarding the properties of the techeiles dye molecule revealed a striking coincidence. The color of a substance is determined by way it reflects and absorbs light. No two molecules have the same pattern (called a wavelength absorption spectrum) which is measured in units called nanometers. Techeiles obtained from the *Murex trunculus* snail derives its color from a sharp peak in its spectrum at exactly 613 nanometers.

*J. Wouters and A. Verhecken, *JSDC* Volume 107, July/August, 1991.



The Coins of Techeiles

Dr. Ari Greenspan

The beautiful coin of Tyre (above) shows the eagle representing the Roman government, and between its legs is the valuable Murex shell.

During the 3rd century the Roman government severely restricted the wearing of techeiles and argaman, and use of these colors was limited to the ruling class. At some point, this most expensive of dyes became worth a fortune, as the Gemara states, “therefore [Techeiles] is expensive” (Menachos, 44a).

Most techeiles and argaman came from the coast of northern Israel and Lebanon, and we are told in the Gemara that the snails are found from “Haifa to the ladders of Tyre” (Shabbos 26a).

Tyre was also renowned for being the most important Roman coin mint east of Rome. So unadulterated was the silver of Tyre, and of such high quality were its coins, that Chazal tell us that for any mitzvos asheh that requires money, the coin to use is the “Tyrian Shekel” (Kiddushin, 11a). The Tyrian Shekel was widely used throughout the entire Roman Empire; it was the dollar of its day.

It is no wonder that for a period of 70 years or so, these coins were used to publicize the most important commodity and industry of the city – the famous dyes of techeiles and argaman.

Numerous coins with a predominantly depicted Murex shell, the ancient source of the dyes, have been discovered.

Perhaps the most interesting intersection of these elements is the following elusive story (Sanhedrin, 12b):

והא שלחו ליה לרבא: זוג בא מרקת, ותפשו נשר, ובידם דברים הנעשה בלז, ומאי ניהו - תכלת, בזכות הרחמים ובזכותם יצאו בשלום.

“It was sent to Ravah: a pair came from Reket, the eagle caught them, and in their hands they had things made in Luz. What were they? Techeiles, by the mercy of heaven and their merits they escaped in peace.”

Two people came to Ravah who was in Bavel. They had items made in Luz, a city known for its techeiles manufacture (Sota, 46b). Reket is the city of Teveria, the seat of the Sanhedrin in those days. Some suggest that these two individuals were shluchei sanhedrin trying to smuggle techeiles into Bavel for mitzvas tzitzis. The eagle is the symbol of Rome, and as Rashi says, Roman soldiers caught them. A great miracle happened and they were released and made their way successfully to Bavel.



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