

## Smut fungi of Israel: a preliminary check-list

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**Abstract.** The information on 59 species of smut fungi known in Israel is given. The genera represented in the country are *Antherospora* (1 sp.), *Entyloma* (19 spp.), *Jamesdicksonia* (1 sp.), *Melanotaenium* (1 sp.), *Microbotryum* (3 spp.), *Sporisorium* (14 spp.), *Tilletia* (3 spp.), *Urocystis* (4 spp.), *Ustilago* (12 spp.), and *Vankyia* (1 sp.).

**Key words:** check-list, Israel, smut fungi

### Introduction

The first data on smut fungi recorded in Israel was given by Magnus (1900). In the check-list combined by the author four species of *Ustilago* and one species of *Sorosporium* for Palestine were mentioned. Further data was published in papers by Israeli mycologist and phytopathologist I. Reichert who focused attention on smut fungi on different cereals (Reichert 1921, 1928, 1930, 1931, 1939; Reichert *et al.* 1944). In particular, he carried out numerous phytopathological studies on *Tilletia caries*. In the middle of 1930's, two species of smut fungi new for Palestine were mentioned by Sydow (1935). At the same time, Săvulescu & Rayss (1935) reported 18 species, including new taxa *Entyloma asterisci* and *E. cynoglossi*. In addition, the latest authors provided a partial analysis of the Israeli mycoflora.

The first mycological paper dealing exclusively with smut fungi appeared in Israel only in 1944 (Rayss & Zwirn 1944). It contained information on eight new species for the country that belonged to the genera *Entyloma*, *Tuburcinia*, and *Ustilago*. Rayss (1952) provided more information on these fungi in the paper "Etude des quelques Ustilaginées récoltées en Palestine". The author mentioned 26 new Palestine species,

including first described *Entyloma ambrosiae-maritimae* and *E. parietariae*. The distribution of smut fungi parasitizing different grasses also has been investigated by scientists of some plant pathological institutions of the country (Minz 1943, 1944, 1945; Minz & Bental 1952; Minz & Solel 1959, 1962; Minz & Palti 1960; Nevo 1963; Kenneth *et al.* 1964).

The most comprehensive paper regarding smut fungi of Israel is a check-list by Palti *et al.* (1966), where 54 species belonging to the genera *Entyloma*, *Melanotaenium*, *Sorosporium*, *Sphacelotheca*, *Tilletia*, *Tolyposporium*, *Urocystis*, and *Ustilago* were listed. However, it should be noted that part of the information known at that moment was missed by the authors. In addition, some later new records of smut fungi of Israel were published (Kenneth *et al.* 1975; Vánky 1983, 1994; Mouchacha 1999), including descriptions of new species. Thus, also taking into account that cardinal changes in the systematics of smut fungi and their hosts have occurred during last years, the revision of all data regarding these fungi is necessary.

Our check-list is based mainly on the literature data with a glance to all last achievements in the smut fungi taxonomy. Two specimens collected in Israel by Prof. Vasyl Heluta and Dr. Svitlana Voytyuk were also identified and included.

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## List of species

Class *Ustilaginomycetes*

Order *Urocystidales*

Family *Floromycetaceae*

Genus *Antherospora* R. Bauer *et al.*

1. *A. urgineae* (Maire) R. Bauer *et al.* (recorded as *Ustilago urgineae* Maire)  
On *Urginea maritima* L.: Jerusalem, leg. E. Rabinovits (Sävulescu & Rayss 1935).

Family *Urocystidaceae*

Genus *Urocystis* Rabenh. ex Fuckel

1. *U. antipolitana* Magnus (recorded as *Tuburcinia antipolitana* (Magnus) Liro)  
On *Anemone coronaria* L.: Abu Ghosh, 12 Apr 1935 (Sävulescu & Rayss 1935).
2. *U. gladiolicola* Ainsw.  
On *Gladiolus* sp.: Israel (Palti *et al.* 1966).
3. *U. tritici* Körn. (recorded as *Tuburcinia tritici* (Körn.) Liro)  
On *Triticum aestivum* L. (as *T. vulgare* Vill.): Qiryat 'Anavim, 6 May 1938 (Rayss & Zwirn 1944).  
On *T. durum* Desf.: Deires-Sheikh, 12 Mar 1941 (Rayss & Zwirn 1944); Hartuv, 12 Mar 1941 (Minz 1944).
4. *Urocystis* sp. (recorded as *U. anemones* (Pers.) G. Winter)  
On *Ranunculus asiaticus* L.: Alonim, 14 Mar 1940, leg. T. Kushnir (Rayss & Zwirn 1944); Carmel, 22 Jan 1938 (Palti *et al.* 1966).

Note. Because the smut on *R. asiaticus* is not *U. anemones*, we hope to find this fungus in Israel and then ascertain its species position.

Genus *Vankyia* Ershad

1. *V. ornithogali* (J.C. Schmidt & Kunze) Ershad (recorded as *Ustilago ornithogali* (J.C. Schmidt & Kunze) J.G. Kühn)  
On *Gagea reticularis* Salisb. (as *G. commutata* K. Koch): Jerusalem, 10 Mar 1953, leg. Sh. Nahmony (Rayss 1959).  
On *Gagea* sp.: Jerusalem, 26 Mar 1935 (Sävulescu & Rayss 1935).

Order *Ustilaginales*

Family *Melanotaeniaceae*

Genus *Melanotaenium* de Bary

1. *M. cingens* Bref. (recorded as *M. hypogaeum* (Tul. & C. Tul.) Schellenb.)  
On *Linaria* sp.: 'En Harod, 27 Mar 1924 (Palti *et al.* 1966).  
Note. *Melanotaenium hypogaeum* parasitizes different *Kicxia* species and grows on the basal parts of stems. In the description of this specimen, Palti *et al.* (1966) mentioned that the fungus developed sori on the leaves. Thus, we have to refer this record to other smut, namely *M. cingens*.

Family *Ustilaginaceae*

Genus *Sporisorium* Ehrenb. ex Link

1. *S. aristidae-lanuginosae* (Maire) Vánky (recorded as *Sphacelotheca aristidae-lanuginosae* Maire)  
On *Aristida plumosa* L. (as *A. lanata* Forssk.): Negev, 15 May 1951, leg. J. De-Angelis (Rayss 1952).
2. *S. consanguineum* (Ellis & Everh.) Vánky (recorded as *Sorosporium consanguineum* Ellis & Everh.)  
On *Aristida caerulescens* Desf.: Kefar Gil'adi, 2 Jul 1923 (Palti *et al.* 1966).
3. *S. cruentum* (J.G. Kühn) Vánky (recorded as *Sphacelotheca cruenta* (J.G. Kühn) Potter)  
On *Sorghum halepense* Pers. (incl. *S. annuum* Trab.): Tel-el-Kadi, 5 May 1942, leg. A. Zlotnik (Rayss 1952); Nahaira, 4 Jul 1937 (Rayss 1952); Carmel, 1 Sep 1936 (Rayss 1952); Neve Yaar, 27 Aug 1955, leg. I. Palti (Rayss 1959); Ayyelet HaShahar, 10 Nov 1926 (Palti *et al.* 1966).
4. *S. ehrenbergii* (Kühner) Vánky (recorded as *Tolyposporium ehrenbergii* (J.G. Kühn) Pat.)  
On *Sorghum vulgare* Pers.: Coastal Plain, Sep 1955 (Minz & Palti 1960); Huleh Valley, Jul–Sep 1955–1959 (Minz & Palti 1960); Jordan Valley, Sep 1955 (Minz & Palti 1960).
5. *S. erianthi* (Syd. & P. Syd.) Vánky (recorded as *Ustilago erianthi* Syd. & P. Syd.)  
On *Erianthus ravennae* P. Beauv.: Sodom, 15 Jun 1939 (Rayss 1952).
6. *S. formosanum* (Sawada) Vánky (recorded as *Sorosporium punctatum* Malençon & Yen)  
On *Panicum numidianum* Lam.: Israel (Palti *et al.* 1966).  
On *P. repens* L.: Yarkon banks, 12 May 1935 (Rayss 1952); Wadi Falik, 4 Sep 1951 (Rayss 1952).
7. *S. penniseti* (Rabenh.) Ershad  
On *Pennisetum asperifolium* Kunth: Wadi Ya'sur (Carmel), 27 May 1926 (Palti *et al.* 1966, as *Sphacelotheca penniseti* (Rabenh.) Reichert)  
On *P. orientale* Rich.: Mount Carmel, Nahal Oren, 22 Mar 2004, leg. V. Heluta & S. Voytyuk.
8. *S. pollinae* (Magnus) Vánky  
On *Pollinia distachya* Spreng. (as *Andropogon dystachyos* L.): Judaea, Jaffa, Bab-el-Wah, 15 May 1897, leg. J. Bornmüller (Vánky 1994).  
Note. Cited specimen was revised by Vánky (1994) and it is a type of *S. pollinae*.
9. *S. reilianum* (J.G. Kühn) Langdon & Full.  
On *Sorghum vulgare* Pers.: Israel (Minz 1945, as *S. reiliana* (J.G. Kühn) G.P. Clinton).  
On *S. halepense* Pers.: Israel (Kenneth *et al.* 1975, as *Sorosporium simii* Pole-Evans).
10. *S. schweinfurthianum* (Thüm.) Vánky  
On *Imperata cylindrica* (L.) P. Beauv.: Yafo, 12 May 1887 (Sävulescu & Rayss 1935, as *Sphacelotheca schweinfurthiana* (Thüm.) Sacc.); Israel (Palestine) (Magnus 1900, as *Ustilago schweinfurthiana* Thüm.).

11. *S. sorghi* Ehrenb. ex Link (recorded as *Sphacelotheca sorghi* (Ehrenb. ex Link) G.P. Clinton)  
On *Sorghum vulgare* Pers. (incl. *S. bicolor* (L.) Moench, *S. cernuum* Willd.): Jerusalem, 6 Jul 1945, leg. Z. Bumstein (Rayss 1952); Tulkarem, 15 Jul 1934 (Rayss 1952); Israel (Sävulescu & Rayss 1935; Reichert 1939).
12. *S. tricholaenae* (Henn.) Vánky  
On *Tricholaena teneriffae* (L.f.) Link: Wadi el Kelt near Jericho, 14 Apr 1909, leg. F. Nábelek (Vánky 1994); Israel (Palestine) (Sydow 1935, as *Ustilago tricholaenae* Henn.).
13. *S. vanderystii* (Henn.) Langdon & Full. (recorded as *Sphacelotheca andropogonis* (Opiz) Bubák)  
On *Hyparrhenia hirta* (L.) Stapf (as *Andropogon hirtus* L.): Bab-el-Wad, 31 Jan 1936 (Rayss 1952); Benei-Berak, 9 Mar 1938 (Rayss 1952); Kefar Vitkin, 7 May 1939 (Rayss 1952).  
Note. Mentioned *Sphacelotheca andropogonis* (current name is *Sporisorium andropogonis*) does not grow on the inflorescences of *Hyparrhenia* species (Vánky 2006), but this part of these hosts can be infected by *Sporisorium vanderystii*. Both species are very morphologically similar. However, they considerably differ from each other by the character of spore germination (Vánky 1994). Thus, we provisory refer Israel specimens to *S. vanderystii*.
14. *Sporisorium* sp. (recorded as *Sphacelotheca andropogonis* (Opiz) Bubák and *Sorosporium reilianum* (J.G. Kühn) McAlpine)  
On *Pollinia distachya* Spreng. (as *Andropogon dystachyos* L.): Judea, 20 Aug 1938, leg. J. Jacobovitsch (Rayss 1952); Zikhron Ya'aqov, 6 Oct 1935 (Sävulescu & Rayss 1935); Israel (Palestine) (Magnus 1900).  
Note. Two smut species, *S. distachyum* Vánky and *S. pollinae*, can parasitize *P. distachya*. To ascertain species position of these fungi, we will try to find old collections and collect new specimens of these smuts.
- Genus *Ustilago* (Pers.) Roussel
- U. aschersoniana* A.A. Fisch. Waldh.  
On *Cutandia memphitica* (Spreng.) Benth.: Revivim, 6 May 1950 (Rayss 1952).
  - U. avenae* (Pers.) Rostr. (recorded as *U. nigra* Tapke and *U. perennans* Rostr.)  
On *Arrhenatherum avenaceum* P. Beauv. (as *A. palaestinum* Boiss.): Israel (Palestine) (Magnus 1900).  
On *Avena barbata* Brot.: Jerusalem, 7 May 1935, 6 Oct 1935, 25 May 1943 (Sävulescu & Rayss 1935); Moza, 13 Apr 1935 (Sävulescu & Rayss 1935).  
On *A. sativa* L.: Israel (Palestine) (Magnus 1900); Nahlat-Itzhak, 4 Mar 1933, leg. N. Naftolsky (Rayss 1959); Israel (Reichert 1939).  
On *A. sterilis* L.: Haifa-Carmel, 9 May 1949 (Rayss 1952); Kabbara, 21 Mar 1951 (Rayss 1952); Safad, 30 Mar 1951 (Rayss 1952).  
On *Hordeum vulgare* L.: Israel (Minz 1944).
  - U. bromivora* (Tul. & C. Tul.) A.A. Fisch. Waldh.  
On *Bromus macrostachys* Desf.: Afula, 27 Apr 1930, leg. N. Naftolsky (Rayss 1959, as *U. bromivora* f. sp. *bromi-macrostachyi* Kze).  
On *B. madritensis* L.: Wadi Qarn, 4 Apr 1942, leg. M. Gurewitsch (Rayss 1952).  
On *B. scoparius* L.: Afula, 7 Jul 1932 (Palti *et al.* 1966).
  - U. bullata* Berk. (recorded as *U. brachypodii-distachyi* Maire)  
On *Brachypodium distachyum* P. Beauv.: Beersheba, 30 May 1942, leg. M. Zohary (Rayss 1952).
  - U. cynodontis* (Pass.) Henn.  
On *Cynodon dactylon* (L.) Pers.: Moza, 12 Apr 1935 (Sävulescu & Rayss 1935); Miqwe Yisra'el, 12 Sep 1934 (Sävulescu & Rayss 1935); Nablus, 2 Apr 1935 (Sävulescu & Rayss 1935); 'En Harod, 25 Oct 1930 (Sävulescu & Rayss 1935).
  - U. hordei* (Pers.) Lagerh. (recorded as *U. levis* (Kellerm & Swingle) Magnus and *U. kollerii* Wille)  
On *Avena fatua* L. (= *A. byzantina* K. Koch): Israel (Sävulescu & Rayss 1935).  
On *A. sativa* L.: Nahlat-Itzhak, 4 Mar 1933, leg. N. Naftolsky (Rayss 1959); Israel (Reichert 1939).  
On *Hordeum vulgare* L.: Israel, from late February to early July (Reichert 1928).
  - U. maydis* (DC.) Corda  
On *Zea mays* L.: Kiryat-Bialik, 27 Aug 1940, leg. M. Seckbach; Ashdod-Ya'acov, 1 Oct 1943, leg. M. Volman (Rayss 1952); Dan, 15 Aug 1946 (Rayss 1952); Israel (Reichert 1939, Kenneth *et al.* 1975).
  - U. nuda* (C.N. Jensen) Rostr.  
On *Hordeum hexastichon* L.: Metulla, 24 Apr 1935 (Sävulescu & Rayss 1935); Judean Desert, 9 Apr 1935 (Sävulescu & Rayss 1935).  
On *H. vulgare* L. (incl. *H. sativum* Pers.): Nahlat-Itzhak, 25 Feb 1933, leg. N. Naftolsky (Rayss 1959); Israel, from late February to June (Reichert 1939).  
On *Hordeum* sp.: Tabah, 8 Apr 2005, leg. V. Heluta & S. Voytyuk.
  - U. striiformis* (Westend.) Niessl (recorded as *U. brizae* (Ule) Liro)  
On *Briza maxima* L.: Jerusalem, 28 Apr 1945, leg. D.V. Zaitschek (Rayss 1952).
  - U. trichophora* (Link) Kunze  
On *Echinochloa colonum* (L.) Link: Gheva, 13 Sep 1945, leg. D. Rijik (Rayss 1952); En Harod, 12 Mar 1932 (Palti *et al.* 1966).
  - U. tritici* (Pers.) C.N. Jensen, Kellerm. & Swingle  
On *Triticum aestivum* L. (as *T. vulgare* Vill.): Israel (Reichert 1939).  
On *T. durum* Desf.: Israel (Reichert 1939).

12. *Ustilago* sp.

On *Hordeum spontaneum* K. Koch: Kinneret, 14 Apr 1932 (Palti *et al.* 1966).

Note. Three *Ustilago* species, viz *U. avenae*, *U. hordei* and *U. nuda*, can parasitize barley in Israel. It is necessary to carry out microscopic examination to identify this record.

Class *Exobasidiomycetes*

Order *Georgefischeriales*

Family *Georgefischeriaceae*

Genus *Jamesdicksonia* Thirum., Pavgi & Payak

1. *J. dactylidis* (Pass.) R. Bauer *et al.*

On *Hordeum distichon* L.: Mishram Haemeq, 7 May 1957 (Kenneth *et al.* 1964, as *Entyloma korchinskii* Lavrov).

On *H. spontaneum* K. Koch: Newe Eitan, 6 May 1957 (Kenneth *et al.* 1964, as *E. korchinskii*); Israel (Palestine) (Sydow 1935, as *E. crastophyllum* Sacc.).

On *H. vulgare* L.: Newe Eitan, 6 May 1957 (Kenneth *et al.* 1964, as *E. korchinskii*).

Order *Tilletiales*

Family *Tilletiaceae*

Genus *Tilletia* Tul. & C. Tul.

1. *T. bromi* (Brockm.) Brockm. (recorded as *T. narduri* Unamuno)

On *Festuca aleppica* Hochst. ex Steud. (as *Nardurus orientalis* Boiss.): Jerusalem, 26 Apr 1935 (Sävulescu & Rayss 1935).

2. *T. caries* (DC.) Tul. & C. Tul. (recorded as *T. tritici* (Bjerk.) G. Winter)

On *Triticum aestivum* L. (as *T. vulgare* Vill.): Israel, inoculation (Reichert 1928).

On *T. dicoccoides* (Körn. ex Asch. et Graebn.) Aarons.: Israel, inoculation (Reichert 1928).

On *T. durum* Desf.: Dahriya; Safad (soc. *T. laevis* J.G. Kühn) (Rayss 1952); Es-Salt (soc. *T. laevis*) (Rayss 1952); El Bireh; Ramallah (soc. *T. laevis*) (Rayss 1952); Jerusalem (Rayss 1952); Israel (Reichert 1928).

On *T. polonicum* L.: Israel, inoculation (Reichert 1928).

On *T. ventricosum* Ces., Pass. & Gibelli (as *Aegilops ventricosa* Tausch): Israel, inoculation (Reichert 1931).

3. *T. laevis* J.G. Kühn.

On *Triticum aestivum* L. (as *T. vulgare* Vill.): Ghiv'at Brenner, 29 Jun 1932 (Rayss, 1952); Haifa, 15 Jan 1949, leg. J. Alson (Rayss 1952).

On *T. durum* Desf.: Dahriya, El Bireh, Es-Salt, Ramallah, Safad (soc. *T. caries* (DC.) Tul. & C. Tul.) (Rayss 1952); Ain-Yabroud, Jerusalem, Naouria, Naourum, Sarona (Rayss 1952).

Order *Entylomatales*

Family *Entylomataceae*

Genus *Entyloma* de Bary

1. *E. ambrosiae-maritimae* Rayss

On *Ambrosia maritima* L.: on the shore of Yarkon river, Tel-Aviv, 4 Sep 1951 (Rayss 1952; Mouchacca 1999).

2. *E. asterisci* Savul. & Rayss

On *Asteriscus pigmaeus* Coss. & Dur.: Judean desert, 28 Feb 1935 (Sävulescu & Rayss 1935).

3. *E. bupleuri* Lindr.

On *Bupleurum lancifolium* Hornem. subsp. *subovatum* (Link ex Spreng.) O. Boldòs & Vigo (as *B. subovatum* Link ex Spreng.): Mikhev Israel, 6 Apr 1942 (Rayss 1952).

4. *E. calendulae* (Oudem.) de Bary

On *Calendula aegyptiaca* Desf.: Hedera, 10 Mar 1942 (Rayss 1952).

On *C. persica* C.A. Mey: Judean desert, 28 Feb 1935 (Sävulescu & Rayss 1935).

On *Calendula* sp.: Qiryat 'Anavim, 10 Jan 1935 (Sävulescu & Rayss 1935); Qv. Shiller (Gan Shelomo), 19 Feb 1947 (Palti *et al.* 1966).

5. *E. catananchis* Cif. ex Vánky

On *Catananche lutea* L.: Jerusalem, 18 Apr 1942, leg. H. Habelska (Rayss & Zwirn 1944).

6. *E. cynoglossi* Savul. & Rayss

On *Cynoglossum creticum* Mill.: Qiryat 'Anavim, 4 Mar 1931 (Sävulescu & Rayss 1935).

7. *E. dahliae* Syd. & P. Syd.

On *Dahlia variabilis* Desf.: Ramat Gan, 12 Dec 1944 (Rayss & Zwirn 1944).

8. *E. fumariae* J. Schröt.

On *Fumaria judaica* Boiss.: Gesher Haziv, 23 Mar 1955 (Rayss 1959).

9. *E. fuscum* J. Schröt.

On *Glaucium grandiflorum* Boiss. & A. Huet: Jerusalem, 24 Mar 1937 (Rayss 1959, as *E. fragosoi* Cif.).

On *Papaver rhoeas* L.: Jericho, 21 Apr 1945, leg. D. Rijik & T. Kushnir (Rayss 1952).

On *Papaver* sp.: Rehovot, 14 Feb 1938 (Palti *et al.* 1966).

10. *E. meliloti* McAlpine

On *Melilotus sulcatus* Desf.: Magdi'el, 10 May 1943, leg. H. Habelska (Rayss & Zwirn 1944).

11. *E. mediterraneum* Syd.

On *Pallenis spinosa* Cass.: Jerusalem, 22 Mar 1935 (Sävulescu & Rayss 1935).

12. *E. microsporum* (Unger) J. Schröt.

On *Ranunculus asiaticus* L.: Wadi Fedjaz, 24 Feb 1957, leg. A. Grizi (Rayss 1959).

13. *E. parietariae* Rayss

On *Parietaria alsinifolia* Delile: Judean desert, 13 Mar 1937 (Rayss 1952).

On *P. judaica* L.: Judea, Bab-el-Wad, 9 Feb 1936; Judean desert, 13 Feb 1940 (Rayss 1952, 1959; Mouchacca 1999).

14. *E. ranunculi-repentis* Sternon (recorded as *E. ranunculorum* Liro)

- On *Ranunculus asiaticus* L.: Mont Jermak, 27 Feb 1951 (Rayss 1952).
15. *E. rhagadioli* Pass.  
On *Rhagadiolus stellatus* Gaertn. subsp. *edulis* (Gaertn.) O. Bolòs & Vigo (as *R. edulis* Gaertn.): Deir-Amar, 8 May 1951, leg. D. Zohary (Rayss 1952).  
On *R. stellatus* Gaertn.: Jerusalem, 31 Mar 1937, leg. H. Habelska (Rayss 1952).
16. *E. serotinum* J. Schröt. (recorded as *E. boraginis* Cif.)  
On *Symphytum palaestinum* Boiss.: Bet HaKerem, 30 Mar 1939 (Rayss & Zwirn 1944).
17. *E. taraxaci* Vánky  
On *Taraxacum megalorrhizon* Hand.-Mazz.: Jerusalem, 25 Feb 1936, leg. Rattan (Vánky 1983).  
On *Taraxacum* sp.: Rishon Le Zion, 13 Dec 1937 (Palti *et al.* 1966).  
Note. The latest record was mentioned as *Entyloma* sp., but only *E. taraxaci* is known on *Taraxacum* in the world. In addition, the type specimen of this species was collected in Israel, about 60 km far from the record. Thus, we provisory refer this record to *E. taraxaci*.
18. *E. tolpidis* Unamuno  
On *Tolpis altissima* Pers.: Moza, 20 Jan 1935 (Săvulescu & Rayss 1935).
19. *Entyloma* sp. (recorded as *E. eryngii-tricuspidati* Maire)  
On *Eryngium creticum* Lam.: Jerusalem, 24 Apr 1942 (Rayss & Zwirn 1944).  
Note. *Entyloma eryngii-tricuspidati* was described on *Eryngium tricuspidatum* L. from the North Africa. Rayss and Zwirn (1944) supposed that *E. creticum* probably is a new host for the fungus. However, Vánky (2009) wrote about seven *Entyloma* species on seven *Eryngium* species. All these smuts are highly specialized parasites. Each of the host species was infected only by one fungus. *Eryngium creticum* was not mentioned among these hosts. Therefore, the smut fungus parasitizing this plant probably is a new species. However, without molecular phylogenetic analyses it is impossible to solve this problem (Vánky pers. comm.). It should be noted that on *E. creticum* *Entyloma eryngii* in the Greece was reported (Pantidou 1973).

Class *Microbotryomycetes*

Order *Microbotryales*

Family *Microbotryaceae*

Genus *Microbotryum* Lévl.

- M. cordae* (Liro) Vánky (recorded as *Ustilago cordai* Liro)  
On *Polygonum acuminatum* Kunth: near lake Houleh, 18 Jul 1924 (Rayss 1952).
- M. jehudanum* (Zundel) Vánky (recorded as *Ustilago jehudana* Zundel)  
On *Silene apetala* Willd.: Jerusalem, 25 Mar 1935, leg. A. Grisi (Rayss 1952).

Note. *Ustilago jehudana* was described by Zundel (1944) from the anthers of *Silene apetala* on Palestinian materials. Later, Denchev (1997) investigated the type specimen of *U. jehudana*, and showed that it was an ovariicolous, non-antheriicolous fungus. He corrected the diagnosis and proposed a new combination *Bauchinus jehudanus* (Zundel) Denchev. Then, *U. jehudana* was transferred into the genus *Microbotryum* (Vánky 1998). According to recent molecular phylogenetic analyses, ovariicolous *Microbotryum* species were clustered together with antheriicolous ones (Kemler *et al.* 2006). Thus, the genus *Microbotryum* seems to be a natural group and *M. jehudanum* is a current name for *U. jehudana*.

- M. scorzonerae* (Alb. & Schwein.) G. Deml & Prillinger (recorded as *Ustilago scorzonerae* (Alb. & Schwein.) J. Schröt.)  
On *Scorzonera papposa* DC.: Gilboa', 25 Mar 1944, leg. D. Rizik (Rayss & Zwirn 1944).

## Doubtful records

- Entyloma xanthii* Massalongo  
On *Xanthium strumarium* L.: Wadi Falik, 4 Sep 1951; Gan Schmucl, 28 Sep 1951; Tel-Aviv, near Yarkon River, 4 Sep 1951 (Rayss 1952).  
Note. Vánky (1994) checked the holotype of the species from Italy and concluded that it is not a smut fungus. Accurate identification of smuts on *Xanthium* collected in Israel will be feasible after revision of appropriate specimens, if they are, to be sure stored in Israeli herbaria.
- Unidentified smut fungus (recorded as *Ustilago* sp.)  
On *Paspalum dilatatum* Poir.: Israel (Kenneth *et al.* 1975).  
Note. Eight species of smut fungi belonging to different genera are known on this host (Vánky 2007). It is necessary to carry out microscopic examination of the respective specimen to identify this record.

## Discussion

At least 59 species of smut fungi are known in Israel as yet. These species referred to 10 genera, eight families, six orders and three classes of the *Basidiomycota*. Most of them belong to the genera *Entyloma* (19 species, including four endemic for Israel), *Sporisorium* (14 species), and *Ustilago* (12 species). The genus *Urocystis* is presented by 4 species, *Microbotryum* and *Tilletia* are presented by 3 species each, and the remaining genera, viz *Antherospora*, *Jamesdicksonia*, *Melanotaenium*, and *Vankya*, only by one species each. The flora of Israel includes both Mediterranean, Irano-Turanian, and Saharo-Arabian

elements. This feature, combined with some climatical peculiarities, determines a specific species composition of the Israeli smut fungi. Thus, such tropical species as *Sporisorium aristidae-lanuginosae*, *S. consaguineum*, and *S. erianthi* were found in the country. The considerable part of the species composition are the cosmopolitan species, e.g. *Entyloma calendulae*, *E. dabliae*, *E. microsporium*, *E. ranunculi-repentis*, *Jamesdicksonia dactylidis*, *Microbotryum cordae*, *Sporisorium reilianum*, *S. sorghi*, *Tilletia caries*, *T. laevis*, *Urocystis tritici*, *Ustilago avenae*, *U. hordei*, *U. maydis*, *U. striiformis*, *U. tritici*, etc. There are a lot of species with a typical Mediterranean area, e.g. *Entyloma catananchis*, *E. mediterraneum*, *E. tolpidis*, *Microbotryum jehudanum*, *Urocystis antipolitana*, *Sporisorium pollinae*, *S. tricholaenae*, and *S. vanderystii*. Such species as *Entyloma ambrosiae-maritimae*, *E. asterisci*, *E. cynoglossi*, and *E. taraxaci* are the Israeli endemics.

There are more than 2700 species of vascular plants in Israel (Kandom & Danin 1999). Thus, 59 species of smut fungi seems to be a very low number for such a wide variety of their potential hosts. Therefore, it is possible that additionally more than 100 species of smut fungi can be found in Israel. Thus, future field investigations on these organisms in the territory of the country beyond a doubt will increase the presented checklist.

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