2018 Rule Proposal 8 - Amended

Purpose of Proposal

To add a procedure for detecting dust-like noxious weed weeds for such genera as *Aeginetia, Alectra, Orobanche,* and *Striga* to the AOSA Rules for Testing Seeds, Vol. 1.

Present and Proposed Rule

SECTION 5: EXAMINATIONS

5.1 Noxious-weed seed examination. –The objective of the noxious-weed seed examination is to detect the presence of noxious-weed seeds in a sample and determine the estimated rate of occurrence in the seed lot. The noxious weed seed examination involves the search for seeds and seed-like disseminules of species declared noxious in regulation by one or more government agencies. The type of noxious weed seed examination conducted shall be specified on the report of analysis (refer to sec. 15 j).

a. Types of noxious weed seed examinations.

(1) All States/Federal Noxious Weed Seed Exam – a comprehensive exam for all state and federal noxious weed seeds based on the current USDA publication entitled *State Noxious-Weed Seed Requirements Recognized in the Administration of the Federal Seed Act*. If the examination conducted excludes noxious weed seeds from one or more states or particular kinds of noxious weeds ~~(e.g., *Orobanche* spp.)~~ this must be stated on the report of analysis. For dust-like noxious weed seeds, such as *Aeginetia*, *Alectra*, *Orobanche*, *Striga*, refer to 5.1.a(8). This examination does not include undesirable grass species [refer to 5.1a(5)] unless specifically stated on the report of analysis.

(2) Federal Noxious Weed Seed Exam – an examination for the presence of species declared as noxious weed seeds under Federal Seed Act Regulations Section 201.16(b). For dust-like noxious weed seeds, such as *Aeginetia*, *Alectra*, *Orobanche*, *Striga*, refer to 5.1.a(8).

(3) State Noxious Weed Seed Exam – an examination for the presence of species declared as noxious weed seeds by a particular state. The state for which the examination is conducted must be stated on the report of analysis. For dust-like noxious weed seeds, such as *Aeginetia*, *Alectra*, *Orobanche*, *Striga*, refer to 5.1.a(8).

(4) Regional Noxious Weed Seed Exam – an examination for the presence of species declared as noxious weed seeds within a given region. The region for which the examination is conducted must be clearly defined on the report of analysis. For dust-like noxious weed seeds, such as *Aeginetia*, *Alectra*, *Orobanche*, *Striga*, refer to 5.1.a(8).

(5) Undesirable Grass Seed (UGS) – an examination for the presence of certain grass species declared by certain states as restricted when found in lawn and turf seed lots. The

examination shall be based on the current USDA publication entitled *State Noxious-Weed Seed Requirements Recognized in the Administration of the Federal Seed Act*.

(6) Canadian Noxious Weed Seed Exam – an examination for species declared as noxious weed seeds under the appropriate grade table designation for the kind of seed under consideration as specified under the current edition of the Canada Weed Seeds Order. For dust-like noxious weed seeds, such as *Alectra*, *Aeginetia*, *Orobanche*, *Striga*, refer to 5.1.a(8).

(7) Foreign Noxious Weed Seed Exam – an examination for species declared noxious or undesirable by a foreign country. The country for which the examination is conducted must be stated on the report of analysis. For dust-like noxious weed seeds, such as *Aeginetia*, *Alectra*, *Orobanche*, *Striga*, refer to 5.1.a(8).

(8) Detection of dust-like noxious weed seeds (e.g., *Alectra* spp., *Aeginetia* spp., *Orobanche* spp., *Striga* spp.).

b. Detection of noxious weed seeds (for noxious weed species with dust-like seeds refer to Sec. 5.1.c).

~~b.~~(1) The determination of the number of seeds, bulblets, or tubers of individual noxious-weeds present per unit weight shall be made on at least the minimum quantities listed in Table 2A, column 5 for the kind of seed under test (refer to section 15).

~~c.~~(2) The working sample shall be weighed in grams to the appropriate number of decimal places (refer to section 2.3 a).

~~d.~~(3) The complete noxious-weed seed examination working sample shall be examined except when the following indicated numbers of a single kind of seed, bulblet, or tuber are found in the analysis of the purity working sample (or in a like amount of the noxious-weed seed examination working sample), the occurrence of that species in the remainder of the bulk examined for noxious-weed seeds need not be noted: 0.5 gram purity working sample, 16 seeds; 1 gram purity working sample, 23 seeds; 2 gram purity working sample or larger, 30 seeds. In such a case, the remainder of the of the noxious-weed seed examination working sample shall be examined for all other noxious-weed species.

~~e.~~(4) Refer to Appendix 1 for examples of calculations of the number of noxious-weed seeds per unit weight. State laws may specify the unit weight to express the rate of occurrence of noxious-weed seeds. In cases where the noxious-weed seed examination working weight is less than the minimum required as described in section 5.1 ~~d,~~ b(1), the calculation of the number of noxious-weed seeds per unit weight of the particular species involved shall be based on the reduced working sample weight. Refer to section 15.

Example:
Alfalfa Purity working sample: 5.052 g
Noxious-weed seed examination working sample
(including the purity working sample weight): 50.15 g

In the purity analysis, 30 seeds of *Cuscuta* spp. (dodder) are found. As specified in section 5.1 d, a search for additional dodder seed in the remaining noxious-weed seed examination working sample is not

required. However, this working sample must be examined for other noxious-weed seed species. In this case, two *Rhaponticum repens* (Russian knapweed) are found.

To determine the rate of occurrence of the dodder, use the purity analysis working sample weight (5.052 g). To determine the rate of occurrence of Russian knapweed use the noxious-weed seed examination working sample weight (50.15 g).

Following the instructions given in Appendix 1, the rate of occurrence of dodder is 2694 per pound, and the rate of occurrence of Russian knapweed is 18 per pound.

~~f.~~(5) The seeds per unit weight shall be based on the number of single seeds. The number of individual seeds shall be determined in burs of sandbur (*Cenchrus* spp.) and cocklebur (*Xanthium* spp.), capsules of dodder (*Cuscuta* spp.), berries of horsenettle and nightshade (*Solanum* spp.), and in the fruits of other noxious-weeds that contain more than one seed. Refer to sections 3.4 and 3.5 b (4).

~~g.~~(6) For tolerances see section 14.3, Table 14G.

c. Detection of noxious weed species with dust-like seeds (e.g., *Aeginetia* spp., *Alectra* spp., *Orobanche* spp., *Striga* spp.).

(1) Samples submitted for detection of dust-like seeds shall consist of raw seed. No treatment, inoculum, coating, encrusting, film coating, or pelleting material shall be covering the seed submitted for testing for noxious weed species with dust-like seeds.

(2) The determination of the number of dust-like seeds individual noxious-weeds present per unit weight shall be made on at least the minimum quantities listed in Table 2A, column 5 for the kind of seed under test (refer to section 15). Preferably, the test should be performed on a stand-alone submitted sample drawn at the same time as the sample submitted for other testing. Note: A larger sample size may be required to meet requirements of phytosanitary certification or foreign import permits.

(3) Samples for detection of dust-like noxious weed seeds should not be run through a mechanical divider. Sampling of the submitted sample should be done using the spoon method or the hand-halving method.

(4) The working sample shall be weighed in grams to the appropriate number of decimal places (refer to section 2.3 a).

(5) Separation of the dust-like seeds from the working sample is done using a round-hole perforation sieve with a hole-diameter sufficient to prevent the kind of seed under test to pass through the sieve, but large enough to allow all loose dust-like material to pass through the sieve. Depending on the diameter of the sieve, the working sample should be split into smaller batches for sieving to allow for adequate movement of seed during sieving and seeds in the sieve should not be more than three layers thick. The sieve stack (cover, sieve, and collection pan) should be placed on a sieve shaker and shaken for at least two minutes at approximately 40 shakes/second (110 volts).

(6) A clean soft brush may be used to transfer the contents of the collection pan (sievings) into a suitable container (e.g., Petri dish), making sure that no seeds remain in the brush or in the

collection pan. Alcohol with concentration of 70% may be used to clean the sieves and pans to eliminate sample-to-sample contamination.

(7) Examine the sievings using a microscope with a magnification of at least 10x, preferably 20× or greater to detect the presence of dust-like noxious weed seeds.

(8) Refer to Appendix 1 for examples of calculations of the number of noxious-weed seeds per unit weight. State laws may specify the unit weight to express the rate of occurrence of noxious-weed seeds. In cases where the noxious-weed seed examination working weight is less than the minimum required as described in section 5.1 c(2), the calculation of the number of noxious-weed seeds per unit weight of the particular species involved shall be based on the reduced working sample weight. Refer to section 15.

(9) For tolerances applied to *Orobanche* spp. refer to section 14.3, Table 14G. There is zero tolerance for seeds of *Aeginetia* spp., *Alectra* spp., and *Striga* spp. when found in agricultural or vegetable seeds (refer to Federal Seed Act Regulations, Sec. 201.16).

Harmonization Statement

ISTA Rules include a dry sieving method for *Orobanche* spp. under Chapter 4 Determination of Other Species. Often phytosanitary certification of seed moving internationally requires declaration of freedom from *Orobanche* and/or *Striga* contamination. The Federal Seed Act does not have a special procedure for detection of dust-like noxious weed seeds; however, the FSA lists *Alectra* spp. *Aeginetia* spp., and *Striga* spp. as noxious weed seeds with no tolerance when found in agricultural and vegetable seed moving in interstate commerce. Additionally, the USDA also classifies non-native species of *Orobanche* as noxious weeds. *Orobanche ramosa* (branched broomrape) is a prohibited noxious weed seed in Arizona. California will be adding *O. ramosa* and *Orobanche aegyptiaca* (Egyptian broomrape) to the prohibited noxious weed list in fall of 2017. *Striga* (witchweed) is a prohibited noxious weed seed in several states.

Supporting evidence

There are several genera of parasitic plants known to damage agricultural crops, including the U.S. Federal Noxious Weed genera *Alectra*, *Aeginetia*, non-native species of *Orobanche* (some species now placed in *Phelipanche*), and *Striga* (USDA 2010). The most notable species of concern in the United States are *Orobanche ramosa* (branched broomrape), *Orobanche aegyptiaca* (Egyptian broomrape), and *Striga asiatica* (witchweed). Infestations of such root parasites cause varying degrees of economic loss depending on the magnitude of the infestation. Individual plants of these species can produce thousands of minute dust-like seeds that are impossible to detect without microscopic examination. Seeds of such species can remain dormant and viable in the soil for decades, rendering fields limited in planting value for host crops. Seeds of such species are readily spread via contaminated seed lots, farm equipment, footwear and clothing of field workers, irrigation water, wind, and animals. For more information on the biology and identification of root-parasitic weeds see Mohamed & Musselman (2012), Musselman (1980), Scher et al. (2015).

The proposed procedure for detection of dust-like seeds of noxious weed species combines the methods found in the ISTA Rules and Elias et al. (2006). A comparison of seed descriptions, plant distributions, and known hosts from Scher et al. (2015) is provided in Table 1. Comparison of seed size for *Orobanche* relative to red clover is shown in Figure 1. For additional images of

Aeginetia, *Alectra*, *Orobanche,* and *Striga* see Scher et al. (2015). Although the methods described in the ISTA Rules and Elias et al. (2006) are based only on detection of *Orobanche* seed, the proposed method should work well for the detection of similar-sized dust-like seeds from other genera.

Table 1. Seed descriptions for *Alectra* spp., *Aeginetia* spp., *Orobanche* spp. (*Phelipanche* spp.) and *Striga* spp. from Scher et al. 2015 (unless otherwise noted).

	***Alectra* Thunb.**	***Aeginetia* L.**	***Orobanche* L. and *Phelipanche* Pomel**	***Striga* Lour.**
Seed shape	Testa of seeds a membranous envelope separate from and enclosing rest of seed. Seed with testa linear to wedge shaped, sometimes curved, truncate at ends. Central 'nucleus' (seed without testa) obovate or cone-shaped.	Seeds elliptic, ovate, wedge-shaped or oblong; tiny, dustlike.	Seeds commonly narrowly to broadly wedge shaped, irregularly wedge shaped, or teardrop-shaped, also elliptic, obovate, or oblong; tiny, dustlike.	Seeds elliptic, ovate, oblong, occasionally D-shaped, triangular, rhombic, or irregular; often twisted or angled from crowding or position in capsule; tiny, dustlike.
Seed Size	Whole seed 0.5–1.4 mm long, 0.3–0.5 mm wide. Central 'nucleus' 0.1–0.3 mm long, 0.05–0.18 mm wide	0.05–0.35 mm long, 0.03–0.26 mm wide and thick.	0.2–0.6 mm long, 0.1–0.5 mm wide and thick.	0.2–0.6 mm long, 0.1–0.3 wide and thick.
Seed coat color	Straw-colored to light brown. Central 'nucleus' amber to nearly black.	Straw-colored to light brown.	Straw-colored, pale brown, reddish amber to black-brown; often shiny.	Orange to golden-brown, light to dark brown, or gray to blackish; sometimes sparkling with colored light at high magnification.
Seed coat texture	Transparent to opaque, delicately reticulate.	Surface reticulate, reticulations large, high-walled, with finer reticulations visible below.	Surface reticulations prominent, intermediate to large in size, often high-walled; walls thick, thin, coarse or moniliform; sometimes nearly transparent, sometimes wavy.	Surface glabrous, with prominent often ropelike longitudinal or diagonal reticulations that sometimes appear as closely spaced ridges rather than reticulations and are often twisted in appearance.
Embryo	Embryo dwarf-spatulate, cotyledons poorly developed.	Embryo very small, endosperm present.	Embryo very small to minute; endosperm present.	Embryo linear; endosperm present.
Distribution	Tropical Africa, Asia	Indian subcontinent, China, Japan, and Korea, through Southeast Asia to New Guinea	Mostly north temperate and subtropical; Africa, Asia, Australia, New Zealand, Colombia, United States	Africa, Asia, Australia, United States (N. & S. Carolina) native range: Old World tropics to South Africa
Known hosts	Cowpeas, peanuts, soybeans and bambara nut	Bamboo, short grasses and crops such as rice, maize and sugarcane.	Solanaceae and Fabaceae hosts such as tomato, pepper, bean, pea, sunflower, and tobacco.	Grasses such as corn, rice and sorghum. *Striga gesnerioides* is a serious pest on *Vigna unguiculata* (cowpea, Fabaceae) and a minor pest on other dicot crops (Mohamed & Musselman 2012).

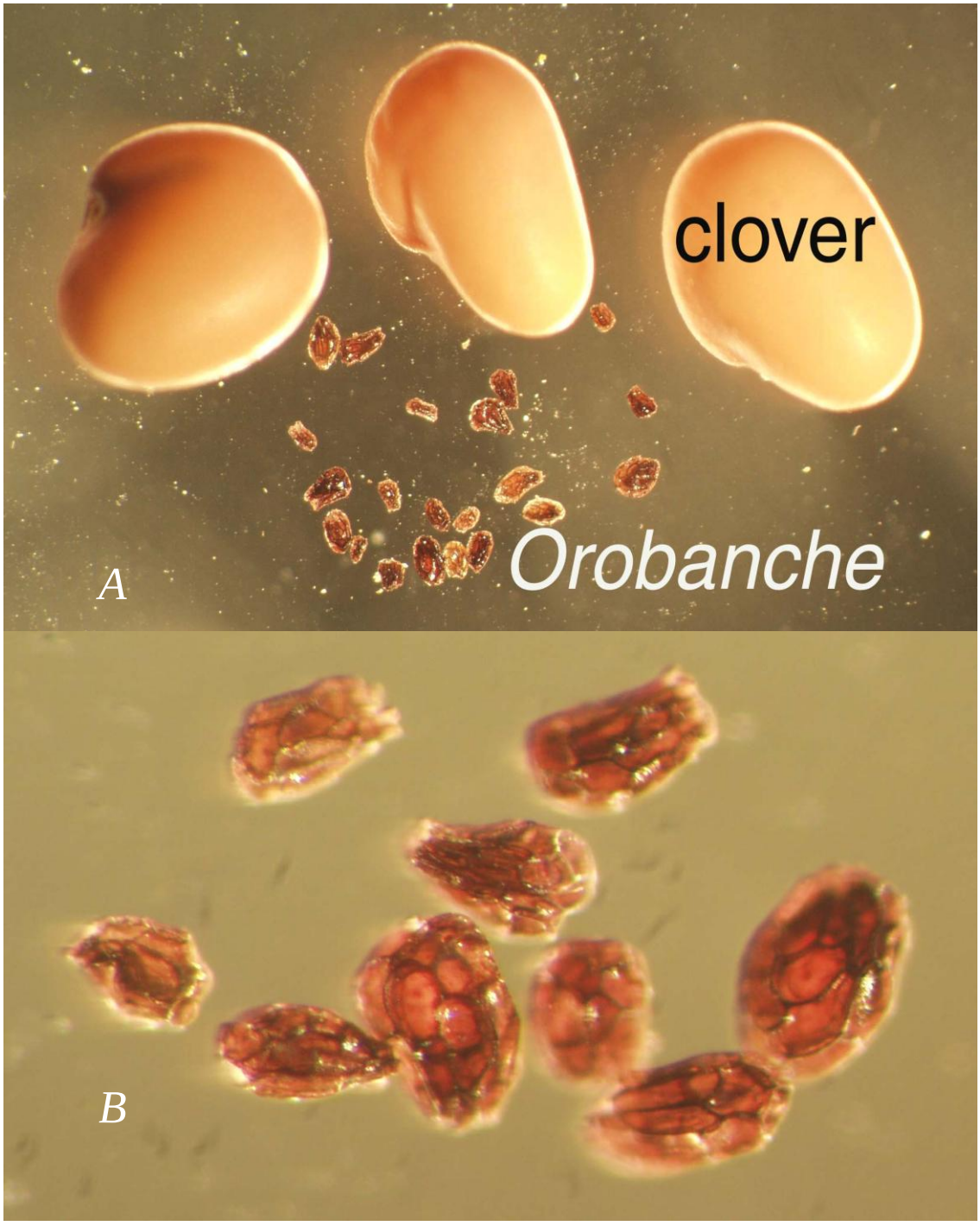

Figure 1. A) Red clover and *Orobanche* seeds, 20X; and B) *Orobanche*, 80X ((from Elias et. al., 2006).

References

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