Pests, Pesticides, and Dosages on an International Basis*

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Received March 20, 1964

Wherever man has gone and where he has stored his crops or his belongings, he has either brought his pests along with him or else furnished an excellent condition for them to grow, to feed, and to flourish. Since many of the most serious pests occur in more than one country and often the names by which they are recognized differ both in the same language and between languages, it is necessary to be able to recognize the same pest under a variety of designations. Also, the name of the host plant may differ both between languages and within the same language, so that indentification of the host plant is necessary. The plant may be of minor economic importance or of local value only, in which case, knowledge of control measures may not be of interest outside a limited region. Since the field of pests and pesticides is so broad, and even one phase cannot be treated fully, but only by a few illustrative examples, the word "pests" as used herein will be limited to the insects and mites.

Host Plants.—Knowing the host plant is often an aid in identifying an insect which has an unknown name, but here we may have a little trouble if we fail to remember that the European corn borer will eat corn in this country, will feed on maize in England, and devour mais in Italy. Corn either with a "c" or "k" is the general word for grain in Europe, and maize or mais the specific term for a certain type of grain, namely, *Zea mais* L. Interestingly enough, even in this country, a geneticist often works on and writes a book on maize, while his friend, the agronomist, writes on corn. Another example of varying common names for the same plant is the case of the peanut, *Arachnis hypogaea* L., which is known as the ground nut and goober in addition to the peanut. A weevil feeds on alfalfa in the United States but on lucerne in Europe. Since the common name may bear no relation to the scientific name, the common name may not give a clue to the identity of the plant. Papers written in India in perfect English will refer to what is called eggplant in North America as brindjal, to what is called okra as bhendi, and to sorghum or sorgo as jowar. Rather interestingly, a host plant may change color as it crosses a border. Thus Blaukohl becomes chou rouge. Plantain (*Musa paradisiaca* L.), one of the names of the cooking banana, is the same as that of a group of common weeds of the genus *Plantago* which occur in many of the lawns and gardens of North America

The identification of host plants is not as difficult, as a rule, as that of identifying the pest or the insecticide mentioned by writers of differing nationalities; but, even in the case of host plants, a liberal use of scientific names, or sufficient description to place the organism in at least a suitable family group, should be made if the article is designed for international consumption. Scientific names are especially necessary when there is no accepted common name or the crop is a highly specialized one. For both the reader and writer, use of standard nomenclature enormously simplifies identification of host plants. Two reference works, Uphof's "Dictionary of Economic Plants" and "Standardized Plant Names"[2] published under the auspices of the American Joint Committee on Horticultural Nomenclature, help to keep the North American writer from being too provincial in his own work and give him at least an inkling of crops in other countries.

Pests.—Names and importance of pests vary from country to country, from language to language, and within a language. Common names frequently reflect certain taxonomic inaccuracies or misunderstandings of what a pest really is. Names, both common and scientific, generally reflect an attempt to describe an organism. The most frequent exceptions to this rule of description lie in those scientific names given in honor of some person—thus, one of the grasshoppers described by Ashley Gurney recently was named *Melanoplus rugglesi* after a former professor of Dr. Gurney. The specific name gives no hint as to the appearance of the grasshopper.

Let us take another example from the moths. A large family, the *Noctuidae*, contains several species of economic importance. In this country these insects are named from the destructive proclivities of the immature or larval stage, and are cutworms of various kinds. Spanish also emphasizes the cutting action by calling these *gusanos cortadores* but in some cases *gusanos de tierra*. Since cutworms operate just below ground level, the idea of ground shows keen observation. Also the cutting action is a correct description of their action. The scientific name and also the German name emphasize another aspect of the activities of these pests. They do their work at night, hence, the original designation of *Noctua* or owl and the family *Noctuidae* or owls. They do not look like owls, but act like them. German nomenclature follows the Latin—these are *Eule* or owls. It is possible to go from *Eule* to moth in the dictionary mentioned,[4] but not from cutworm to *Eule*.

The more common the insect, the more names it has. These may differ from language to language and within the same language. A good example of an international insect enjoying wide distribution is the domestic cockroach (Table I). It is common enough that some writers, who should know better, take for granted that, of course, everyone knows what a cockroach is. The cockroach is neither

* Presented before the Divisions of Chemical Literature and Agricultural and Food Chemistry, Pesticides Subdivision, Joint Symposium on "Problems of the Pesticide Literature and Some Solutions," 147th National Meeting of the American Chemical Society, Philadelphia, Pa., April 9, 1964.

Table I
English Names for the Cockroach

Cockroach
Water bug
Croton bug (New York City usage)
Black beetle (British usage)

black nor is it a beetle, but dictionary descriptions frequently do use the word "black" or "nero" or some other equivalent. Cockroaches come in various colors—brown, green, striped, and even white, but not black. Perhaps their nocturnal habits are such that the observer cannot tell black from brown.

Let us see what the cockroach is in another family of languages, namely those derived from Latin (Table II).

Table II
Names for Cockroaches in Latin Languages

French	blatte
	cafard
	concrelat
Italian	blatta
	scarafaggio domestico
Portuguese	barata
Roumanian	cărăbus
	gândac de bucătărie
	şvab

Here the French adapt the Latin or scientific name *Blatta* to their own language or they give the insect names derived from its habits. In Roumanian, the idea of "beetle" occurs; *cărăbus* is a Latin name for beetle. Persons who see cockroaches scurrying about along water pipes or in damp areas may not stop to examine the characteristic morphology of the pest observed. The idea of "beetle" also occurs in one of the Italian names for cockroach, the *scarafaggio domestico* or the beetle that lives in the home. One of the Roumanian names emphasizes the domesticity of the cockroach, for it lives in the kitchen.

What is the cockroach in Germanic languages? Here the names vary so little from language to language that they can easily be recognized. *Schabe,* however, does not sound or look like *Kakerlak* (Table III). Cockroaches in the

Table III
Names for the Cockroach in Germanic Languages

Afrikaans	kakkerlak
Danish	kaperlak
Dutch	kakkerlak
German	Kakerlak
	Schabe
	Schwalbe
Norwegian	kakerlakk

Slavonic tongues (Table IV) carry distinct labels, none of which is derived from the scientific name. Although the common name in Slavonic language does vary, it can be found in dictionaries.

We have seen that color may vary from language to language and so may classification. An example of an accurate identification in one language and a misidentification in another lies in the popular nomenclature of sawflies which belong to the *Hymenoptera,* the order which includes the bee, ant, and wasp. German, Dutch, and the Scandanavian languages name them correctly as saw wasps or leaf wasps, depending upon their habitat and species.

Table IV
Names for the Cockroach in Slavonic Languages

Croatian	žohar
Latvian[a]	prusaks
Polish	karaluch
Russian	tarakan

[a] Latvian may be classified as Baltic rather than Slavic.

English usage probably does not reflect an inability to count since wasps have four wings and flies only two, but may indicate that any creature with membraneous wings which is seen flying around is a fly. The French play safe and use a classical name modified to suit the habits of the French language (Table V).

Table V
Names for Sawflies (*Hymenoptera, Tenthredinidae*)

English	sawfly
Dutch	zaagwesp
	bladwesp
German	Sägewespe
	Blattwespe
Norwegian	bladvesps
French	tenthréde

No one name can express the entire characteristics of an insect, as was said before when discussing the *Noctuidae* or cutworm moths. Even greater diversity occurs when leafhoppers are given common names by observers who speak different languages. The Spanish word emphasizes the shape and in some cases of a species, both the shape, that of a cigar, and color. Germans and Scandinavians see leafhoppers in their taxonomic classification as near the cicadas. English sees the action of jumping (Table VI).

Table VI
Names for Leafhoppers
(*Hemiptera–Homoptera–Cicadellidae–Jassidae*)

English	leafhoppers
Dutch	dwergcicade
German	Zwergzikada
Norwegian	dvergcikade
French	cicadelle
Spanish	cigarrilla

Many other common names could be given illustrating different concepts of the same insect, *e.g.,* flea beetles, which are ground or earth fleas in the German and Scandinavian languages and become merely fleas in Russian, modified by the plant fed upon. *Eurygaster* spp., a senn bug in some parts of the Near East and a noxious little tortise in some parts of Russia, shows that direct literal translation hardly works between languages.

Now the problem of common names in various languages has been stated. Statement is, however, not a solution. The best solution is undoubtedly familiarity with the literature of various countries and a good working knowledge of entomology or acarology if we work in the field of pesticides on an international basis. Obviously, no one person can know all the pests all over the world, but we can learn how to handle some of the typical problems.

Probably the simplest case for identification is that of deriving the scientific name from the common name, either by a simple transformation of Latin or Greek into the habits of a modern language or of translating the term directly into a modern language. In Latin languages in which there is no initial asperate or "H" sound, the "H" may be removed and the ending modified to suit the habits of the modern language (Table VII). Thus *Haltica* minus the "H" would be *altica* and a further modification of the case ending would give *altiche*. Similarly in French, removing the initial "H" and modifying the ending to the habits of the French language gives *altise*, the common name of the flea beetles in French. Undoubtedly, it is easier to go from the scientific name to the common name than the reverse, but it is by no means impossible to add an "H", juggle the ending, and check the synthesized name in a standard reference.

Table VII
Transformation of a Scientific Name into a Common Name

Latin	Haltica
Italian	Haltica–altica–altiche
French	Haltica–altica–altise

Some scientific names are modified into common names by a change in the ending with the stem either unchanged or only slightly modified. The various names for cricket will show these changes (Table VIII). The old classic name "Gryllus" appears in some form in German and in various Latin tongues, and can be recognized without difficulty except perhaps in Roumanian.

Table VIII
Modifications of "Gryllus"

German	Grille
French	grillon
Portuguese	grilo
Spanish	grillo
Roumanian	greere

In some cases, the modification necessary to adapt a scientific name to the habits of a modern language are scarcely noticeable unless one is using an index arranged alphabetically. Thus *Thrips* is really a scientific name which we have taken over into English without even realizing what we are doing. In languages without a "th" sound, a "th" generally becomes "t", or in some cases in very old words may become an "f" in Russian. The guide here is: try "th" in the scientific name if "t" occurs in the common name.

Direct translations from Latin or Greek scientific terms often occur. Many times these are not recognized as such because the reader does not know the meaning of the scientific term. A few examples of direct translation are shown in Table IX. Many more examples could be given.

Table IX
Direct Translations of Scientific Name into Common Name

Scientific name	Modern language	Common name
Gryllotalpa	English	mole cricket
	French	taupe-grillon
	German	Maulwurfgrille
	Portuguese	grilo-toupeira
Orthoptera	German	Geradflügler
Tarsonemus	Norwegian	tradfåt
Diptera	Norwegian	tovinge

In some cases the translation is only partial, *e.g.*, the pigeon tremex, *Tremex columba* L., a wasplike insect which lays eggs in tree trunks.

Thus far we have pointed out some of the aids that arise from the language itself that either make allowance for different aspects of an insect as they are expressed in different ways, or analyze and recognize linguistic changes in the same term and, lastly, translate meaning in one language to the same meaning in another. Any of these methods has limitations, but they can be used to locate names or terms which can be checked further.

Perhaps the best single aid for a given language is a good dictionary. The most difficult and baffling problem of all is to identify something that we fail to recognize in any language. Once a name or term is defined in any language, which we can read, it may be possible to find a scientific name or a common name which is comprehensible in other languages. Some of the most helpful monolingual dictionaries that I have used are listed. Webster's "New International Dictionary," 2nd Ed., unabridged,[5] is really international in outlook. The "Novo Dizionario Scolastico della Lingua Italiana" by Petrocchi[6] is of great value as it gives both definitions and derivatives. The well-known "Larousse" is a must for any serious translation or abstracting in French.[7] The Real Academia Española publishes a very excellent dictionary,[8] "Diccionario Manual e Illustrado de la Lengua Española." A useful dictionary for Brasilian Portuguese, which also includes many words and usages of the European Portuguese, is "Dicionário Enciclopedico Brasileiro" under the editorship of Alvaro Magalhãco.[9] "Der Sprach-Brockhaus" has proved invaluable.[10] An all-Russian dictionary is that of Ozhegov,[11] which has been of special use when the bilingual dictionaries failed. Schegolev's "Entomological Glossary (Slovar' Spravochnik Entomologa)" has a wealth of material and is especially useful for common names which are not derived from Latin roots.[12] Nearly every language of importance has at least one outstanding dictionary. The great national encyclopedias also are of real aid.

There is need also for use of bilingual and multilingual dictionaries. One small bilingual dictionary I have found useful is Langenscheidt's "Taschenwörterbuch Lateinisch-Deutsch, Deutsch-Lateinisch."[13] This little volume is a great aid for those terms, and there are many of them, which originate from medieval rather than classical Latin. These are only a few aids, but this paper is written with the viewpoint of defining problems rather than giving extensive elaborate lists. Multilingual dictionaries generally have distinct limitations, but there are some useful glossaries among them. One which may not be too well known is a glossary in nine languages by Kwizda.[14] This is a paperback book and has proved to be very accurate for European insects.

Just as a comprehensive dictionary in any language is a help, so is a comprehensive text on entomology in any language which the searcher can read. One of the best reference works which gives a worldwide survey of the chief groups of insects is Schröder's "Handbuch der Entomologie."[15] It is old and out of print, but anyone who can find a copy of this monumental work listed by a bookseller would be wise in buying it. Bonnemaison has recently compiled a monumental work, "Les Ennemis Animaux des Plantes Cultivées et des Forêts," in three volumes.[16]

Balachowsky[17] has started a great work on entomology of which two volumes dealing with Coléoptera have been completed. Balachowsky covers western Europe, the Near East, and North Africa. Rivnay[18] has recently compiled an excellent book on field insects of crops in the Near East. Skaife[19] has compiled a book on African insects. The old work of Wille "Entomologia Agricola del Peru" is a classic in its field.[20] Costa Lima's "Insectos do Brasil"[21] is extremely useful for the Eastern side of South America.

The excellent work of Metcalf, Flint, and Metcalf[22] on destructive and useful insects covers most of the important pests of America north of Mexico. Since many of these are imported, this book issued in the United States is of value for some of the European insects.

A fairly simple treatment by Brandt, "Welcher Schädling ist Das?" covers insects and fungi and related forms which attack vegetables and fruits.[23] An excellent Norwegian book[24] by Ramsfjell and Fjelddalen gives brief descriptions of insects and mites attacking principal crops together with the type of injury. The illustrations of both injury and pest are quite accurate. Diseases from fungi, bacteria, and viruses are also covered.

The great work by Sorauer, "Handbuch der Pflanzenkrankheiten," should be known to anyone working in the field of pesticides.[25] Volumes IV and V include insects. Volume IV also contains material on protozoa and some of the metazoa which attack crop plants. Plant pathology is is used here in the European sense of any agent either living or nonliving which affects the health of the plant. The earlier volumes are devoted to the nonparasitic diseases of plants and to bacteria, fungi, viruses, and weeds. Sorauer's Handbuch is mentioned here since the title Pflanzenkrankheiten or Plant Diseases might indicate to a North American that this publication deals only with fungi, bacteria, or viruses.

Specialized works, especially those on tropical crops, are a must for anyone dealing with pests in a truly international way. Pests of sugarcane, cotton, cocoa, rice, rubber, and tea are among those which affect the economic life of a country, since these crops may be sources not only of food and fiber to the people where these crops grow but also are sources of foreign exchange. A few examples of the books which any person should know about if he works with tropical pests on an international basis are Guagliumi's "Las Plagas de la Caña de Azúcar en Venezuela" which gives an account of the pests of sugarcane, and their control.[26] Lavabre's "Protection des Cultures de Caféiers, Cacaoyers, et Autres Plantes Pérennes Tropicales," gives useful information on perennial and tree crops.[27] The insect pests of cotton in tropical Africa are discussed by Pearson and Darling.[28]

Another source of information on pests are the various lists published by national entomological societies and various experiment stations. The Entomological Society of America[29] publishes lists of approved common names. The Ministry of Agriculture, Fisheries, and Food[30] publishes a technical bulletin on common names of British insects and other pests. Recently in Poland there has been an extensive list of pests with both Polish and Latin names and summaries in Russian and English. This valuable publication was issued by the Instytut Ochrony Roślin[31] in 1963. These are only samples. Any worker in this field should be on a constant watch for lists or descriptions of insects and mites published by the learned societies, experiment stations, or governmental reports. Trade literature also is not to be despised.

Current journals are another avenue to knowledge of pests in countries other than one's own. The *Bulletin of Entomological Research* [32] covers material from the British Commonwealth. The Anzeiger für Schädlingskunde[33] prints not only material from Germany and Austria but also from other parts of the world. The *Indian Journal of Entomology*,[34] the *Pakistan Journal of Scientific Research*,[35] the *Queensland Journal of Agricultural Science*,[36] and the *Botyu-Kagaku*[37] of Japan are only a few of the journals which should be known to anyone seriously interested in pests on an international basis. Obviously, no one person can know all the pests in all the countries of the world but he should be acquainted with the bibliographic sources which are international. The *Review of Applied Entomology*[38] and the "Bibliography of Agriculture"[39] will give the avid searcher quite an international outlook if he follows up the references in these and does not confine himself to those in the English language. He can know at least that there is a red bollworm and a spiny bollworm of cotton (pests not found in the United States), that termites are pests of living plants, *e.g.*, tea and rubber, and that larvae of two winged flies are serious pests or root crops in Northern Europe.

Scientific Names of Pests.—Now that we have equated common names with scientific names, we might think we have no further problems, but the scientific names also can change and do change in both time and space. According to the rule of priority which governs the naming of living organisms, the correct name is that name given by the person who first described a given organism in proper Latin or Greek form. Nothing before 1758 or the year when Linnaeus[40] published his "Systema Naturae" is counted. A valid name must be accompanied by a description in words or a figure sufficient to identify the organism. The organism may have been described by a number of persons each thinking that his was the first. The identification may have been erroneous. A difficulty may arise when a given species of wide distribution is described independently by more than one person and the insects so described are far apart geographically. Discovery of an intermediate form may show that what was thought to be two species is one. The final name in a case of this sort involves a quasi-legal procedure to determine what name was first. Further study of species may result in transfer of a species to another genus in which it was placed when it was originally described; *e.g.*, *Pyrausta nubialis*, the European corn borer, is now called *Ostrinia nubialis*. A name may be suppressed; *e.g.*, *Calendra*, the old genus, used for granary weevils, is now *Sitophilus*. In some cases a name has become so embedded in the scientific literature that changing it for reasons of priority or for a better description would be well-nigh impossible. When a name of a very important insect, *e.g.*, the housefly, *Musca domestica* L., came up for change, the feeling against change was so strong that this name was placed among the *nomena conservada* or retained names. Some of the warmest arguments in biology have been over the naming of an insect. To whom does a name belong, has more than once been asked. Does a name belong to the taxonomists who searched for old manuscripts to find some priorities or does it belong to the agricultural or medical workers who must control the insect no matter how named? Scientific names for the same insect often will differ from language to language and from country to country. Thus *Cydia pomonella* L. is used in England for the codling moth, and *Carpocapsa pomonella* is the name applied in North America. The Colorado potato beetle frequently goes under the genus *Doryphora* in France and other European countries but is known under *Leptinotarsa* in North America. The searcher in pesticide literature need not and, indeed, cannot be an expert in entomological or acarological taxonomy, but he should know that an entomological code does exist, he should know how scientific names are formed, and he should not be too scandalized when names do change. Chamberlin[41] gives a useful discussion of the rules of entomological nomenclature and also the international rules for zoological nomenclature. If he studies the *Review of Applied Entomology*, he can usually equate variant generic and specific names. Such is the advice given by Weidner,[42] a German authority on pests of stored products.

Names of Pesticides.—Now we come to the chemical section of this paper and again we must emphasize that the names of insecticides can differ and do differ in both time and space.

Frequently the early publications designated a given insecticide by a code name or number. Later this same material received a common name and also a trade name. A question which frequently occurs in pesticide literature is "What was that pesticide called before it was called what it is now?" Table X shows a few cases where the name used at present, former names, and the chemical formula are given for a few of the common insecticides or acaricides.

Table X
Chemical Equivalents of Some Code Names and Accepted Common Names

Code name	Common name	Chemical equivalent
Velsicol 1068	Chlordane	1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene
Compound 88R	Aramite	2-(*p*-*t*-Butylphenoxy)isopropyl-2′-chloroethyl sulfite
E-605	Parathion	O,O-Diethyl-O-*p*-nitrophenyl phosphorothioate
Pestox 14	Dimefox	Tetramethylphosphorodiamidic fluoride.
Compound 4049	Malathion	S-[1,2-Bis(ethoxycarbonyl)ethyl] O,O-dimethyl phosphorodithioate

Another ambiguity which can easily arise in names of pesticides is a change in name, the second or third name bearing very little or no relationship to the original name. There is a law of priority in the patent office, and there are rules for trademarks. The rules governing trademarks are designed to prevent two like products from being confused and also to give a commercial advantage to the owner of a trademark. Otherwise any trademark may be used. Common names are finally stabilized by committee, but often this stabilization occurs after chaos has set in. The Committee on Insecticide Terminology of the Entomological Society of America [43] publishes lists from time to time. A committee in Great Britain sets up standards for nomenclature of insecticides, and there are numerous official and unofficial bodies elsewhere. The British Standards Institution [44] issues a list of "Common Names for Pesticides." The Crop Protection Products Approval Scheme,[45] a section of the Ministry of Agriculture, Fisheries, and Food, also publishes valuable lists. A new list of accepted common names of insecticides together with their chemical names has appeared in a recent issue of the *Review of Applied Entomology*.[46]

Since authors, however, do not always follow approved lists, and editorial vigilance is not always present for all manuscripts, some superseded names will continue to appear. Even if editorial vigilance were perfect, literature older than the official ruling would contain names which are not standard. Table XI shows a few of the older names of two common insecticides. Similar tables could be compiled for many others. When abstracts or journal articles are prepared for international use, understanding of a common name cannot be taken for granted. Either more than one common name should be given, or the chemical name should be written out in full if there is any doubt that the material used will be misidentified.

Table XI
Official Name (Entomological Society of America) and Superseded Names of Insecticides

Accepted name	Chemical name	Other names
DDT	1,1,1-Trichloro-2,2-bis(*p*-chlorophenyl)ethane	Dinoxide Dicophane Pentachlorin Zerdane Gesarol Neocid
Parathion	O,O-Diethyl-O-*p*-nitrophenyl phosphorothioate	SNP DNTP Folidol Niran Etilon

Variations in international usage tend to be far greater than those within the same language or country. There are variations both within the same language and between languages. Some of the variations are quite small and should cause no difficulty for anyone conversant with the language involved. Omission of an initial "H" in those languages in which there is no initial asperate should cause no trouble. Thus, Heptachlor in Italian is *eptacloro*, the final "o" being again added to fit the language. In French, "e" must be added in many cases in order for a word ending in a consonant to have the approximate sound of the original. In Russian a "g" is substituted for "h" in Heptachlor and herbicide. DNOC (dinitro-*o*-cresol) transliterates as DNOK in Russian. Transliteration of Japanese names, even if written in katakana, which is used for foreign words, can offer some difficulties. Thus HoRiDoRu transliterates back into Folidol, a name for Parathion. Since there is no "Fo", it is transliterated by "Ho"; with no "L" in Japanese, "Ri" is substituted. The "L" on the end of the word again must be replaced by an "R" since there is no "L". A consonant cannot end a syllable except in the case of "N" so the syllable must be filled out. By following rules very carefully and then checking the result, most names foreign to Japanese can be transliterated into recognizable European terms. Native materials without a chemical name attached, can and do represent great difficulties.

Just as in the case of common names of insects where one designation was more correct from a taxonomic standpoint, so also some common names of one language are more accurate than those in another. The North American designation BHC for benzene hexachloride is bad chemistry, for BHC is really hexachlorocyclohexane, or the entirely saturated ring compound. Here HCH used in Europe and its transliterated form GKHTSG in Russian is more accurate chemically than is the official designation of the Entomological Society of America.

Transliteration of chemical names from languages which do not use the Roman script does require both care and imagination. Theoretically there is a standard way of transliteration, but in agricultural literature, transliteration sometimes goes by ear and sometimes by eye. Actual pronunciation of the words to be read in the language in which they are written will often give a clue to what pesticide was used when the rules fail.

Dosages and Formulations.—Thus far, this paper has dealt with qualitative concepts only, *e.g.*, names or symbols. Dosages would seem to be far more standardized than mere names, but variations do occur in what purports to be the same language and also between languages. Results from field experiments destined to be read by nationals of the same country are expressed in local or national uses.

Let us give a simple example of applying 2 oz. of pesticide to a bushel of seed. On a weight basis, the dosage may vary considerably. For wheat the dosage would be 2 oz./60 lb. For buckwheat, 2 oz./46–50 lb., and for beans, 2 oz./24–78 lb. Under some conditions, volume may be more important than weight, but the type of seed and the weight, if given, should always be stated.

The volume of an imperial bushel is 2219.36 British cubic inches or 36.3677 liters of water at 62°F. The definition of a standard bushel is 2160.42 cu. in. or 35.2383 l. of water capacity at 39.2° F. The British seed at the same dosage in ounces might be less heavily treated.

Differences between the measures in pints, quarts, and gallons do exist. In writing or in abstracting for international use, the type of gallon or bushel should be given, since the same term may have a different value.

Not only in English from different localities but in other languages as well, the same word may stand for quite different quantities, and, especially in reports on field work, terms other than metric will be used. Actually, mistakes are more often made by the reader when the same word varies between languages or countries than when a person is confronted with an entirely new word. In field tests in South Africa, pesticides are spread or sprayed over morgens of 2.12 acres of area (U. S.), but in Prussia, where they are also applied to morgens of land, each morgen is only 0.631 acre.

Weights by the same name also vary from country to country and also from language to language. Thus libra, a weight, is 1.0128 lb. in Argentina, 1.102 lb. in Colombia, and 1.0143 lb. in Peru. The metric libbra of Italy is 2.2406 lb. or 1 kg.

Entirely different words as tan, which is 0.992 hectare, and feddan (one feddan is 1.038 acres) are used in Japan and Egypt, respectively. In spite of international committees and in spite of the ease of the metric system, field results will be reported in terms of gain in weight by pounds, or quintals, or tans, or piculs, to mention only a few.

Determination of the amount of insecticide used can still be difficult if the dosage is not stated in active material. Excessively high dosages reported in field work may be quite normal if expressed as active material. In the Latin languages, an abbreviation *m.a.* standing for *materia activa* in Italian, *materiel active* in French, or *materia activa* in Portuguese should be recognized as the clue to the actual amount of pesticide used.

The familiar LD_{50} becomes DL_{50} not only in papers written in the Latin languages but frequently in those in German and Scandinavian. The DL is *dosis lethalis*.

Another abbreviation which occurs in both German and English is the TLm_{50} used in studies on the toxicity of pesticides to fish. The TLm_{50} is the concentration in the water in which the fish are living, which concentration will kill 50% of the fish. The values of TLm are not comparable to LD unless the insect to be killed is swimming in the treated medium.

Residues are frequently expressed in p.p.m. or parts per million and p.p.b. parts per billion. In France, billion is sometimes used, but miliard is more common. Miliard in German is a thousand million. A simple p.p.m. may offer real difficulties in international understanding.

Materials can be applied as dusts, sprays, wettable powders, emulsions, or as gases (fumigants). Some terms have been taken over from North American usage; W. P., *e.g.*, appearing in Spanish where there is no W. E. C. for emulsion concentrate, has also wide usage. On the other hand, a native term such as *pó mohado* may be used in Portuguese. In Spanish "wettable" may be expressed by a term derived from either *mojado* or *hymedo*. The French idea of wet is derived from *mouiller*, meaning to wet or soak. Dutch emphasizes the way a wettable powder is used, *spuit poeder* or spray powder being used.

Dust is a word of limited international value, but oddly enough it is used unchanged in Russian. Elsewhere the term varies from language to language. The terms used in some of the closely related Slavonic languages may themselves be unlike either by sight or sound. Table XII gives some of the equivalents for dust used in pesticides.

Table XII
Terms Used for Dust in Various Languages

Latin	
French	poudre
Italian	polvere
Portuguese	pó
Spanish	polvo
Roumanian	praf
Germanic	
Dutch	stuif
German	Staub
Norwegian	støv, dust
Slavonic	
Croatian	prašak
Polish	kurz (okurzac, verb) proch
Russian	dust
Ukranian	poroshok

Table XIII
Emulsion in Various Languages Other Than English

Latin	
French	emulsion
Italian	emulsione
Portuguese	emulsaõ
Roumanian	emulsiune
Spanish	emulsión
Germanic	
Dutch	emulsie
German	Emulsion
Norwegian	emulsjon
Swedish	emulsion
Slavic	
Croatian	emulzija
Polish	emulsja
Russian	emul'siya
Japanese	nyûdaku
Turkish	sükye

The word emulsion can be recognized in almost any language using the Roman or Cyrillic alphabets. Japanese uses its own word and symbol, emulsion generally being represented by an ideograph, not by katakana or hiragana. The Turks use their own word *sübye*. The Latin word *emulsus* has been carried far out of the ordinary Latin territory and has retained both form and meaning.

In comparing results, not only the amount but the way the material is applied must be taken into account. Both dosage in numerical quantitative expressions and type of application must be used to give the idea of dosage. In some cases terms will vary greatly both within and between language groups, but in other cases the same term or the same term with a slight modification may be used truly internationally.

SUMMARY

1. In order to understand the international literature on pesticides, the worker must be familiar with the common names of pests and host plants and with variations in usage of scientific names from language to language and from country to country. He must also know that the terms used for the pesticide itself will vary both with time and place. He should know that designations for weights, measures, and formulations will differ both between languages and within a language.

2. Ingenuity in recognizing variations, transliterations, or translations of the same name is necessary for a person working on international literature.

3. Comprehensive monolingual dictionaries, texts on entomology or plant pathology, various languages, current periodicals, and government publications are some of the bibliographic aids necessary for understanding pesticide literature.

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An Evaluation of the Pesticide Literature—Problems, Sources, and Services*

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Received March 19, 1964

I. INTRODUCTION

Pesticide literature includes literature from many and varied scientific fields. It is exceedingly scattered and sometimes difficult to retrieve. This may be true in any field of scientific endeavor, but in recent years, agricultural research and development have become major activities of an increasingly large number of commercial and nonprofit organizations. This has created complexity and scattering of valuable information.

* Presented before the Divisions of Chemical Literature and Agricultural and Food Chemistry, Pesticides Subdivision, Joint Symposium on "Problems of the Pesticide Literature and Some Solutions," 147th National Meeting of the American Chemical Society, Philadelphia, Pa., April 9, 1964.

II. PROBLEMS

Vastness of the Literature.—When you consider that the utilization of literature in any one of the allied fields results ultimately in the publication of more and more, this fact alone is sufficient to explain the vastness of the pesticide literature. However, by analysis of any one single phase of pesticide research, "insecticides," for example, we find that there are four types of insecticides: contact poisons, stomach poisons, systemic insecticides, and fumigants.[1] The term also covers the allied fields of attractants, repellents, and chemosterilants. Chemically these may be arsenicals, carbamates, chlorinated hydrocarbons, organophosphorus compounds, etc. In addition to information on the chemistry and synthesis of such com-